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AIR PHOTOGRAPHS OF THE MIDDLE EAST: A paper read at the Evening Meeting of the Society on 18 March 1929, by O. G. S. CRAWFORD

The new subject of archaeological air photography was born in the Middle East during the War, and the first expositions were published in the Geographical Journal in 1919 and 1920. Colonel Beazeley's pioneer work in that region, however, was not followed up. A few air photographs of ancient sites were taken and used to embellish books and articles; but they revealed little that was not already known. That was mainly because they were of the oldest sites in Mesopotamia, which, for the most part, are too deeply buried to reveal their plan. But it was already evident that there did exist a multitude of suitable sites both in Mesopotamia and in Trans-Jordan; and it was decided therefore to approach the Air Ministry, in the hope of enlisting their help. The result was very gratifying. An undertaking was given that, subject to certain obvious limitations, ancient sites might be included in the normal routine of practice photography. Further, it was agreed that these, and also many existing but obsolete negatives of sites abroad, should be handed over to the Director of the British Museum, to form the nucleus of a national collection. In order to set the scheme in motion, I decided to visit the countries concerned, and collect and bring back with me the first instalment of obsolete negatives. This has now been done, and the first instalment of the negatives (which number 1700 in all) was handed over to the Director of the British Museum on March 18. The second part of the scheme—the photography of certain promising selected sites—is now being carried out. Having myself seen so much of the country concerned, it is very much easier for me to make suggestions; it would, indeed, have been impossible otherwise. My object in this paper is partly to "report progress," to give some idea of the actual results achieved and of the wonderful harvest that is waiting to be reaped. But there is also another and equally important object: it is to make a public expression of thanks to the Air Ministry and the officers of the Royal Air Force, for the way in which they have met us. I am sure you will agree that, as members of a scientific society, we deeply appreciate their help. To this I should like to add a word of personal thanks for the unbounded kindness and hospitality I received everywhere during my travels from the officers of the Royal Air Force.
The results are not only of archaeological interest. There are many photographs which are primarily of geographical importance. The present scheme owes much to the support of the Royal Geographical Society. When it was first mooted, our late President represented this Society on the deputation which, in conjunction with the Society of Antiquaries, waited upon the Secretary of State. Since then, our Society has in many ways contributed liberally towards its success.

Amongst the photographs there are several taken with a pocket camera by Squadron-Leader Insall, v.c. Squadron-Leader Insall has now added to his list of discoveries, which began with Woodhenge, many new sites in Mesopotamia, of which perhaps the most important is that of Seleucia; and the mosaics of Hatra and Samarra are both due to his initiative. Further, the Aircraft Operating Company have kindly lent a mosaic of part of the area they have surveyed for the ‘Iraq Government. For the description of these I am indebted to Mr. Harold Bowen, who has also called attention to at least one feature of geographical importance revealed, namely, the old bed of the Tigris near Balad.

My paper must necessarily be discursive; it covers a thousand miles of country and five thousand years of human progress. A thread of unity is supplied by the evolution of town-planning, which may be taken to include also the plans of palaces. The recovery of such plans is one of the main objects of archaeology; excavation has hitherto been the principal method employed; but it will, I think, be evident that air photography is often a quicker, cheaper, and more effective method of achieving the same object. The most conspicuous example up to the present is the Samarra district. The modern town of Samarra lies 65 miles north-north-east of Baghdad, on the left bank of the Tigris. It is now the only habitation there, the shrunken relic of a vast continuous mass of buildings 20 miles in length. The ruins were visited between 1830 and 1850 by Ross, Rich, and Felix Jones, who published useful accounts and plans. They were again visited and described by Herzfeld, Viollet, and Miss Bell early in the present century. Herzfeld’s monograph (Berlin, 1907) is the standard work, upon which my remarks are based. Colonel Beazeley published two short papers in the Geographical Journal (May 1919 and February 1920), illustrated by excerpts from war maps which had been compiled from air photographs. But he reproduced only one vertical air photograph, and it cannot be regarded as a success.

We are fortunate in possessing a detailed description of these ruins written by a contemporary—the Arab chronicler Ya’qubi, who wrote in 889 A.D. It is a curious history, and it all falls within the short span of forty years (836–876). In the year 836 the ‘Abbasid Caliph of Baghdad was Mu’tasim, son of the famous Harun ar Rashid. One day, when out hunting, he stopped at a Christian monastery, and being pleased with the country round decided to move his capital thither from Baghdad. (There were, of course, political reasons for this, but we are not concerned with them.) Calling his architects, he ordered them to lay out the ground, assigning different quarters for the different nationalities and classes of society. The hordes of Turkish and Persian mercenaries were kept apart from the civilian population. The police had their headquarters in the walled enclosure called Asnas. A deer park
was laid out called Hair el Her. Mu'tasim built a mosque immediately north of Samarra, with a high minaret called Malwiya, ascended by a spiral staircase outside. A study of Ya'qubi's very detailed account, with the help of air photographs, should make it possible to identify every one of the important buildings and residential quarters.* He laid out wide streets with side streets leading off on either hand. The original standard width was 100 metres, but even in the short period concerned it had been contracted by the encroachment of buildings. Ya'qubi tells us the name of each of the main streets and who lived there and what their trade or profession was. Finally he built himself a lordly pleasure-dome on or near the site of the Christian monastery. It is now called Dar al Khalif, and has been excavated by M. Viollet (Mem. Acad. Inscr. et Belles-lettres, vol. xii, part 2, 1913). The main buildings fronted the Tigris, and, having been uncovered, present a different appearance from the rest. The three arches still stand; the central arch led to the main hall, which was flanked by two smaller halls. Beyond lay a corridor, and on each side square blocks of rooms round open courts. The arches recall the Sassanid arch of Ctesiphon (third century A.D.?), from which they are lineally descended. The rest of the palace grounds consisted of pleasaunces, formal gardens, a circular basin (whose rosette plan is a new feature revealed by the air photograph). At one end is a stadium and pavilion from which start the two ends of a looped race-course 6 miles in length. A good idea of its general appearance is given by Viollet's oblique restoration. We are reminded of Hadrian's villa and the Palace of Versailles.

To beautify his palace and enrich his capital, Mu'tasim collected an army of craftsmen from every part of his empire. Workers in marble and plaster were obtained from Antioch and the Syrian coast; teak and palm-trunks from Basra, together with glass-workers, potters, and mat-makers. From Egypt came paper-makers. Encouragement was given to any one who could claim any skill, whether in agriculture, gardening, vine-culture, irrigation or the construction of underground water-channels (kanat). All this we are told by Ya'qubi, and the excavations of M. Viollet have proved him correct so far as the material evidence survives.

Mu'tasim died in 842. His successor, Wathiq, reigned only five years and seems to have confined himself to the building of one new palace, called Al Haruni, and the embellishment of existing (?) quays for the ships coming from Baghdad, Wasit, Basra, and Mosul. This causes Ya'qubi to exclaim, "Now first did we realize that what up to then we had called a military camp had become a civilized town."

Mutawakkil (847-861) was the brother and successor of Wathiq, and was the last great builder of New Baghdad. He laid out a huge new quarter at the north end of the plain of Samarra. For his own delectation he built a palace, with the usual courts and gardens attached. The eastern corners abut on an

*In the court of ablution was a famous stone basin called Pharaoh's Cup (Kas-i-Fir'aun), 23 paces in circumference. This too can be seen, and the measurements agree, proving beyond doubt that this is Mu'tasim's mosque. (Lestrange, 'Lands of the Eastern Caliphate,' 1905, p. 56; on the authority of Mustafi—early fourteenth century.)
intake of the Nahrwan Canal, and plainly show that the canal was there first. He himself used to urge on the workmen and encourage the zealous. He laid out a fine broad road, called Sari al Azam, leading from his palace to the police headquarters at Asnas,* and beside it dug water-channels, perhaps to enable the dust to be laid, as is the custom still in Baghdad. The breadth of 100 metres (recorded in ells by Ya'qubi) agrees exactly with the air photograph. On either side, says Ya'qubi, he built houses; but they were plainly not all completed. The photograph reveals one rectangle with nothing in it, and several obviously unfinished. These doubtless were the residences of people of means. He also built a mosque; and one would naturally attribute to him the one which lies between his new houses and his palace, and which has the minaret called Abu Dalif at its northern end. It has the merit of fitting Ya'qubi's description, since it is plainly unencumbered by buildings, whereas the Malwiya mosque near Samarra is not. Outside it are the evident traces of a cemetery. Beneath the eastern corner runs a line of kanats, or shallow wells connected below by brick tunnels, to lead water. It is evidently older than the mosque.

On the opposite (west) bank of the Tigris is an unfinished villa, probably built by Mu'tasim; it is now called Istabulat, but is not referred to under this name by Ya'qubi, nor can I find any account of it elsewhere. It is equally difficult to obtain any account of the octagonal walled enclosure called Qadisiya. It contains an unfinished villa, and may well be, as Herzfeld suggests, the Qatul where Harun ar Rashid built a residence, perhaps of a temporary kind. In any case, it belongs to our period. Tall Alij is a moated mount, supplied with water by two kanats and surrounded by a bank. The moat is crossed by a ramp, formerly carrying a bridge, and prolonged by a bank or wall to a group of ruins, now called Madrasa (school). The enclosing bank is broken on the south, where start two sets of parallel banks. One of these is now lost; the other runs straight for just under 3 miles and then curves westwards till it reaches the buildings south of Samarra.

Musta'in, one of a series of short-reigned Caliphs, most of whom were murdered by their successors, returned to Baghdad in 865, and the region was gradually deserted. There was, at any rate, no more building on the grand scale; and contemporary writers of a century later (Ibn Hauqal in 978 and Muqaddasi in 985) describe Samarra in the past tense. "Samarra now lies in ruins; one can walk two or three miles through them without seeing a soul. On the west bank are gardens." Only three or four outer nuclei, such as Dur al 'Arabaja, still survived, shorn of all their short-lived exotic splendour. Dur is the Dura where the Roman army camped in 363 during its retreat from Julian's disastrous expedition to Ctesiphon. The wall by which it is seen to be surrounded has not the regular alignment of the 'Abbasid architects; and the ruins contained seem more ruinous than the rest. The air photograph also shows that the alignment of streets and house-walls within is irregular, suggesting an earlier date. The same features recur in the deserted towns and villages which we can see as we fly above the Tigris from Baghdad to Mosul. Some are walled; the majority, however, are open. As we fly along the river

*Ya'qubi records the distance as 3 farsakhs (=10½ miles), thus enabling us to identify Asnas. The distance agrees exactly.
The Palace of Mutawakkil, Samarra
Ruined town on the Tigris between Mosul and Baghdad
these deserted towns and villages appear beneath us every few minutes. The
bigger settlements generally reveal a square enclosure, probably the remains
of the ruler's palace. They must remain nameless until some one will take
the trouble to identify them; and now that reasonably large-scale and reason-
ably accurate maps are available, there should be no difficulty.*

Seventy miles south-west of Mosul in the grassy desert lies a walled city.
There are to-day no permanent settlements near it, and it is itself completely
deserted and in ruins. We flew there from Mosul. The first glimpse is im-
pressive. On the barren and monotonous plain there looms up a circle of
greyish hue, at first a mere blur; soon it takes the form of a sleeping city with
mouldered houses and streets, and in the middle the ruins of great stone
arches and buildings, laid out on a grand scale. This is Hatra, a Parthian
town that flourished at the beginning of the Christian era, a semi-independent
city state. Founded by Satirun, of whom we know nothing, probably about
the beginning of the Christian era, it first touches Western history in the
reign of Trajan, who besieged it unsuccessfully in A.D. 117.† Severus invested
it twice, about the year 200, but also failed to take it.‡ In 231, Ardashir, the
founder of the Sassanid dynasty, made a fourth and likewise unsuccessful
attempt.§ It fell at last to Shapur I (240–271), son of Ardashir and captor of
the Emperor Valerian; but the story goes that it was betrayed by the king's
dughter, who fell in love with Shapur, seeing him from the city walls. She is
the heroine of the tale of the crumpled rose-leaf; and her ingratitude so dis-
gusted Shapur that he had her tied to the tail of an unbroken horse and dragged
to death. Shapur destroyed Hatra; and when Jovian passed it in 363, the old
city was lifeless and deserted.||

It was doubtless the haunt of nomad Badawin throughout later times, as
it is now; but, except for inscriptions of 1190 and 1196, recording temporary
use, it was lost until Ross re-discovered it in 1836.¶ His plan is crude, but
gives essentials, and we must remember that, like all the early travellers, he
was in considerable danger and was actually maltreated by Arabs on his first
visit. In 1908 Hatra was successfully assaulted by an army of explorers
led by Dr. Andrae, whose magnificent monograph leaves little, it might
be thought, for subsequent investigators. His plan is full and accurate,
but, as you will see, there are blanks which he could not, or at any rate
did not, fill. I do not know how long he spent there; certainly it was many
weeks. My own visit, accompanied by Squadron-Leaders Insall and Morgan,
was a matter of hours only; we left Mosul after breakfast and were back again
in time for lunch. We had time to land and inspect the ruins pretty thoroughly,

*The documentary sources are simply waiting to be interpreted in the light of this
new geographical knowledge.
†Dio Cassius, Book 68, § 31.
§Dio Cassius, Book 80, § 3.
||The date when Hatra was finally abandoned is unknown, but has been supposed
to be some time before 363. The whole matter depends upon the exact meaning of
Ammianus Marcellinus's phrase olim desertum.
¶Geographical Journal, 9, 1838, pp. 443–470. Layard, 'Nineveh,' I (1849), p. 110,
refers to a paper read by Ross before the Institute of British Architects and published
in The Builder, but he does not give any exact reference, and I have not traced it.
but before we landed, Squadron-Leader Morgan took a fine mosaic from which it is evident that Dr. Andrae's gaps are filled in. It took about five minutes to get this mosaic.

I must not linger over Hatra. The palace is of the familiar type whose home is on the Persian plateau. The photograph reveals details in the courtyard not observed before, and the general impression is given that the palace enclosure is later than the rest of the town. Certain parallel markings suggest half-obliterated walls, as if a space had been cleared of buildings to make room for the palace in the middle of the city. Of the town itself the air photograph gives an excellent idea. Dr. Andrae has classified the houses according to their ground-plan, and this is a profitable line of inquiry that air-photography will speed up in the future.

The line of circumvallation is plainly Roman work and may be attributed to Severus.* Beyond the limits of the mosaic, I observed from the air a square enclosure, which is probably a Roman camp; Andrae records another; and a third is visible on the mosaic itself. Being within the circumvallation, it may belong to Trajan's siege. (It was first observed by Mr. C. F. C. Hawkes, who has made a special study of Roman sieges in connection with Masada.) Herodian tells us that every kind of siege-works was employed, and engines (designed by Priscus) were rigorously applied to the walls. The rectangular platform was plainly made for a balista, and the re-entrant angle of the agger was designed to protect it.

The besieged retaliated vigorously with a form of missile not used during the last war. They hurled down at the besiegers "earthen vessels filled with little venomous winged creatures " which, lighting on them and creeping under their clothes, stung the soldiers and inflicted painful and even dangerous wounds. This and sickness in their camp caused the Romans to withdraw.

Hatra is unique and has survived largely because of its isolation. It is not Time, but Man the Quarrier, that is the arch-destroyer of antiquity; and since here the only men are the tent-dwelling Badawin, there has been little destruction.

We fly back, and as we descend we see the Mound of Nineveh. Just across the river is Mosul, its modern successor, an attractive town of grey and white stone, the meeting-place of three civilizations. The mighty ramparts of Nineveh still survive, broken (in the foreground) by Nabi Yunus, named after the Prophet Jonah. The Mound of Nineveh itself can be seen beyond. A fine mosaic has been composed, including the whole extent of the rampart, but it is unsuitable for the screen, not because of the wickedness of the place, but because of its size.

From Mosul we can visit Erbil, the ancient Arbela and the still more ancient Arba-ilu, claimed with some justification to be the oldest continuously inhabited city in the world. It is mentioned by name in the third millennium B.C. (though it may well be even older), and the huge oval mound, 160 feet

*That it is Roman admits of no doubt, though Andrae attributes it to Shapur. The discovery of other examples of Roman siege-works may well be expected of air photography.

†See Antiquity, June 1929.
high, is still crowned with houses. The mound is, like others, artificial, an accumulation of five thousand years of municipal dirt.

Erbil lies in the foothills; from it we may fly into Kurdistan and the mountain villages, such as Bari, with their terraced fields divided by walls and hollow stony lanes. Thence to Altun Köpri, an island bridge-head where the Erbil–Kirkuk road crosses the Little or Southern Zab; thence back to Mosul, passing, to the north of it, the mound of Tepe Gawra, where there have recently been found a copper axe of the early type found in the Royal Tombs of Ur, and painted pottery (black on cream).*

Turning southwards, before we reach Baghdad, we see the so-called Median Wall, running 20 miles out into the desert from the Tigris near Balad. Then we pass the ziggurat of 'Aqarquf, of whose environs a mosaic has been constructed; and the so-called 'Tomb of Zobeida outside Baghdad. We pass over innumerable derelict canals, some doubtless mediaeval, others of remote antiquity, till we come to the far-famed Arch of Ctesiphon. It is a huge vault of brickwork, reinforced in parts by beams of teak wood which may still be seen embedded in it. Some idea of its size is given by its shadow, and by the human figures standing on the crown of the arch. The Arabic name, Taj Kisra, relates it to Chosroes; but this means little more than 'Sassanid.' Herzfeld † ascribes it to Shapur I (242–272). It formed the open hall of his palace, and is one of the finest surviving examples of Sassanid architecture, whose home is Persia. Close by is the flat wide mound of the city of Ctesiphon, founded as their capital by the Parthians in 150 B.C. and not superseded as capital till after the Muhammadan Conquest.‡ The existing ruin-field is divided into two parts by a watercourse on which is the wretched modern village. Presumably this ruin-field represents the 'Abbasid cities of Al Madain ('the two cities'); and the appearance of these ruins on the air photograph is quite different from any we have yet seen. Plans of houses and streets are almost absent; the ruin-field has a totally different texture or grain. It is a huge shapeless smudge which might almost be mistaken for some defect in the negative, were one not already familiar with such. Doubtless this appearance results from the decay of buildings of brick or mud-brick; it is characteristic of all late mediaeval sites, and it provides a useful means of dating at sight by air photography or even mere observation from the air. I wish to emphasize this point because it has been stated by a friendly critic that air photography is blind to relative age—that it records but does not date. On the contrary, air photography will eventually enable ancient sites to be classified chronologically from their external appearance, though of course only the latest topmost layer counts as a rule.

Ctesiphon succeeded its neighbour Seleucia across the river. Seleucia was a Macedonian foundation, dating from about 300 B.C.; it survived its supersession for about four centuries, till it was destroyed by the Romans in 165 A.D. The exact site has often been misplaced, and the name Seleucia has

*Exhibited in the Baghdad Museum.
†'Archaologische Reise im Euphrat und Tigris-gebiet,' II, 1920, p. 76.
‡The Sassanids were overthrown at the battle of Kadisiyah in 637, and Baghdad was founded by the 'Abbasid Caliph Mansur in the years 762–766.
been wrongly attributed to various mediaeval ruin-fields. What is plainly the correct site was discovered and photographed by Squadron-Leader Insall, and it may well prove to be one of the classic achievements of aeroplane observation and photography. Seleucia was laid out on or near the site of Opis (Hupiya), one of the most northern of the ancient Sumerian cities.*

The site is seen to be that of a city laid out in squares, the streets running parallel and intersecting at right angles; and this rectangular lay-out is imposed upon or contiguous to what are evidently older remains. One can distinguish the two main streets crossing at the centre; a group of apparently older buildings; a curious oval mound (still quite high) at one end of the main cross-street, with what looks like a bailey-wall enclosing the ground in front of it; a rectangular object in a rectangular enclosure, possibly the remains of a temple platform; and, enclosing the whole, the remains of the city walls. A closer view reveals the streets more plainly. They show as dark lines, consisting probably of vegetation and caused probably by the retention of moisture.† The general effect distinctly resembles the plan of Caistor near Norwich, also revealed by air photography, but Seleucia is, of course, far bigger. A rough guess puts the size as 3 kilometres in length by 1½ in breadth, and the insulae or blocks at 150 metres square. There are as yet however not enough data for compiling an accurate scale for this mosaic.

Should this really be Seleucia it is a discovery of the first importance. It is the only example we have of a Macedonian town plan that has not been obscured by later growth and encroachments.‡ It is strange that one should be found in the land that was probably the first to use the rectangular system. It is an important discovery, whatever its name may be, and I repeat that the honour of making it is entirely due to Squadron-Leader Insall, who flew me over and showed it to me on our first flight.

We have now seen three types of town plan—the ‘Abbasid of Samarra, the Parthian of Hatra and of the Tigris cities, and the Macedonian. If we proceed a little farther southwards on the way towards the Persian Gulf we come to Najaf, a walled city of pilgrimage. It represents the modern town-plan and its immediate antecedents, and stands for growth, not design. Finally we reach Basra, the port of ‘Iraq, standing in palm-groves. The town itself is no older than the Arab Conquest; it was founded in 638 A.D., and

*The site of Opis is fixed by the statement of Nebuchadnezzar II (604–651 B.C.) that the outermost of his three defences of Babylon was an earthen rampart and ditch extending from the bank of the Tigris above Opis to a point on the Euphrates with the city of Sippar. Sippar is certainly identified with the mounds of Abu Habba, 6 miles west by north of Mahmudiya. Here the two great rivers approach nearest and must formerly have been within 15 miles of each other. It is the obvious place for a dyke barring the way across the land between them, a dyke of precisely the same character as Bokerley Dyke in Dorset, and the Cambridgeshire dykes across the Icknield Way. It is therefore, in the face of this evidence, futile to look for Opis at Tall Manjur (63 miles north of Abu Habba), or anywhere else north of Baghdad.

†I have asked a friend in Baghdad to investigate the site, and write field-notes upon the air photograph itself. Until this has been done any attempt at detailed explanations would be premature.

‡For Greek town-planning see Haverfield’s ‘Ancient Town-planning,’ chs. ii–iv Oxford, 1913\(^{\dagger}\)
Sketch-map to illustrate Mr. Crawford's paper on Air Photographs of the Middle East
rapidly increased in size till in the tenth century its breadth was 3 miles and the length even more. The plan here seen, of an old part of the existing town, suggests a rectangular block-plan which has lost its original straightness. It is interesting therefore to find that Old Basra was actually laid out on a rectangular plan. The lines of the streets are revealed by darker bands; and there are traces too of houses and irrigated gardens. But the design is less regular than that of the earlier Seleucia or the later Samarra.

But we must now turn northwards. We pass over Ur, seeing the ziggurat mound after excavation, with its triple stairway leading to the temple platform; the temple at its foot, and the house which the latest of the builders on that ancient site, Mr. Leonard Woolley, has built and fortified for the expedition of which he is leader. We pass quickly over Ur because its importance lies too deeply buried for the camera to penetrate, and here air photography has achieved little. A fine mosaic, however, has been taken and is among those handed over to the British Museum; it is so large that I have not had prints made, and previous compilations from contact prints have not been altogether satisfactory. There are, however, many minor features observable in the desert round Ur and Abu Shahrain—I noticed traces of irrigation—and these will be worth close study later on. We know that such irrigation existed, for we are told that there was a palm-grove outside one of the gates of Ur. To-day not a tree or bush is to be seen there.

As we leave, we pass by Tall al 'Ubaid, 4 miles to the north, where is a temple platform of the 1st Dynasty of Ur (first half of the third millennium b.c.). The site was excavated by Dr. Hall in 1919, and by Mr. Woolley in 1923-4, and the results have been published in a fine volume by the Trustees of the British Museum.*

We must now cross the desert for Trans-Jordan; and there is much of interest to see on the way. The Syrian desert is only relatively desert. There are no fixed settlements, but there is a fairly large nomadic population and enough vegetation to support many forms of animal life, from scorpions upwards. On the day I crossed it large pools of water were quite common in one portion, and one could see heavy showers of rain falling. The atmosphere was marvellously clear and the journey was quite unforgettable. When we reached the basalt country I began to see those extraordinary arrangements of walls that are familiar to every Middle-Eastern aviator. First described in Antiquity (vol. i, 1927, pp. 197-203) by Squadron-Leader Maitland, they have since been studied by Group-Captain Rees and Squadron-Leader Insall. The whole of the basalt area is literally covered with a network of them as thickly as furze with cobwebs. I regret that I can do little to solve the mystery of their age. Group-Captain Rees took me to see some of them, and we found worked flints in abundance, both Mousterian and Neolithic.† Each of us picked up a fine, highly patinated Mousterian axe, one of them inside an enclosure, the other at the foot of the hill. It is proof that at the time when the axe was used the hill was visited; and other worked flints of similar patina and type were found on the hilltop, amongst them a fine Mousterian scraper.

† 'Neolithic' may of course mean anything here.
The Arch of Ctesiphon

The so-called Median Wall

The Arch of Ctesiphon
The walls consist of loose boulders collected from those which cover the surface. Their relative weathering proves them to be ancient structures, and they can always be distinguished from modern Badawin work. The Badawin know nought of them; they call them the "works of the Old Men."

Before reaching 'Amman we pass Qasr el Azraq. It is a wonderfully beautiful spot, inhabited by outlaws from the Jebel Druz. The country is spacious and undulating. The castle of slaty-grey stone stands in a strange setting whose spirit only an artist could reproduce. In the far distance rise the peaks of blue volcanoes, emerging apparently from a rolling sea of heather—actually the hills of the flint-desert whose myriad brown flints reflect a purple sheen. In the foreground is a huge reedy lagoon, fed by a perennial spring, and over the yellow-green rushes pass flights of duck and other birds. On the margin straggle a few palms. Otherwise the scene recalls Killarney. In its present form Qasr el Azraq is a mediaeval structure, dated by Dussaud to 1236–7 A.D. from an Arabic inscription there.* But the Romans got there and have left an inscription dated 305 A.D.,† which still lies on the courtyard. A Roman road goes northward towards Bostra, and is visible on some air photographs. It is tempting also to see in the round-cornered enclosure in which the castle stands (askew) a Roman camp. It now consists of a founded wall of boulders. It looks old, and there are suggestions of a traversed entrance, but we had not time to examine it carefully.

The Old Men have been busy here. There is a huge circle near with one of those turreted enclosures which, from their shape and from the long streamer-like tails of walls converging upon them, have been christened kites. We visited this enclosure. It is not easy country to walk in, for the black ground is really a mass of small round basalt boulders, as on a rocky shore. We found flints and some potsherds of a late character.

From Azraq we pass to Quseir 'Amra, a group of baths planted in the midst of the solitude by one of the Omayyad Caliphs, probably Walid I (705–715). Inside it is covered with paintings, amongst which are seen the kings conquered by Walid—Roderic the last Visigothic king of Spain (which proves that the painting cannot be earlier than 711), "Caesar," Chosroes and the Negus of Abyssinia.† The paintings are marvellously clear, in spite of the depredations of Badawin and of Musil himself, whose chemical treatment and attempted removal have irretrievably ruined many. The problem of conservation was discussed on the occasion of our visit by the heads of the administration of both Palestine and Trans-Jordan, but proved insoluble. It is 50 miles from the nearest house, if we exclude Azraq, and is now used as a repository for Badawin corpses, one of which we found there. It was easy to find.

From here we pass on to Qasr et Tuba, 60 miles south-east of 'Amman, where

†Brünnow and Domaszewski, 'Die Provincia Arabia,' iii, 332, referring to Dussaud, *op. cit. supra*, p. 670, No. 85.
‡The paintings have been reproduced by Musil, Quseir 'Amra, and by Jaussen and Savignac, 'Mission Archéologique en Arabie,' vol. iii, 1922; see also Musil, *K. Abad. der Wiss.* (Vienna, 1907), vol. i, pp. 3–186; 'Painting in Islam,' by Sir Thomas Arnold (Oxford, 1929).
we find "a small Omayyad palace."* The style is pre-Islam, but we know that Walid II (743–4) used to go to Ghadaf, and since that is the name of the wadi on which Qasr et Tuba stands, we may reasonably associate the palace with him.† The plan is, in essence, the one we have met with so often before—a court with surrounding rooms—but here the court is duplicated at each end. There is a large dyke to protect the palace from the wadi when it comes down in flood. The barrel-vaulting is well preserved above one of the halls.

There is a hill-fort at Mudauwara, a station on the Hejaz railway, 73 miles south-east of Ma'an; it is elongated in shape to suit the contour of the hill, and was built during the war.

El Meshetta—the name means "winter quarters"—also lies on the desert fringe east of the Hejaz railway and 15 miles south-east of 'Amman; the palace probably belongs to the same period as Qasr et Tuba. The ground-plan is Persian, and the barrel vaults recall the Palace of Ctesiphon and the Dar al Khalif at Samarra; but the elaborate façade, now in the Kaiser Friedrich Museum, Berlin, is Byzantine in style.‡

We must hasten on past innumerable fascinating spots, catching a glimpse on our flight of ancient fields and stone lynchets, remarkably like those in this country, but probably Roman in date. Our last site in Trans-Jordan is Jerash, a walled city of Macedonian origin, but Roman in its present state and half of it still inhabited. It is being excavated and contains, amongst other things, a Christian church. The site is picturesque; the ruins are likely to attract tourists, being within easy reach of Jerusalem by road.

We now cross the Jordan, and passing Jericho, an attractive place, inspect the huge mound of Husn, the ancient Bethshan, now being excavated by an American museum, with most important results.§ Like the mounds of 'Iraq it is, of course, entirely artificial.

On the way to the Dead Sea, where our journey somewhat inauspiciously ends, we pass the Crusaders' Castle of Ras el 'Ain, near Jaffa. Our objective is Masada, overlooking the western shore of the Dead Sea, whose citadel was besieged by the Roman General Silva in 72 A.D. The remains of Herod's palace are plainly seen. The incidents of the siege do not concern us; furthermore, they have been fully worked out by Mr. Christopher Hawkes of the British Museum, from whose forthcoming paper in Antiquity I have borrowed my information. Round the foot of the precipice on which the citadel stands, the Romans built a wall with turrets. This wall completely encircled the fortress except at a few points where it was not required. They constructed camps for cohorts, standing within an almost obliterated Roman camp

†See Brünnow and Domaszewski, 'Die Provincia Arabia,' ii, 1909, 172; Jaussen and Savignac, 'Mission,' iii, 1922, p. 110.
‡El Meshetta has been assigned to various dates. According to Dieulafoy, 'L'Art Antique de la Perse,' 1884—9, vol. 5, it belongs to the period of Chosroes II, and more precisely to about the year 612; Brünnow, 'Die Provincia Arabia,' ii (1909), 172, regards it as having been built in the pre-Islam period, but before 614, by Arabs employing Byzantine architects and labour; Jaussen and Savignac agree that it is probably pre-Islam in character, but suggest with hesitation the Gassanid, Lahmid or Omayyad Dynasties. See also Strzygowski, Jahrb. der. Kön. Preuss. Kunstsammlungen, 1904.
revealed for the first time by an air photograph. Masada is going to be the classic instance of Roman siege-works and also of Roman Camps of the Flavian period. They are well preserved here, and every detail of internal plan is plainly recorded. The photographs are amongst the most valuable of their kind ever taken, and those who know the country, which is very precipitous, will realize that we are more than usually indebted to the officers who secured them. We still need, however, vertical photographs of the individual Roman camps, taken at a low altitude so as to reveal the details of their internal arrangements.

I had hoped, when I began to write this paper, to finish up, not on the shores of the Dead Sea, but in Egypt. But that would have compelled me to deal too briefly with every subject touched upon, and my paper would have become even more of a "tourists' guide" than it is. If it has seemed rather a breathless rush through time and space, that is a true impression. That was my own feeling during the two months when the marvellous wealth of the Ancient East was being unrolled beneath me. The aeroplane, merely as a means of conveyance, is by far the best invention of man, for it is swift, safe, and comfortable. As an instrument of archaeological research it is (with a camera) second only to excavation, and sometimes even more effective. The photographs shown on the screen—a selection only from 1700, the nucleus, I hope, of a great national collection—will inaugurate a new epoch in oriental studies. The future of exploration, and not only of archaeological exploration, is literally in the air.

DISCUSSION

Before the paper the President (Colonel Sir Charles Close) said: The paper we are going to listen to to-night is entitled "Air Photographs of the Middle East." Some years ago the late President of the Society, Dr. Hogarth, and Lord Crawford, President of the Society of Antiquaries, approached the Secretary of State for Air and were received by him on behalf of the two Societies. The representations made by the deputation were as follows: firstly, that all records taken by the photographic sections of the Royal Air Force which were of geographical or of archaeological interest should be preserved; secondly, that the efforts of squadrons in training should be directed to areas of special archaeological and geographical interest. The deputation was received sympathetically, but the matter had not been carried very far when Dr. Hogarth died, and the question remained for a short time in abeyance.

We owe it to the energy of Mr. Crawford that the project has not only been revived but has come into operation. At his own expense he undertook a journey to Egypt, Trans-Jordan and Iraq. Having secured the cordial interest of the Air Ministry and of the officers commanding the air forces in those countries, he was able to select from their negatives several thousand important pictures which he has brought home with him, to take part himself in several flights over the areas of particular interest, and to leave behind him an awakened interest in the objects for which he had made the journey. He has now come to give us the first instalment of his account of what he has been able to collect and to do.

I ought not to detain you too long, but I think I should say that the Director of the British Museum, Sir Frederick Kenyon, has very kindly agreed to store the negatives of archaeological and geographical interest, and has also approved.
of a scheme by which students interested in the subject may inspect the negatives and buy prints of them. That is all very much to the good, and of course prints of particular geographical interest will be kept in the collections of the Society.

I should like to add that Mr. Crawford is the Archaeology Officer of the Ordnance Survey; that he is founder and editor of that very remarkable journal, Antiquity, which has so amply justified its existence; and that he also reached the public in his book entitled 'Wessex from the Air.' What Mr. Crawford does not know about air-photo topography and air-photo archaeology is not worth knowing. I will ask him to commence his lecture.

Mr. Crawford then read the paper printed above, and a discussion followed.

Sir Percy Cox: I do not think I can add very much of interest, but I have, when in Mesopotamia, flown over a good deal of the ground that Mr. Crawford has described, and I can entirely corroborate what he says as to the great value of photographing from the air from the archaeological point of view. I have for years known ground and been over it time after time without being able to recognize any system of irrigation or line of foundation which at once became obvious from the air. I noticed that particularly in the neighbourhood of Samarra and also near the estuary of the Shatt al 'Arab, Basra, and the Hor 'Abdullah, and also in the network of canals between the two rivers from Samarra downwards, where, as we know, there was a tremendous organization of canals which, owing to neglect and the bursting of dams, has absolutely disappeared so far as present irrigation goes. We do not know how far some of it can be restored, but as far as we are now concerned much depends upon population, and there is not the population to put upon the soil if any very great irrigation scheme were to be carried out. Consequently we can only go very slowly.

I am sure there are experts here on various aspects of archaeology who will be able to make much more interesting comment on the lecture. I can only say that photography from the air, as far as archaeology is concerned, must have a tremendous future and that we want to and should give strong support to the energy and enterprise of pioneers such as our lecturer this evening.

Sir Frederic Kenyon (Director, British Museum): I do not think any words are necessary to emphasize the moral of Mr. Crawford's paper. His photographs speak for themselves: it is possible to see from them what an extraordinarily powerful new instrument has been added to archaeology; that facts as to a buried site which could only be revealed formerly by, sometimes, years of excavation, are revealed from the air before a spade has been put into the ground. Some of those present have probably seen photographs of the site near Caistor, which is going to be excavated, and realized how the air-photograph shows the plan in advance and enables the excavator to lay out his scheme of operations. 'Iraq, of which we have seen photographs this evening, was the first country in which the discovery of this new invention was made. I remember seeing some of the very early air photographs made during the war which revealed sites of towns unknown and unidentified which still await the explorer.

I do not think, in regard to a paper such as we have heard, which tells its own story so clearly, that long speeches of comment are necessary, but as the British Museum was mentioned by the President in his introductory remarks may I say I hope that no Trustee of the British Museum is present, because he might feel inclined to complain that this is the first he has heard of the matter. Time has not been hitherto ripe for it to come up officially before the Trustees, because it was not clear until Mr. Crawford had been out and returned whether he would be in a position to offer anything to the Museum. Therefore only general encouragement was given him by myself as to what we might hope to
do if he was successful. Well, he has returned successful, and it will be a great pleasure to report to the Trustees what has happened and to receive their official sanction of the arrangement. In any case the negatives are at the Museum, and when once a thing gets into the Museum it is ordinarily—unfortunately not always—difficult to get it out!

The President said that it would be possible to supply prints to any inquirer who asked for them. I hope that will prove true in the future, but you must not press us too much: it may take some little time to complete the mechanism for supplying prints. I am sure they will ultimately be available. There can be no doubt that the Museum is a very proper place for the collection to be housed, so that photographs from the air of sites of archaeological importance will become one of the archives of archaeology to which explorers can have access, and gradually we may build up a library of such photographs to which those who have real and legitimate motives for consulting the records may turn. Thus I think this occasion an historic one in the development of archaeology, for the collection of air photographs of archaeological sites now deposited in the Museum will be the starting-point of a wider collection which will do a great deal to facilitate the work of the explorer in the future; will save time and direct his efforts, and therefore add to the efficiency of his work. So that both personally and officially I should like to do, what I am sure you would all wish to do: that is, thank Mr. Crawford for his energy and enterprise in developing this new instrument of work, and thank him also for the extremely interesting way in which he has laid his discovery before us.

Group Captain L. Regs, v.c.: I have recently returned from 'Trans-Jordan and Palestine, and the photographs you have seen of 'Trans-Jordan were taken by men I was out there with. The photographs were taken, mostly, as a matter of training. They are extraordinarily useful in showing new pilots the landmarks of the country, because in the desert there are often no landmarks except some of the old ruins. It is thus important that pilots should know them. The photographs of Qasr el Azraq were taken about a year ago when we had a camp out there looking after some of the Druz rebels, and they were taken as a matter of routine, to ascertain what the country was like. There were no maps, and that was the only way we had of finding out how to send cars and cavalry round Azraq.

I am sorry the photographs were not produced in colour, because I think it is possible to group the cairns and group the walls according to ages by means of colour. In 'Trans-Jordan, if you see a red cairn or red village—I do not think Mr. Crawford will allow me to call them red—you can always find an inscription on it. All the walls of "kites" that you saw are black. I do not know what their age is, but, speaking as a pilot, I can say they look older than the red cairns, and we know the red cairns belong to the time of the Romans. I think Mr. Crawford will possibly agree. The actual selection of the "kites" that you saw did not give you a very good impression of them, because some of them literally go right across the desert, being 15 or 20 miles long. From the air you can see them disappearing in the distance. I was very pleased indeed when Mr. Crawford came out to 'Trans-Jordan, because he explained to us what we had been looking at in our ignorance without knowing what things actually were.

Dr. H. R. HALL: All I can do is to emphasize what has already been said with regard to the obvious use and importance to archaeology of these air photographs. I need only ask you to compare the plan of Hatra as it was published after months and months of excavation by Andrae and the Germans, with the view of Hatra which has been shown you by Mr. Crawford after, as he says, five minutes' air photography. Of course excavators digging on the actual site find
all sorts of details that photography from the air does not show, but you will remember whole areas of the town of Hatra which were left absolutely un-mapped by Andrae and of which Squadron-Leader Insall's photograph gives you all that is necessary to get a general idea of the whole. At the same time the air photo shows how very accurate the German excavators were in their measurements and in their plotting of the shape of the town, etc.

It is evident that photographs taken from the air will be more useful in such bare country as is common in the Near East and occurs in other parts of the world. I speak subject to correction by Mr. Crawford, but I should imagine that in lands which are heavily wooded and in which sites are overgrown, as in India or Cambodia, we shall not be able to use this new method so much. In the Near East, however, and on bare steppe-ground resembling that of the Near East, such as our own downland, it is obvious that this new art of archaeology from the air will be of the very greatest importance.

I think we have all heard with great pleasure what Sir Frederic Kenyon has said with regard to the part the British Museum is taking in the work of preserving photographs taken by air surveys, and we can only hope that not only those taken on air surveys but on other occasions also will very soon be brought into, if I may say so, Mr. Crawford's net, and that he may show us even more work of the same kind. I am sorry he stopped at the Dead Sea, because I should like to have seen air photographs of sites in Egypt, especially the new work at Sakkarah. There, too, as in Mesopotamia, air surveys of this kind, obviously, will be of the very greatest use to all future archaeological work, telling us what we are likely to see, as at Caistor, and obviating a great deal of waste time in trenching here and digging there in search of what we cannot see when our eyes are glued to the ground. We shall be able to see from the aeroplane what we want to dig.

The President: Mr. Crawford has taken us on a most delightful archaeological journey through the air and shown us, incidentally, how much we owe to the Royal Air Force. He often in the course of his lecture emphasized his indebtedness to the Air Force, and I should like to express our indebtedness to them and also to Mr. Crawford for the persistent way in which he has advocated this new method. Looking forward, say, a couple of thousand years, I hope to see, or to hear of, the Air Force of that day flying over South Kensington and recording photographs of the Ancient Palace of the Royal Geographical Society. That Palace will be in course of erection very soon, if only the Fellows of this Society will subscribe.
I EXPECT that some of us are unaware of the significance of the name “Tavistock Theodolite”; so I had better make it clear at the outset that the name applies to certain theodolites that are now being produced to a specification drawn up as the result of a meeting of British instrument makers and surveyors at Tavistock in 1926. Before I give you any details of the actual design of these new instruments I would like to touch briefly on the events that led up to this meeting.

Since the war certain Continental instrument makers had put on the market new designs that appeared to be a great advance on the models we had always been accustomed to. The man largely responsible for these go-ahead ideas was Heinrich Wild. He had had an extensive experience as a surveyor in the mountains of his native country of Switzerland, and I have no doubt that the labour of “humping” heavy instruments about had set his mind to work on how he could cut down weight.

It was in 1905, while he was with the firm of Zeiss, that he endeavoured to improve on the idea of producing a theodolite, so constructed that it would not be necessary for an observer to leave his place at the telescope to read micrometers on either side of the instrument, but he would be able to observe two opposite portions of the circles at once with a single eyepiece and read them by means of a single-screw micrometer. Owing to difficulties of construction, Wild was not able to produce an instrument on these lines until 1919, though in the meantime he had discovered that it was possible to obtain images of both points of the circle moving in opposite directions and to read the arithmetical mean by bringing opposite graduations into coincidence.

I am told that the idea of bringing the two readings together was originally Norwegian, and was offered to Zeiss and to Watts; but it was Wild who was the first to combine the fields successfully.

The instrument, which was completed by the Zeiss firm to Wild’s specification in 1920, was intended to meet the following requirements:

1. Smallest possible dimensions and weight;
2. Convenient manipulation;
3. Greater insensitivity in respect of transport, rain and dust;
4. Combination of images, from two opposite parts of the circle, on one fine dividing line, for observation in one eyepiece;
5. Images of opposite points of the circle to be reproduced through the hollow axis, so that the circles might be completely enclosed;
6. Use of a highly sensitive micrometer for adjustment of coincidence to allow of direct reading of the arithmetical mean;
7. Use of glass circles to ensure a symmetrical type of graduation.

In 1921 Wild left the Zeiss firm and moved to Heerbrugg in Switzerland, where he proceeded to produce an instrument of his own on the same general lines as that manufactured by Zeiss to his original design.

The conclusions arrived at after a season’s test of a Wild instrument in Canada were that its 33-inch glass circle gave results apparently equal in accuracy to those usually obtained from 12-inch circles, and that the telescope, with its 40-mm. objective, was inadequate for primary triangulation but was
suitable for secondary work. Its weight was that of a light mountain theodolite, and the speed of operation was almost twice that of 12-inch theodolites. Tests elsewhere went to corroborate the conclusions brought out in Canada.

The advantages of theodolites of the Wild pattern over large geodetic instruments were found to be: light weight; increased stability in high winds; reduced surface dimensions for temperature change disturbances; and reduced work in recording and reduction. Their chief disadvantage is that their internal mechanism is so complicated that if anything were to go wrong inside the instrument, it would be necessary to send it to the makers, whose claim is that as all parts are dust-proof, their instruments should not require attention for several years, except in cases of accident.

The Services have long felt the want of a theodolite that would combine accuracy with portability and increased speed of manipulation, and the Dominions have been urging upon British manufacture the same thing. In order to give British makers an idea of the conditions influencing the design of geodetic theodolites for use in Canada a paper entitled "Geodetic Theodolites for Canada," the author of which was Mr. J. L. Rannie, Supervisor of Triangulation, Geodetic Survey of Canada, was read before the Optical Convention of 1926 by Colonel H. St. J. L. Winterbotham. In his paper Mr. Rannie paid a tribute to the quality of theodolites of British manufacture and went on to say that "Theodolites many years old give as accurate results as when first purchased. The optical parts are second to none. If such a criticism is not heresy, however, it is suggested that British instruments are so strongly built that they never wear out, and on that account there is sometimes difficulty in obtaining permission to replace them with types of improved design."

The earlier theodolites used on triangulation in Canada (1906-14) were of English make, and though capable of the highest accuracy were of such an excessive weight that instruments of Swiss design were purchased. Mr. Rannie made it clear that the governing factor influencing the design of theodolites best suited to Canadian conditions was the high cost of labour. In Canada there is no cheap native labour, and the engineers have to carry their own instruments themselves; so it can be realized that heavy instruments are decidedly unpopular, and that Canadian engineers are constantly on the lookout for ways and means of reducing expense and heavy labour, exactly as Wild did while he was a surveyor.

Though it will probably be some time before surveyors have complete confidence in instruments so revolutionary in design as the Wild, it is fairly certain that as time goes on there will be an increasing demand for them, not only by the Services but by those dominions and colonies where labour is expensive. It was for these reasons that it was decided to give a Wild theodolite a trial at Tavistock in 1926 and to compare it with existing British models. Officers from the Admiralty, the War Office, and the Ordnance Survey were present, and the opportunity had been taken of inviting the leading British instrument makers to send representatives in order that they might join in the discussion.

As a result of this meeting a specification for a British theodolite was drawn up, as we were all convinced that an all-British instrument could be produced that would combine the latest ideas in design with the well-known qualities
of strength and reliability possessed by the existing types of British make. The chief difficulty the makers had to contend with was in producing an instrument that would not transgress existing patents. Messrs. Cooke, Troughton & Simms, Ltd., have succeeded in doing this, the optical arrangements of their model and the method of reading it being different in every respect from existing patterns. Messrs. E. R. Watts & Son, Ltd., on the other hand, came to an agreement with the firm of Zeiss and have incorporated in their model several of the Zeiss patents; thus it can hardly be said that theirs is an all-British instrument. So far nothing has materialized from the third firm of instrument makers, Messrs. C. F. Casella & Co., Ltd.

I will now give a few details of the two instruments, taking the Watts-Zeiss theodolite first.

The Watts-Zeiss Instrument.—The horizontal circle is 3 inches in diameter and is divided on glass to 20'. The vertical circle is 2 inches in diameter and is similarly divided. The images of opposite sides of each circle are brought together and automatically meaned by an optical micrometer and viewed in the one eyepiece as in the Zeiss and Wild Theodolites. Direct readings to single seconds can be made. (The method of reading will follow later.)

The telescope, which has a prism in its optical system in order to make the instrument more compact, transits eye-end only. The object-glass aperture is \( \frac{1}{10} \) inches and the magnification 25.

Both the plate and altitude bubbles are of the "constant" type, the former giving a sensitivity of 30" per 0.1-inch division and the latter 17" per 2-mm. division.

The altitude bubble can be read from the observing position by means of a reversible prism of the Zeiss pattern; the reflector fitted to the underside of this bubble is hinged, and when folded up gives it protection.

The Tribrach is fitted with three foot screws with dust covers.

For night use both circles, the altitude bubble, and the micrometer are illuminated by small electric lamps fitted in sockets that can be swivelled or slid in and out so as to get the best illumination. A wandering lamp is used in conjunction with the reflecting cap on the O.G. end of the telescope for illuminating the diaphragm. A battery box fitted with a switch and rheostat is strapped to a leg of the tripod. The lamp is connected direct to the terminals of the battery box, while the other lamps are connected by way of a plug-and-socket contact.

Tripod.—The legs are of the open-frame pattern with a centering head giving a total movement of \( \frac{1}{5} \) inches. The clamp for this head is operated by means of a long handle projecting downwards between the legs. Any play in the legs can be taken up by suitable fittings. The upper surface of the tripod head is fitted with a protecting cap, which, when the instrument is being used, is screwed to a special stud on one of the legs. A circular bubble is fitted to the tripod head for rough levelling. The legs are finished off with bottom shoes and foot-rests for ramming in the legs in soft ground.

The instrument is carried in a teak box \( 10\frac{1}{4} \times 8\frac{1}{4} \times 7\frac{1}{4} \) inches, which is in turn encased in a thick leather covering; this has rucksack fittings so arranged that the instrument is carried in a vertical position.
The weight of the instrument alone is 9\frac{3}{8} lbs., the box and all accessories 6 lbs., and the leather outer case 5\frac{1}{2} lbs., making the total weight 21\frac{1}{2} lbs.

The telescope is sighted, clamped, and adjusted on the mark. The circles are then viewed through the eyepiece of the micrometer and the illuminating prisms adjusted to give the most suitable field of light. The view of the circles might be as in Fig. 1a, showing the Horizontal and Vertical circles in separate fields, designated by the letters H and V. At the bottom of the field of view will be seen the illuminated micrometer scale of seconds.

To read the azimuth, by means of the micrometer drum M you bring the two opposite sides of the Horizontal Circle, as seen in field H, into coincidence (see Fig. 1b). (N.B. It will be noted that coincidence always comes either with

![Fig. 1.](image)

\[ a. \text{ The circles at the end of the observation with micrometer at zero; } \\
\quad \text{b. Reading of Horizontal Circle } 78^\circ 41' 52''; \quad \text{c. Reading of Vertical Circle } 90^\circ 35' 3'' \]

a circle division directly in line with the index line, as in this case illustrated, or with the Index midway between two circle divisions shown in Fig. 1c.)

Take the reading as given by the Index on that side of the circle of which the figures are upright, say 78° 40'; add the reading of the micrometer scale, say 1' 52''; the azimuth reading is 78° 41' 52''.

In the same manner, to read altitudes, make coincidence of the Vertical Circle in field V (see Fig. 1c); read the Index on the upright figures, say 90° 30'; add the micrometer reading, say 5' 3''; the altitude reading is 90° 35' 3''.

It will be seen that the Index gives the reading direct to the nearest 10', the whole circle being divided to 20''.

The Cooke, Troughton & Simms 3\frac{1}{2}-inch Double-Reading Theodolite.—The horizontal circle is 3\frac{1}{2} inches in diameter and is flat divided on glass to 20'; the vertical circle is 2\frac{1}{2} inches in diameter and similarly divided.

The images of opposite sides of each circle are brought together and are viewed through a single eyepiece situated near the eye-end of the telescope. Readings are taken by means of a patented diagonal scale direct to 10'', and by estimation to 5'' or even 2\frac{1}{2}''. The change over from horizontal to vertical circle or vice versa is made by means of a lever on the standard. (The method of reading will follow later.) The horizontal circle is carried on an independent axis with its own clamp and slow motion for repetition.

The telescope is of the "no constant" type and can transit at both ends even with the diagonal eyepiece in position. The focussing, which is internal,
THE COOKE, TROUGHTON AND SIMMS THEODOLITE.


is actuated by a milled collar on the telescope. The object-glass aperture is 1.5 inches and the power 22.

The plate bubble has a sensitivity of 20" per 2 mm. division, and the altitude bubble 10" per 2 mm. division. The latter is fitted with a device to enable it to be read from the telescope eye-end in any position.

The Tribrach is fitted with three levelling screws with dust covers.

The illumination of the circles (by P and R), altitude bubble (by E), and diaphragm (by F) for night use, is effected by standard 4-volt lamps permanently fixed but easily accessible for replacement. A switch on the cover plate controls each light separately, with an extra stud for illuminating both circles together. This switch is wired to terminals on the tribrach for the battery connection. A rheostat (S) is fitted for controlling the diaphragm illumination.

The tripod legs are of the open-frame pattern, and are made of mahogany. There is a centering movement of 1.5 inches. The fitting of the hinge pins which connect the legs to the head is capable of being adjusted in the field by a spanner provided. The thread on top of the tripod head is fitted with a protecting cap and a circular bubble is fitted for rough levelling. Bottom shoes which are securely attached to the legs have foot-rests forming an effective grip for the foot.

The instrument is packed complete in a vertical position in a duralumin box, in which are fitted all the necessary accessories. The instrument is clamped at three places on the cover plate to a frame which is supported on shock-absorbing springs, thus minimizing any risk of injury to the instrument during transit and ensuring that the axis, standards and circles are free from all risk of strain. A light canvas outer case is provided with rucksack fittings for carrying the instrument in a vertical position.

The weight of the instrument alone is 11.5 lbs., the box and all accessories 6.9 lbs., and the canvas case 4 lbs., making the total weight about 22.5 lbs.

By optical means, images of the divisions from two diametrically opposite points on the circle are brought together at a suitable focal plane, and appear adjacent to each other, but separated by a broad black line in the field of view of the circle eyepiece, as shown in Fig. 2. The circles are divided to 20', and on being rotated the images of the divisions at each side of the broad black line move past each other in opposite directions.

Although the circles are divided to 20' the intermediate 10' readings are read by the stationary reading mark (x), as shown on drawing Fig. 2. After reading to the nearest 10' by the stationary reading mark (x) the final or exact mean reading is obtained by measuring the separation of a pair of adjacent divisions, one on each side of the broad black line by means of a special ruled graticule (z). This graticule is ruled with a number of vertical and sloping lines forming a diagonal scale with appropriate figuring, and the optical arrangement is so devised that the images of the diagonal scale and the circle divisions are superimposed and simultaneously in focus.

The total vertical length of the diagonal scale is made to coincide exactly with a 20' space on the circle, but is figured to read 10' instead of 20', so that the mean circle reading is indicated directly, thus obviating the necessity for adding the two readings and dividing by 2. The graticule can be moved in a
direction parallel with the broad black line by rotating the milled head (V) on one of the standards, and the accurate reading is made by moving the graticule until the space between the two short lines (y) on the right is bisected by a circle division and then observing that point on the diagonal scale where a circle division is symmetrically placed between two adjacent sloping lines as illustrated on the drawing.

The reading obtained is the equivalent of the mean of two independent readings of opposite points of the circle, and is free from any inaccuracies due to eccentricity of the circle.

This method of reading has not received universal approval, and the makers are now at work on a second model, which, though built on the same general lines as the earlier one, incorporates a method of reading invented and patented by Captain T. Y. Baker, B.A., R.N., which is very ingenious.

The new method is as follows: By optical means images of the divisions from two diametrically opposite points on the circle are brought together at a suitable focal plane and appear adjacent to each other, as shown in Fig. 3, one portion of the circle appearing to follow on the dividing of the opposite portion, but with a space between them. This space is just a fraction larger than a fixed black mark situated in the centre of the field.

A micrometer scale, which carries a pointer fixed symmetrically over the black mark, appears in the field of vision immediately above the circle images. This scale covers the complete range of 20' and is subdivided down to 2", thus giving readings direct to 1". To read, the micrometer drum is rotated till the black mark is symmetrically placed in the space between the circle
images. Degrees and twenties of minutes then being read off the circle, the remaining minutes and seconds are taken from the micrometer scale.

Thus it is seen that Captain Baker has adhered to the principle, standard in the ordinary pattern micrometer theodolite, of balancing two slits of light on either side of an opaque mark. I think most surveyors will hail this as superior to the Wild method of setting circle graduations opposite one another.

We have not yet had the opportunity of giving either of these theodolites a thorough try out in the field, but I have no doubt that when one of the later Cooke, Troughton & Simms instruments is available, arrangements will be made for such a test. It is clear, however, that these new types fulfil the essentials we originally set out to achieve.

Both instruments are portable, being single units contained in one box complete with accessories. Though considerably lighter than ordinary patterns, their weights are not so low as was hoped for, but a certain amount of unnecessary weight will probably have been removed by the time they are put on the market.

The circles and optical mechanism of both instruments are completely enclosed and dustproof, and they are so packed and carried in their boxes that there is the minimum chance of strain or breakage.

Finally, their manipulation is easier and more rapid than in the older types in the fact that an observer can take all his readings without changing his stance.

Without a doubt it took the Continental makers some years to develop the technique of dividing glass circles; but from what I saw at York on a recent visit, it is clear that Cooke, Troughton & Simms, Ltd., are rapidly going ahead in this respect, and I think the greatest credit should be given to this firm for the way in which they have tackled the problem.

DISCUSSION

Before the paper the PRESIDENT (Col. Sir CHARLES CLOSE) said: This afternoon Captain Peake is going to describe what is called the Tavistock theodolite. I understand there are at least two varieties of the instrument, and that neither of them really bears the name of Tavistock. We hope to listen to an account of some new designs in theodolites, and I think we shall hear of some designs so new that they have not actually been carried into effect yet. I ask Captain Peake to begin.
Captain Peake then read the paper printed above, and a discussion followed.

The President: We are very fortunate this afternoon in having many eminent authorities on the subject with us. We should be glad to hear what Captain Geary Hill can tell us.

Captain Geary Hill, R.N.: As representative of the Admiralty and on behalf of the Hydrographer of the Navy, I should like to make a few observations on the Cooke, Troughton & Simms model in amplification of what Captain Peake has already told us. We have tested this instrument to a certain extent, and we found that the daylight illumination was not as good as it might be, but that has now been improved, and we hope that it will prove satisfactory, though we have not yet had an opportunity, on account of unfavourable weather conditions, of giving it a really satisfactory trial. This instrument was tried in Scotland last year by the Hydrographic Department, and although the weather was not very good it was found to work very satisfactorily, and when an observer became used to the method of reading off by the diagonal scale it was found quite easy and the method of estimation was found to be quite accurate. But, as Captain Peake has told you, a new method invented by Captain Baker is going to be incorporated in the next model, and we consider that this will be more suitable than the diagonal method of reading off. It was at one time suggested that an arrangement should be fitted to this instrument for ascertaining by means of a prism and reading glass whether the plummet was exactly over the required spot, but after consideration the conclusion arrived at was that it was too expensive a luxury to adopt. The case and carrying arrangements have been found quite satisfactory, and the whole lay-out of the instrument is very compact.

One of the supposed disadvantages of this instrument arises owing to the complicated optical arrangement. Any difficulty which may occur in the field owing to this arrangement immediately throws the instrument out of action as it can only be remedied by the makers. I noticed in a recent report of the American Survey Expedition to Peru that the Wild Theodolite, on the same principle as the Tavistock, was used for trigonometrical and astronomical work and proved very satisfactory. At one period the vertical circle went out of action owing to a defect in one of the prisms, and had to be dismantled and reassembled in the field. That took a considerable time, but, considering the reputedly complicated optical arrangements, it was remarkable that it was possible to get the instrument back into good working order again. If any representative of Messrs. Cooke, Troughton & Simms is able to state that that could be done with their theodolite as well as with the Wild, it would be interesting.

Mr. Hinks: To what accuracy could you read those diagonal scales? Did you read them to single seconds?

Captain Geary Hill: No, only to ten seconds; but you can estimate to five.

Mr. Wilfred Taylor (Messrs. Cooke, Troughton & Simms): I have listened to this paper with the greatest interest. There really does not seem much for me to say except that the daylight illumination of the first instrument made was not quite as good as we expected. I think that has now been improved and that in future instruments it will be better still. Captain Hill also referred to the optical plummet which was abandoned. There is no doubt that this can be done, but it is just a question as to whether the complication is justified. As regards optical adjustment in the field, that is rather a difficult question. I think when the Wild instrument went wrong in the field I know exactly what happened. The prism which illuminates the vertical circle is operated by gravity, and as the instrument is turned over this prism has to drop down; if the guides
get a little sticky, or if any additional friction comes in, the prism may refuse to drop. That is not a very difficult thing to put right in the field, but I would not like to say that any optical difficulty in the Wild or either of these two Tavistock instruments could always be put right in the field. It would depend really on where the difficulty arose.

It might interest some present to know just what sort of accuracy can be expected from these instruments. I took a great number of readings to try and arrive at some idea as to what might be expected. With the Wild theodolite we obtained plus and minus errors of 3"., the average error being 1'53". With the Tavistock theodolite the maximum and minimum errors were both 5" and the average error worked out at 2'61". As I say, conditions were ideal, and I think those figures about represent the sort of readings to be expected from the two types of instruments. The actual errors in the circles of the Tavistock theodolite are considerably below that, and the error mostly comes in through estimation, it being impossible to estimate nearer than 23". Our main aim was to get comparative figures—to treat the two instruments in exactly the same way.

Mr. Hinks: With the diagonal scale you got practically the same error as with the 5-inch micrometer. In each case you estimated to single seconds with these two instruments.

Mr. Taylor: In the case of the Tavistock instrument we were estimating to 23".

Mr. Hinks: Whereas in the Wild you estimated to tenths of seconds?

Mr. Taylor: Yes. I do not think there is much value in the estimation of the fractions of seconds. It can be done, of course.

At the request of the President, Mr. Taylor described and illustrated on the blackboard the Baker device, remarking: You see a representation of the horizontal circle; the light enters through a hole in the cover and is received by two prisms and at once divided into two beams. The beam to the right is received by a second prism which deflects the light down on to the glass circle, which is silvered behind, at a slight angle, so that instead of passing back along the same path it is deflected and received by a small sloping face and reflected into another prism. It is then received by one of the eyepiece prisms and brought to the focal plane. The apertures that Captain Peake showed in his diagrams are in the focal plane, and the reading mark also. The rays received by the other side pass through prisms in an entirely symmetrical manner and come to focus in the common focal plane. Now we have the two scale images symmetrically disposed. It is necessary to provide some means of obtaining the fine reading, and by turning the operating head the two deflecting prisms move up and down between two extreme positions and, by refracting the rays going to either side in the focal plane, cause the two sets of scale images to move in the same direction by equal amounts. The frame carrying these two deflecting prisms is linked up with the fine reading circle, which is so arranged that if a setting is made with the fine reading-scale reading zero, it will go through its whole travel of 20' when adjacent circle divisions will have taken the place of the old ones and a new setting will have been brought about.

Mr. V. W. H. Towns (representing Messrs. E. R. Watts & Son): Mr. Watts has been compelled to leave, but he asked me to reply to any questions that may be put to us. Captain Peake has not explained the micrometer arrangement, so I might say a word or two on that. Unfortunately, we have not a brilliant British idea to put before you. You probably well know the arrangement of the Zeiss system of reading. Its chief advantage lies in that the two sides of the circle are picked up by means of prisms, and from then until reaching the focal plane the two beams travel together through the same optical system. Therefore no
derangement of that optical system can alter any coincidence which has been made between the opposite sides of the circle. The only thing we have to ensure is that these reading prisms are a good fit in their housing, and then nothing that might go wrong, such as a slight displacement of any member of the optical system, due to vibration or transport, will in any way give you wrong readings. The only moving part in this design, apart from the axes themselves, is in the micrometer. The optical micrometer consists of two small parallel blocks of glass, one for each half of the field, which are tilted in opposite directions by a very coarse mechanical arrangement; that is to say, the amount of rotation or tilt is very small, but the amount of mechanical movement giving the tilt is very large. There is, therefore, no need for particularly fine workmanship there and very little can go wrong. The accuracy required of the spiral cam by means of which the blocks are tilted is not great, because the reduction is so large.

Asked how much the cross-hair subtended and whether it would be possible to re-set to one second and a half, the speaker replied: You could point the telescope to within a second with a magnification of about 20. Accuracy will probably be limited by the setting into coincidence of the circle divisions. That depends upon the quality of the optical work and the sharpness of the division, but that will give the accuracy with which you can produce one straight line across the field. That could probably be done under ideal conditions to a second. I rather agree that there is not much point in splitting the seconds, especially if you are reading to divisions not absolutely perfect.

Mr. Hinks: Might we know what is the date of the patents under which Messrs. Watts have a licence to manufacture these instruments?

The representative of Messrs. Watts said he was afraid he did not know, but another speaker said "1922."

Mr. Hinks: The parts are differently disposed, but is there any fundamental difference between the design of the Wild theodolite and the Watts? I recognize all the parts are differently arranged, but it is fundamentally the same.

Mr. Towns: I think there is a difference in the micrometer readings. It is so long since I had anything to do with the Wild theodolite that I have forgotten.*

Brigadier-General Jack: There is one question I should like to ask, and that is with regard to Captain Baker's method of reading. The reading depends, I understand, on centering the broad mark between two adjacent marks. Now, if

*Note by E. R. Watts & Son, Ltd.

The optical reading system of the Watts Monocular Micrometer theodolite follows that of Zeiss, which, although based on the same fundamental principle as the Wild, namely, the bringing into coincidence of the two opposite sides of the circle, is nevertheless of entirely different optical design. It presents a fundamental difference of design in that both circles are in the field of the micrometer simultaneously with the scale of seconds.

The micrometer eyepiece, moreover, does not travel with the telescope, being arranged on one side of the instrument outside the standards, but it will turn to enable readings to be taken from either side of the theodolite.

The Watts "M.M." differs from both the Wild and the Zeiss in that it will transit at the eye-end and will take zenith sights with a diagonal eyepiece.

With regard to the accuracy of re-setting the divisions into coincidence, we quote the following results which were obtained during a "speed test" at our works. The telescope and limb were left clamped. Five consecutive readings were made; the vertical circle readings had a variation of 4.3", and the horizontal circle 1.4", the average time taken for a complete reading, viz. vertical and horizontal circles, being 19 seconds. It was interesting to note that the last four horizontal circle readings varied by only 0.5". Eight more readings were then taken of the vertical circle, which showed a total variation of 1.7".
there is any difference of illumination between the opposite sides of the circle, it seems to me that that would throw out the centering between the two marks. Is the illumination on the opposite sides of the circle bound to be the same? If one side is rather darker than the other you would naturally, in centering this broad mark between the two fine lines, tend to be a little bit nearer to the bright side than to the dark.

Mr. Taylor: I think that that is a point, and it would be a very strong one if the illumination to both sides of the circle had a different origin. As the one beam is divided and half is brought to illuminate each half of the circle it is only a matter of properly arranging that illumination in the first instance, and I think one may say that no errors will arise from that cause. That is the whole point: that the same illuminating beam should be used for both circles.

Colonel M. N. MacLeod: I think the only point I have worth mentioning is the fact that the initiative in the matter of these instruments was taken by Colonel Winterbotham, who, unfortunately, is not present to-day. He telephoned to know whether I was coming, and asked me to apologize for his absence; he is embarking to-morrow and is, of course, very busy. This matter was raised by him, and he is, as you know, a soldier, and that is rather interesting in view of what I think must be a well-known story. The first soldier who appeared with a theodolite on the Western front is said to have been immediately arrested on the ground that no Britisher would ever think of fighting a war with such an instrument; he must have been a German.

Major Boullnois: I should be very glad to see a little more play given in the horizontal top of the tripod. One knows by experience that the centering of a theodolite takes a great amount of time, and in the re-design I should like to see that brought out. I should also like to see a vertical collimator. It was mentioned, that the theodolite was too heavy, but I should have thought there might have been a little addition which would weigh 1½ lb. and you would get rid of the swinging plumb-bob which has tried all out tempers.

Lieutenant D. R. Crone, R.E.: I have been carrying out some observations with the Wild theodolite, and the figures for the readings on the vertical arc may be of interest, as the instrument is that with which those described to-day have to compete. The first point was to determine the actual sensitivity of the bubble. This appears to give a reading of 16" per millimetre; that is, half as sensitive as the bubble described on the Watts. I do not know how it compares with the Cooke, Troughton & Simms. I think probably it is considerably less sensitive. Following the readings on the bubble, I made a number of readings to determine what the accuracy of readings arising from that bubble would be. They were carried out on a fixed mark with no special preparation, and the figures given showed a total range of reading of 10°6' of arc, with a mean error of 3" and a probable error of 2'2". A better series of observations taken by night with the electrical illumination on Polaris of fourteen observations on the same face, taken continuously and corrected for time, showed an extreme range of 11", a mean error of 2'3", and a probable error of 1'9" of arc. That 1'9" of arc, which includes the error of intersection of the star, the error of stop-watching, and the error of reading the micrometer as well as the error of bubble setting, shows what the instrument will do. I think it gives a very fair idea of its accuracy. Following these the point arose as to how close a single reading of the micrometer could be relied on. From thirty-two readings of one setting of the telescope the extreme range of readings was 1'7", the mean error 0'33" and the probable error 0'28" of the micrometer. So that it is certainly useful to interpolate to tenths of a second.

While carrying out these readings of the micrometer a slight error was
detected between readings taken on the earlier part of the micrometer and on the latter part. In the way the vertical arc of the Wild theodolite is arranged it is possible to get micrometer runs, since the vertical circle will give coincidences at two points on the micrometer. For instance, if you make a coincidence with the micrometer reading 0' you get another coincidence at 5'. You get two readings on one setting. A number of micrometer runs were taken on the vertical circle and the micrometer showed distinct error. For instance, the mean micrometer run on one division from the o' mark to the 5' mark was 5° 3'3'', whereas from 5' to 10' that same division read 5° 0'5''. That error is very large, and I think it can only be due to an error of adjustment. It may be in the connection between the parallel plate of the micrometer and the actual reading circle. It is difficult to say. The possibility of taking micrometer runs is due to the division of the Wild vertical circle, and I do not think it is possible, from the description of the instrument, on the Watts, in which, I believe, the micrometer only includes one coincidence of the circle divisions. The value of being able to take micrometer runs is very great; because that error of 3'' detected on the vertical circle would give quite large undetected errors when applied to the horizontal. Taking a number of micrometer runs on various parts of the arc, about fourteen in all, the actual micrometer gave a value of 5° 0'6'' when read from the 4' mark to the 9' mark.

Colonel Crosthwaite: I want to ask one question, namely, is there any chance of this optical system of the prisms fogging up when you get into a climate with a moist atmosphere and sudden changes of temperature? It seems to me that if that happened it would be impossible to get at the prisms in the field, because they are all sealed up. I do not know what the experience of those who have used the theodolite in such a climate is.

Lieutenant Crone: I had a Wild instrument out when there were about 4° F. of frost, and there was very considerable trouble owing to the lenses, which are in the body of the instrument, freezing up. The beam from the vertical circle is carried down one of the pillars in the Wild instrument, and then it is carried across between the pillars in the open. The two lenses by which it emerges and enters the pillars condensed moisture which froze. They are recessed about ¼ inch and they are only about ½ inch diameter. It required much poking about to get this off, and about 70 per cent. of the time of observation was taken in getting these two lenses clear of moisture.

Mr. Hinks: In India do you get internal condensation? I think that was what Colonel Crosthwaite had in mind.

Lieutenant Crone. The experience of the use of the instrument in India was on the North-West Frontier and in Sind, where there is practically no moisture to condense.

Mr. Reeves: First of all I would like to say that the surveyor in South America referred to just now is a personal friend and former pupil of mine; and when he was in England last summer he told me something about his experience with the Wild theodolite he took on his expedition. He got on quite well with the instrument until something went wrong with one of the prisms connected with the vertical circle, and then he was in serious difficulties. The whole of the interior, though wonderfully ingenious, is most complicated, and if anything gets out of order there are no ready means of putting it into adjustment again. I know it is supposed to be impossible for the instrument to be put out of adjustment, however rough the country over which it may be carried, but it is not safe to assume this of any instrument, especially in the case of one with such intricate optical arrangement. At any rate it did go wrong, and the unfortunate breakdown caused my friend most serious inconvenience and delay; and
it was only because he is an exceptionally good man, with considerable optical knowledge and experience of delicate instruments, that he was ever able to get the theodolite into anything like working order again.

Now, this absence of any ready means of adjustment seems to me to be a great drawback to this type of theodolite, which includes those we have heard about this afternoon. They may be all right in the hands of exceptional and highly qualified men, but on many exploring expeditions the man who has to do the astronomical and surveying work has frequently had but a short training—just enough to enable him to take useful observations—and has had little previous experience with instruments. In a case like this I do not feel that it would be safe for the man to be dependent upon a complicated instrument which he is unable to set right if it goes out of adjustment when he is in the wilds of Africa or elsewhere. Another improvement badly needed is some ready way of cleaning the interior glasses when they get misted or frosted over. We have just heard of a case where considerable difficulty and delay were occasioned through this happening. It is to be hoped that in the instruments now being made this difficulty has been provided for. At any rate, until these difficulties are got over there should be some other instrument to fall back upon in emergency.

These new theodolites, of course, possess certain advantages over the ordinary type. They are exceptionally light and portable, and the accuracy obtainable is remarkable for such small instruments. Then the fact that the means of the opposite sides of the circles can be read off without going round the instrument is a great saving in time, and avoids the risk of kicking the legs in the dark. In the case of the theodolites which we have just heard described there is no need for pushing in a special prism when one wants to read the vertical circle and taking it out when the horizontal circle is read; neither is there that remarkable arrangement whereby the difference between the readings, on the two vertical "faces" gives the altitude, but the mean altitude on each "face" is read off. These are, I consider, commendable simplifications, tending to prevent mistakes. The marking of the micrometers by letters is again an advantage since one can tell at once which is being read.

Still, after all, when everything is considered, the ordinary pattern micrometer theodolite with which many of us have been familiar for years will require a lot of beating, especially in the lighter and improved forms in which it is now made. This instrument has for years past done excellent work; it is simple in construction, and there are no complicated prisms and glasses inaccessibly closed in. It can be readily cleaned, and if it gets out of adjustment it is an easy matter to put it right again. Nothing but a blow sufficiently heavy to bend its centre axes would put it hopelessly out of action; and in this case no theodolite would be of any further use until it had been sent to the makers.

Mr. Hinks: I am sure everybody would agree with Mr. Reeves that it is always sound to have a second string in your pocket—if that is the proper place for a second string. I think it ought to be remembered that, at any rate, the Wild photo-theodolite went all through the Shaksgam expedition and then along the Mosul boundary; came back here and had minor trivial things done to it, and went out to South Africa, where it has done a lot of work in the Drakensberg in Natal, and in the Cape Province, and up to the present nothing has gone wrong with its optical arrangement, so that there is a good deal of accumulating evidence that if you treat these instruments carefully nothing much goes wrong with them. It must be remembered, too, that these small instruments are very tough things—one of Wild's instruments was dropped 2000 feet in Switzerland, and although the object glass broke, the glass circles did not break. I do not think there are many theodolites which would stand more than that.
What I wish to speak about is the question as to whether it is worth while to go in for the tenths of seconds. I cordially agree with Lieut. Crone and entirely disagree with Mr. Wilfred Taylor on that matter. I think I remarked here once before that my first acquaintance with the Wild theodolite was on a genial sort of day like this (a day when a keen east wind was blowing) upon the terrace of the Polytechnikum in Zurich, where I was allowed to try the instrument after it had been demonstrated to the German-Swiss surveying society. Not having touched a theodolite for over ten years, I made five consecutive settings upon a not very good mark, and to my intense surprise found I had obtained a range of 1°2" in the five readings, which immediately brought to my attention the fact that this was an instrument of very unusual capabilities. It does seem to me that when you can, with a Wild photo-theodolite in the garden here, repeat angles to single seconds, it is worth while to record the tenths. You do get, undoubtedly, an increase of accuracy if you record to tenths, in spite of the probable error which has been made of several tenths; and I was rather surprised when Captain Peake, having shown a circle divided to 2", said you can quite easily read to 1". I thought the proper way of putting that would be: you can quite easily estimate to two-tenths of a second, and that rather implies that it will probably be found worth while to divide that circle into single seconds. I feel convinced that when there is the possibility of repeating this setting so accurately it is worth while to work to tenths of seconds, especially in astronomical work.

I am grateful to Mr. Crone for the results he has been obtaining, because nobody had up to the present known the accuracy of the Wild theodolite at all for astronomical positions. The Swiss constructors had not astronomical positions primarily in mind in the design, and one would not have been surprised if the instrument had turned out rather uncomfortable for astronomical work, excellent though it was for terrestrial. Mr. Crone, I am delighted to hear, found that with relatively small alterations in illumination he was satisfied with the instrument for astronomical work. That seems to me to open up great possibilities. I suppose there is nothing more badly wanted in this country than to have latitudes and longitudes observed at every primary point of triangulation and at as many secondary points as possible, so that we shall know something about deviations of gravity in this country. If one can adopt the Wild theodolite and readily bicycle about with the theodolite on one's back and occupy a station a night, given good weather in a few years any one could make a tremendous contribution to the geodesy of this country. I think you will find that you must not overlook the tenths of seconds in that case, but that it will prove thoroughly worth while to pay attention to them. Therefore, I always feel that Mr. Wilfred Taylor's ingenious scheme of the diagonal scale, which reminded me of 'Tycho Brahe's celebrated instrument, which is familiar in the Progymnasmata, was not the solution which English makers would eventually adopt in their attempts to beat the German and Swiss instruments. The delightful device of Captain Baker is an enormous improvement on which I think he is to be very cordially congratulated.

I very much hope that Messrs. Cooke, Troughton & Simms will get one of the instruments made as soon as possible, so that we can try it and that it shall not suffer the fate of the original model. When that came to us Mr. Reeves was so indignant about the diagonal scale that he sent it back before I had time to see it!

Captain CLIFFORD: I had an opportunity of trying the Wild theodolite in Africa. I was unable to test it at all for any terrestrial work, but I tried it on stars. In the first place, owing to the shape of the telescope and the absence of star-sights I could pick up isolated second-magnitude stars, but certainly nothing smaller, and it was impossible to identify a second-magnitude star that
was near any others. For instance, in the case of Orion’s belt it was impossible
to state which of the three you were on. I have not examined Cooke, Troughton
& Simms’ instrument properly, but I did not see any star-sights. If they are
to be fitted I hope they will be of good type and not simply the crude type we
were accustomed to on the old 5-inch.

When using the Wild theodolite I was not able to test it very fully. As to the
lenses, we were in a dry climate. We had it on camels, and I did find one diffi-
culty, namely, that the collimating bubble got out of adjustment, and that there
was no adjustment fitted. I pulled that, to a certain extent, to bits and succeeded
in screwing it up and getting it right. That brings me to another point. On the
Wild horizontal bubble there was a zero mark and no graduations, and you
are supposed to correct the vertical pointings by bringing that bubble right.
That may be all right for terrestrial work, but it is not of much use in astro-
nomical. I see the Cooke, Troughton & Simms’ instrument has a graduated
bubble, and I think the value was quoted at 17” per tenth of an inch, or there-
abouts. Is not that about twice as coarse as it should be when you are reckoning
on arc readings to single seconds? That is an old point, and I know it has been
a criticism against theodolites for many years, but I think that point is still
evident.

Mr. Wilfred Taylor: If I might just make one more remark. First of all, as
to the fractions of seconds. I suppose there is no reason why one should not
record the fractions so long as one recognizes the value they have. That is to
say, one cannot possibly point the 14-inch telescope to a tenth of a second. Of
course that is understood. I take it that Mr. Hinks’ point is that it is better to
record a fraction of a second than nothing at all, but not to look upon that
fraction as necessarily correct.

Mr. Hinks: Not right to one or two in the last place, but you can point to
a few tenths of seconds.

Captain Geary Hill: That rather savours of false accuracy.

Mr. Hinks: Not a bit. I think that is quite an error. It is a general rule that
you should make your observations to one figure more than is really significant,
otherwise you will get unnecessarily rough results.

Mr. Taylor: As regards the Wild method of reading, I think one should
make it quite clear that the Tavistock specification originally called for an
instrument to read to ten seconds, and when we introduced the grid it was to
make an instrument to that specification. We understand now that it is thought
desirable to read to a much finer angle than 10”, and we have several of the Baker
instruments at present about half finished. We hope they will give this new and
higher degree of accuracy.

Captain Peake: Mr. Hinks has said that one should read to one figure beyond
the actual direct reading of the instrument. I understand that the Wild firm are
bringing out an instrument which is actually divided to one-tenth of a second.
Would he estimate to hundredths?

Mr. Hinks: Certainly. I should estimate to hundredths to see what happens.

Captain Peake: I think the analogy of logarithms can be taken there.

Mr. Hinks: No. In this case the instrument has been deliberately designed
by Wild, divided into tenths of seconds, estimated to hundreds. I think it would
be interesting to study and see what you can get out of it. You can repeat to one
or two tenths on that instrument, because I have tried it.

Captain Peake: The analogy of logarithms does hold good; when 5-figure
logs. are required with a certainty that the fifth figure is correct, it would usually
be advisable to use 7-figure logs. in order to avoid the necessity for troublesome
interpolation. That, however, is no justification for assuming that the result is
correct to 7 figures or for undertaking the unnecessary labour of interpolating in the seventh place.

Mr. Hinks: I do not quite agree with your analogy.

The President: We are indebted to Captain Peake for introducing this subject. It is probable that this new kind of theodolite has come to stay. I do hope that what Mr. Reeves has said will be borne in mind, namely, that there shall be some method of adjustment in the field. Personally, I have the utmost respect for the old 5-inch micrometer theodolite of Cooke, Troughton & Simms. I knocked about Africa and elsewhere with it in years past. It might occasionally want little adjustments, but it is very easy to adjust. I understand with these new instruments, as at present designed, that you may find yourself in a situation in which something goes wrong inside the box of tricks and you cannot mend it unless you are an exceptional man. I believe that, with all the advantages which the new instruments have, that matter of easy adjustment ought to be provided for as well: if you were in the wilds of Africa, for instance, you might want to be able to adjust the internal optical arrangements.

I am not going into that vexed question of the degree of refinement to which you should read, or attempt to read, the instrument; but I feel that one does not want very great accuracy for ordinary terrestrial work. Those instruments are not going to be used, in most cases, for geodetic work, and what is wanted is ease of reading, portability, general convenience and, of course, resulting saving of time. It is not until you get to astronomical work with small instruments that you want very great fineness of reading. Then of course you do want it. I should be glad to see Mr. Hinks' idea carried out of a sort of campaign, by which selected University men should be sent out to a number of primary and secondary stations in Great Britain to observe latitudes on two or three nights with these small instruments.

We are all much obliged to Captain Peake for his interesting address, and in the name of the Society I beg to thank him.
FROM SOUTH TO NORTH THROUGH DANAKIL

L. M. NESBITT

During the last six months we have received from Mr. Nesbitt, a mining engineer of English family long settled in Italy, much original material from his recent Danakil expedition—sketch-maps, panoramas, photographs, and diaries—in addition to an account of some aspects of his journey, written since his return to Europe from Ethiopia. This had not been arranged to give a systematic topographical description of his important expedition, and it appeared that the task of doing justice to Mr. Nesbitt's material would occupy many months. On the other hand, he was anxious that some preliminary record of his journey should be published. We have therefore prepared for the present number of the Journal considerable extracts from his account, and strengthened the topographical treatment by summarizing his diaries, which were kept in English, though the speech of the Expedition was Italian. The principal facts of an important exploration are thus put on record: and we hope to give the material more adequate treatment in due course, and to produce a map embodying Mr. Nesbitt's sketches and observations.—Ep. G./f.

HAVING entered Abyssinia by way of the Sudan, following upstream the Nile, Blue Nile, and Yabus, through the provinces of Beni Shangul and Walega in the far west of Ethiopia, and having thus gradually risen terrace after terrace to the great plateau, after several months' caravan travel on it, a strong desire grew in me to see, before leaving the country, the wide belt of lowlands, desert or desertic, running more or less parallel to the Red Sea and stretching from it to the eastern front of the central plateau. In particular my intentions were directed to the region which goes under the name of Abyssinian Danakil, and roughly forms a rectangle of some 5½ degrees north to south by a degree and a half east to west.

I had often heard of this comparatively speaking large section of Abyssinia which had attracted explorers at different times. All attempts to penetrate the country, however, though invariably aiming at crossing the Danakil rectangle along its shortest or east to west axis, had been unsuccessful. In fact, expeditions which had ventured too far into the interior had been without exception wiped out, often with a total loss of the information collected. Others, owing to increasing physical difficulties and the hostility of the natives, had limited their activities to exploring the border lands or the safer portions. In the rare instance of some white, generally a trader, having succeeded in crossing the region, he had done so by adhering strictly to one of the three existing caravan routes: that running from the ports of Tajura and Assab on the Red Sea coast to the Aussa Sultanate and thence westward to the plateau, eventually reaching the markets of Mofa, Dessie, Batie, etc., on the highlands, or one of the two other routes which run close, respectively, to the northern and southern border of Danakil. But travel along an original itinerary, outside these three routes, had always met with fatal results, which accounted for the fact that those zones were still unexplored, partly through the difficulties inherent on voyaging in a dry country, especially Upper Danakil, and partly through the hostility of the natives, met with everywhere.

There were, accordingly, all the elements for an original exploration and
topographical survey of considerable extent to be made, for the geographical information about Danakil was either entirely lacking, as the white patches on the existing maps denote, or much that was available had little claim to accuracy, having been compiled in many instances from sources as modest as natives' reports. Further, to me, a mining engineer, there was the attraction of large fields for absolutely first-hand mining and geological observation. The greatest force drawing me, however, was that of travelling for the first time over ground ungazed, untrod yet by a white, of being the first to see whatever there was to see of people, races and habits, of mountains, rivers, deserts and volcanoes, to "put all this on the map," and more than to cross, to cleave the large Danakil rectangle on its longest axis, that is, from south to north, and to zigzag about it. In one word, to exploit, as far as conditions allowed, the possibilities of exploration in that little-known territory.

Probably because I do not possess sufficient means to spoil my conservative outlook on certain matters, to the extent of releasing a fleet of motor-lorries with aeroplanes overhead dropping comforts, it was a source of satisfaction to me to think that nothing beyond God-created live beings, camels, mules and ourselves, would bear the burden of the test, since in my opinion land exploration should first be attempted with no further subsidy than man's half-brothers, the animals which share his life and his toils. I was glad that it was to be a test of living creatures and not of shop products. To awaken terra-incognito by the roar of the exhaust, or to bring the forest to attention by a clash of gears, as the first sign of our presence among conditions which have remained as they were since God made them, and which do not pale at such manifestations of ours, has always seemed to me, as a first form of approach, one in keeping with the practical materialism of our age. Whenever I have seen those deep parallel ruts, the spoor of the mechanical beast, on virgin soil, I have been struck by the profanity of them. Mechanical assistance changes the feature of exploration, since instead of man's struggle step after step towards his goal, surmounting the obstacles on his path by sheer physical endurance, tact and tenacity, it makes of it a fleet exploit to be viewed from behind a steering gear, with foremost in one's sight the quivering pointers of the dials. Exploration is no longer a record of the uninterrupted contact of man with the life and its struggles, actually lived, fought and conquered on the very ground.

At Addis Ababa I was very fortunate in meeting two Italians, Signor T. Pastori, a prospector, trader and traveller of experience, and Signor G. Rosina, a hardened Eritrean farmer. They, I found, were also anxious to penetrate into the Danakil territory, though their motives were commercial: to see if any trading possibilities existed in the reputed rich Aussa Sultanate. We therefore decided to join forces and make the attempt together.

The caravan consisted of ourselves, fifteen natives, twenty-five camels and four mules. We kept it as small as was compatible with our plans in order to have all the natives always directly under our control and to afford greater agility of movement. Besides, as more than half of the travel was to be through deserts or barren country (and we did not know yet of the boulder region nor of the basalt and lava fields of Upper Danakil), the basic foodstuffs for the whole caravan had to be carried throughout the entire trip. We could hardly
rely on game which we might shoot because beyond the Aussa it was doubtful if any would be found. Further, we anticipated having to carry water, and in effect this proved to be the case for an average of 50 per cent. of our journey. There was still another paramount consideration: the necessity for avoiding a display of wealth or numbers and thus exciting the cupidity and suspicion of the more avaricious and bloodthirsty among the tribes and rulers through whose territories we hoped to pass.

Accordingly the advisability of a small party was calculated and its various units were reduced to the minimum. In practice this proved to have been a wise decision. Our men, each known and faithful and continually under our eyes till they learnt from actual experience as the events were developing what order and discipline and tact with regard to the Danakils meant, gave the latter no cause for arrogance. A small party is more easily watched by its leaders and the ostentation of wealth, at the best always a disputable practice, may sometimes become very dangerous within certain surroundings.

We were fortunate in getting through with the loss of only three men killed by the Danakils, one turned insane through heat, and ten camels and three mules died of fatigue. With regard to the surviving mule, his having survived was entirely due to a series of very fortunate circumstances and to the pride eventually taken by all of us in seeing him through. His resistance therefore can hardly be taken as evidence of success of a test which could be sustained in the usual run of events in such a climate, when the camels succumbed in spite of all care. The caravan had to be remounted on two occasions (and renewed as to personnel); first at the Erafible plateau market, Mofa, where three new camels were bought and the weakened ones changed, and then in Aussa, where ten new camels were purchased from the Sultan. As to the loss of three human lives in open attacks or by sniping, this can be considered as trivial if one bears in mind the fact that all previous European expeditions which had penetrated far into the interior had been wiped out and that my itinerary represented a course half a dozen times longer than any hitherto attempted.

Touching the question of passports, the advantages whereof are sometimes of extreme importance, I must say that here we went without any or even the permission of the Abyssinian Government or the official knowledge of our respective Legations, in order to avoid the otherwise inevitable official embargo which would have been put on our enterprise. Besides, in a lawless country such as Danakil is, where even in the border lands one feels in the air the utter disregard of any allegiance to the rule to which politically Danakil is supposed to belong, and this accentuates as one travels to the interior, all the possible safe conducts and passes from Addis Ababa would have been of no protection to us.

Returning to the Danakil rectangle, I have introduced the division of Lower and Upper Danakil, taking the Aussa Sultanate as the centre and the caravan route from the coast to the plateau markets as the dividing line. We started from Hawash Bridge Station on the Addis Ababa—Jibuti railway, lat. 9° N., on 13 March 1928, and followed the Hawash downstream, zig-zagging about its course. At one time we were forced to push as far west as the first plateau markets in Amhara and Gallaland to re-supply and re-strengthen the caravan,
which had suffered considerably from attacks. Eventually, however, we reached the Aussa Sultanate, where the river Hawash disappears, drying up in the desert. Here the Sultan was friendly and helpful once his suspicions had been set at rest, to the extent of coming in state with much display of forces and pomp and staying for a few days near the party’s camp. From Aussa the caravan moved northwards again, now through sand deserts, barren country, or lava fields into the Biru Sultanate. From here we crossed the Dlorum plain, past a hitherto unknown salt lake, and after skirting the western face of the Hertale mountains, with a group of four active volcanoes and a series of salt lakes likewise unknown, we came up across the great Salt Plain to Assale–Dallol near the frontier of the Italian territory, which was reached on 26 June 1928.

One of the main difficulties experienced in our exploration was in finding sufficient water. In Lower Danakil, where the Hawash winds its course, it was generally met without trouble. We could not always travel alongside the river, as the vegetation was in places almost impassable. It was therefore best to strike a course on the clear lands lying immediately beyond the vegetation belt which closely accompanied the river banks. At periodical intervals the caravan could approach the river, selecting such places where the forest was sparser and the loaded camels could travel without catching their loads on branches above or on trunks at the sides. In fact, the difficulties were of a very minor nature as the water was always within reasonable reach. As to fording the Hawash in the dry season when we were travelling, we experienced no serious handicaps. We always managed to find a place where the camels touched bottom all the time. Often the fords were very shallow. None of the tributaries of the Hawash which we crossed were perennial, with the exception probably of the Mille. They were only torrents which swell after the plateau rains, and accordingly the greater number were met on the west side of the Hawash. Those on the east side were few and unimportant in size as compared to those of plateau origin. Yet, in almost all instances, both west and east bank tributaries, however dry at the time of our progress, bore constant water-holes where their courses traversed rocks, or water was obtainable by digging where the soil was gravel or sand. We always struck water where indications were favourable, though of course at variable depths.

In Upper Danakil, on the other hand, one realizes what a “sine qua non” factor water is. It is a dry country without question. Water is only found at certain water-holes, often four or even six days’ journey apart, which accounts for the scarcity of the population and in the dry stretches between, for the awe-inspiring desolation and utter lack of anything alive, animal or vegetable. The water-holes are often mere wells dug deep in the ground, a foot or two in diameter by some 6 or 9 feet in depth, and from the bottom of which a mineralized liquid percolates in small quantities almost drop by drop, to the agony of the thirsty. Sometimes these wells dry out, for a period or for good, when the sequence or amount of the rains on the distant plateau has suffered any variations, or a feeding torrent has altered its course to distribute its supply to another sector of the lowlands which stretch from the far-away spurs of the plateau to the sea-coast. These conditions all foster a state of continuous apprehension as to the morrow, since no travellers are met and the portion of
the country we traversed is uninhabited except in a few places, where un-mineralized water and moisture below the surface allow a little pasture. The natives themselves do not stir, they keep to these isolated and rare spots and guard them with suspicion and jealousy. Thus from place to place the barren country is almost unknown to the majority of them except for the very few who, once or twice in their lives, have chanced to cover such stretches. In some cases our very guides had not been over the ground for ten and even fifteen years. Accordingly information was scanty and unreliable, and we had the prospect when leaving a water-hole of finding the next well dried out, after four and six days' travel to it. So that it sometimes happened that we had, on arriving, to continue because the long-hoped-for recess held nothing but caked mud. Then the remnants of our water provisions were treasured more than all the gold on earth and doled out not to waste one single drop, till even that little ended and the last goat-skin was wrung. I have sucked, and the others did the same, the very sacks which still held some moisture from the exudation of the goat-skins they were wrapped around during the journey to protect them from evaporation or ripping.

Only on very rare occasions, probably twice or three times in all Upper Danakil, did we find an abundance of fair unmineralized water. This was in all instances in deep volcanic hollows occurring, for example, in basalt flows and which a torrent had chanced to fill, as once in a period of several years it had succeeded in carrying the plateau rains so far east into Danakil. These impermeable cavities, some of considerable size, storing comparatively speaking great quantities of water, can outlast for a few years any vagaries in the run of the seasons, when there is no demand on them and they suffer only from evaporation. They may accordingly be considered as permanent water-holes as against those giving only an occasional supply.

Yet even where these singular permanent water-holes are to be found, just because their site is deep-set in rock usually volcanic, the conditions about are of the most prohibitive to life of any kind, and one would search in vain for any vegetation. A forbidding landscape of harsh black lava or basalt flows, the former with all the signs of its fearful, slow but unrelenting progress, the latter in bluish ramparts of columnar structure often overtopping white chalk beds almost incandescent in a blazing sun, at the torturing heat of 170° F., affords no means for any life to exist, and only in some remote instances we witnessed a few deadly snakes and their transient prey, the desert partridge. These birds, sometimes in numbers together, fly great distances according to the season of the year, to reach a water-hole at sunset, and thereby often assist the thirsty traveller through the direction of their evening flight. The snake, the sole permanent inhabitant, deeply hidden in the moist cracks of the rocks around the water-hole, comes out only at sunset to prey on the birds which have arrived from above at that time of the day to drink.

In contrast, in Lower Danakil game is plentiful: in places the forest along the Hawash teems with wild life, especially monkeys and brightly coloured birds. In the river there are hippopotami, crocodiles, and fish; on the banks there are boars, snakes, leopards, buck, gazelles, and antelopes of many kinds, these latter animals grazing in flocks, sharing the pasture with zebras, ostriches and wild asses, and almost unafraid of man's approach on the short grass.
With regard to fruit, I found none except, very rarely, a few hard berries, from a thorny tree, tasting like very poor cherries, and others, from a bush, of a sickly-sweet, gluey consistency under a bitter red skin. In the Aussa and at some water-holes in Upper Danakil near the Hertale Group the dum variety of palm grows, from which a liquid is extracted which goes under the name of dum-wine. Slightly acid and pleasant to the taste for a few hours after dripping from an incision made in the tree trunk, after a day it is not fit to drink, having turned quite sour.

Upper Danakil was covered in half the time we took for Lower Danakil, as we had to travel through the former almost always by compulsory forced marches, from water-hole to water-hole, usually at night when the moon was favourable, to avoid the heat, or at sunset and before sunrise.

Concerning the ground we travelled upon, we experienced from the easiest to the hardest conditions. At times we passed over perfectly level boundless expanses of clayey, talcy surfaces, beautifully smooth and hard, or flaky and crisp or over soft gravel or fine sand on a hard bottom, and these fortunate conditions would last for days and days, allowing us to make quite good progress. Then we would travel for days on end over boulders and rocks of volcanic origin, piled in confusion, as if dumped at random from above by giants of a fabulous age. Often forming mounds and rises of a few hundred feet altitude, outstanding from the apparently even spread of similar rocks covering the landscape all around as far as the eye could reach, these totally barren prohibitive stretches proved a sore trial to our advance. For several days these continued, hard rocks of all dimensions up to monoliths of 200 and more cubic yards, sometimes half sunk, at others standing out boldly from the humber stones surrounding them, but all in a jumble, with hardly even the disintegration of the larger masses to form the smaller. Such huge Cyclopean units had to be circled around or a passage forced between them, often so narrow that camels would jam their loads or shake them out of balance. In other places the roundish stones under foot, especially on the descents, would prove a rolling ground and the camels would fall continually. Under such conditions, with the limited progress imaginable, we at times travelled for many days without the possibility of foot or paw or sore back at night resting flat once. What I have witnessed these poor cushion-footed camels perform on such occasions could not have failed to amaze anybody, because I have actually experienced their adaptability pushed to extremes I would have never thought realizable before. But there was no alternative. We were often forced to continue by thirst and lack of forage for the animals. They frequently went without food for over a week, and even when any was found it was of no quantity or substance. The weaker animals in many instances received a few handfuls of durra from our scanty provisions, to keep them alive.

At other times, to make matters worse beyond comparison and make us wish for the boulder regions and the rockiness above described, we went for days at a stretch over sharp, hard, cutting lava fields. Lava, at the best is a painful surface, but here it was, so to speak, set on edge, so that the flags hard as cast-iron, broken and rebroken by subsequent earth movements and recemented hard by more recent molten flows, were protruding, standing out
in confusion at all angles. Often deep crevices, severing the masses, had to be
detoured, or a series of small spent vents of an ancient volcano had to be
crossed, necessitating getting down and climbing out of them again. The very
landscape was black, forbidding, terrible, barren, dry, and at a furnace
temperature, because we could not travel by night over that inferno. The
camels' feet were cut, their fetlocks ripped, and their knees opened, while our
very hands were bleeding. Lower Danakil was hard, mainly through the
hostility of the natives, but Upper Danakil had the hardness of a saw edge
even to the ground. The blackness of its immense lava-fields, the sharpness,
the confusion, the pitfalls, the howls of the despairing camels and the thirst
of those days will never fade from my memory.

From Assale, the end of our northward trek, we marched to the nearby
locality of Beliga, and here divided. The greater part of the caravan, or what
was left of it, went west to the plateau, to recover and be disbanded. I and
one of my companions marched east into the Italian territory and, without
difficulty, reached the little village of Mersa Fatima, on the Red Sea coast,
on 1 July 1928. From here we proceeded by native fishing boat to Massowa,
which we reached on July 4, i.e. on the 114th day since leaving civilization at
Hawash Bridge Station, having spent 106 days on a march of over 800 miles
in Abyssinian Danakil, and completed a successful survey of some 20,000
square miles of lands in the greater part of which no white had set foot or
had returned before.

The following topographical summary of the journey has been prepared from
Mr. Nesbitt's diaries and sketch-maps deposited with the Society.

Leaving Hawash Bridge Station the caravan first journeyed north-westward,
away from the Hawash, past some hot springs, to the native village of Urama-
rla, which lies in fertile lava country. They then turned north-east over
a barren thorn-bush plain, crossing two clear streams flowing to the Hawash.
Near the main river they passed through the forest belt which accompanies
the river until it ends in the Aussa region. The vegetation in this belt is
sometimes very thick and interlaced with lianes.

Fording the river they continued northward on very broken ground, over
a black earth plain. After crossing and recrossing the river once more they
proceeded down the east side, through the villages of Ontutti-Omar and
Additali. At Kortumi the native chiefs wished them to return two stages,
cross the river and continue along the west side, at the foot of the hills fringing
the Abyssinian plateau. Mr. Nesbitt had no intention of doing this, as it
would have lengthened the journey considerably; but, to pacify the Danakils,
who were very insistent, the party retraced their steps a short distance and
then struck out south-eastward. At some hot springs they turned north
again, climbing a long low hill. At this point rain, which fell frequently in
Lower Danakil during the early part of the journey, had made the ground so
slippery that it took the camels an hour and a half to proceed a mile and a half.
From the hill-top a fine panorama was obtained of range upon range of hills,
mainly volcanic.

The caravan now made across a thorn-bush plain for Mount Galalu, a
truncated cone which formed a prominent landmark. They had to march seven hours before reaching the first water-hole, a muddy pool containing at the most 20 gallons of water distributed in hollows left by the hoofs of cattle. Proceeding west and then north they passed near the spot, at the foot of Mount Kurbili, where the massacre took place in 1922 of two Greeks and fourteen natives, members of an expedition sent out to catch zebras for zoological gardens. Game was plentiful throughout the region through which Mr. Nesbitt's party had so far come.

They continued northward over a clay and sandstone plain, largely barren or marshy, lying between the river and the volcanic peak of Mount Aielu. Passing through the villages of Gauani and Arafen, where one of their men was murdered by a native, they skirted Mount Sibabi, with its scattered cliff dwellings, and then forded the Hawash and made north-west for the Abyssinian plateau, to replenish the caravan at the market of Erafible. After traversing a desolate arid stretch they crossed the dry bed of the Borkenna, which drops down by a gorge from the plateau, and then proceeded, through barren hill country and across other dry stream-beds, to Budaia. This is the last Danakil village at the foot of the plateau. From here they climbed westward, through Gallaland, gradually coming on more and more signs of cultivation and habitation, until they reached the plateau market of Erafible.

Here Mr. Nesbitt obtained three fresh camels and four new men and then set out again for the Danakil country. Retracing their steps through the Galla territory, the party turned north-east and proceeded parallel to the Hawash, but at some distance from it. After passing through barren rocky hills and across three stream-beds containing running water, a product of the plateau rains, they entered the clay desert plain of Ialdi. Here they crossed more stream-beds, most of which were dry and marked only by a line of water-holes, though the clay soil was blistered with the recent rains and everywhere there were signs of deep erosion.

Rounding Askoma hill, an isolated eminence for which they had made across the plain, they came upon the caravan route to Batie and other plateau markets. Skirting the eastern end of the Addadale range they reached the Mille, a considerable left-bank tributary of the Hawash, to find it swollen and muddy with the recent rains. They crossed the river and made, by Faro hill, for the great bend of the Hawash where it turns sharply eastward. They made their way through broken lava stretches to a pass in sandstone hills just west of the bend of the river. Here fortifications command the caravan route which runs along at the foot of the hills. Later they met a caravan of some 400 camels journeying from Assab to Dessie and Batie.

Turning east with the Hawash they crossed a desert plain bordering the river. At Gallifage, a ford on the river, they were met by envoys of the Sultan of Aussa, to whom they had sent a messenger announcing their arrival in his territory. Aussa south of the Hawash is the only fertile and at all prosperous part of Danakil. Irrigation is practised, the land is well cultivated, and large herds of camels and cattle are kept. The Sultan, who is the greatest of all the Danakil chiefs, was evidently suspicious of this expedition led by white men, and Mr. Nesbitt felt that the envoys were really sent to watch the party rather than as a sign of deference. However, the Sultan sent them presents of camels and durra, both of which they needed badly, also milk, butter and meat. At
Mr. Nesbitt's Route through Danakil: March—June 1928
his request they moved south towards him, and at Arborifage, in the bend of
the river, awaited his approach. After several days' delay the meeting took
place with considerable ceremony, on May 21. The Sultan quickly became
friendly to the party, near whom he camped. He loaded them with gifts of
food and durra and sold them ten camels. After ten days they at last set off
on the second stage of their journey, provided with a guide and the Sultan's
silver baton of command to convey them in safety through his territory.

Proceeding north from the Hawash Mr. Nesbitt and his companions
quickly reached the desert edge of Upper Danakil. Passing along the western
foot of Mount Borauli they entered the dreary Curub plain, where low basalt
hills stood out in strong silhouette against the dazzling white sands and clays.
The party suffered greatly from the heat and from thirst in crossing this
desert and the Sardo plain which succeeded it. Eventually they reached
Sardo, where they found the stream dry and the village abandoned. Sardo
is the occasional residence of the Sultans of Aussa, but in 1928 the reigning
Sultan had never lived there. Water was discovered a little north of the village.

The caravan now began to climb into rocky hill country, barren and volcanic,
over ground so strewn with boulders of all sizes as to make progress extra-
ordinarily difficult for man and beast. For nearly three days they journeyed
through this rocky region before reaching a water-hole in milder surroundings.
They then climbed a range of low hills and found themselves looking down on a
level sandy plain, encircled by hills, evidently a volcanic crater. Crossing
this plain and the far hills they came upon a second crater, separated by a
gulley from the first, and then finally upon a third, though this was less clearly
defined. In none of these was there a sign of vegetation, and water was only
reached after a further desert stretch, being found in the canyon of a dried-up
stream.

They continued northward, traversing the Guia plain, near a long lava flow
behind which lay a series of five parallel flows. Beyond Guia water-hole they
crossed a rugged lava region where the sharp-edged rocks and frequent fissures
made going very difficult. They had now entered the Biru Sultanate. During
this part of their journey they saw several tombs of Danakil chiefs on the hill-
sides bordering their route. Farther north they passed on their right three
vertical ridges, separated by deep canyons and behind which lay the abrupt-
sided mountains of the Auginnale chain. Later they entered the gorge of the
Tio, where basalt cliffs some 300 feet in height were bordered on each side by
chalk hills. Here, at Tio water-hole, they located the site of the massacre in
1884 of the Italian expedition led by Bianchi. They attempted to raise a cairn
commemorating the expedition, but had to abandon it owing to the hostility
of the natives, who feared that they meant to avenge the massacre. The next
day they were imprisoned by the Danakils in the narrow gorge of the Gaiaa,
where for three days they suffered intensely from the heat and from thirst, and
one of their men went mad. They were only released at last and allowed to
proceed when they had with great difficulty satisfied the natives of their peace-
ful intentions.

After crossing a sand-dune plain east of the chalk hills the caravan entered
a region of narrow parallel basalt gorges. Emerging from these they continued
northward across frequent lava flows on the sandy plain of Sodonta. On their
left lay the prominent volcanic peak of Mount Afdera, said to have erupted
last in 1915. North-east of this peak, between it and Mount Amarta, they came upon a large salt lake which they believe to be hitherto unknown. Fringing the lake were marshes dotted occasionally with small palms. At the edge of the lava flows, where they gave way to sand and marsh, the party found three wells containing very abundant fresh water.

The caravan now journeyed westward, skirting the northern spurs of Mount Afdera, across a dreary sand and chalk plain broken by stretches of lava. Here they had great difficulty in locating water, and spent a night suffering great thirst and hourly expecting an attack, which never came, by a party of natives who were evidently seeking them. Next morning they found quite near at hand the Alo water-hole for which they had sought. A further march across a wide flat expanse of desert was necessary before the barren country began to give way to the grassy plain of Her, in the Dlorum region, and signs of cattle and men announced the presence of water. The caravan found it here in the furrow of one of the streams from the Abyssinian plateau, near to the eastern edge of which they had approached.

They now proceeded north-north-west, across the sandy plain between the plateau on the west and the Hertale group of volcanic peaks on the east. Four of these volcanoes, the most southerly of which was Mount Hertale, were emitting smoke, so Mr. Nesbitt, Signor Pastori, and three natives left the main caravan and deviated north-eastward to obtain a nearer view. Climbing was very difficult in the intense heat over the cracked and broken lava flows, but the party succeeded in getting near enough to obtain a fine view of the volcanoes and of the endless fields of lava which surrounded them. Four vents in the side of Mount Alu, the most northerly, were pouring out smoke like so many factory chimneys, and the sulphur fumes from the burning deposits higher up the mountain were carried down to the party by the wind. Mount Gabuli stood out as a wonderful landmark and after dark the landscape was lit up from time to time by the glare from the mouth of the Hertale cone. Mr. Nesbitt and his companions then turned west and rejoined the caravan.

After passing several water-holes containing salt or highly mineralized water they reached Fia in the Sabba stream-bed. Here they met a party of fifty Danakils from the Assale salt deposits a little farther north. A long dispute had been carried on between the Danakils and the Indertas over the rights of working the deposits, and it had finally been decided that as the Danakils were the more numerous they should have the major rights of exploitation but should allow the Indertas to work the deposits for three days in every month. The Indertas were due to leave that day.

Travelling north from Fia the caravan passed on its right the salt lake of Assale or Karumbae, the most northerly of a group of three salt lakes in the lava region to the east. Beyond the lake they entered the Great Salt Plain, passed the Assale deposits, and then turned north-west towards the foothills of the Abyssinian plateau. Here, in a sandstone gorge, they found sweet water in the dry bed of the Beliga, which loses itself in the Great Salt Plain. Setting out once more across the plain they finally reached the village of Dalol, near the Italian frontier, where a small settlement works a potash mine.

Here the party separated, Signor Pastori going west on to the plateau and thence to Addis Ababa, while Mr. Nesbitt and Signor Rosina continued north-east into Eritrea and so to Mersa Fatima on the Red Sea coast.
MR. DYOTT'S EXPEDITION IN SEARCH OF
COLONEL FAWCETT

In the Journal for November 1928 we gave a preliminary account of this
expedition, compiled from the reports made to the North American News-
paper Alliance and published in New York. The Society has now had the
pleasure of hearing from Mr. Dyott at a Special Meeting on April 22 a full
account of his journey, magnificently illustrated by still pictures and kine-
matograph films. We hope in due course to publish his carefully considered
report of the expedition with a selection of his pictures; but the great interest
in the fate of Colonel Fawcett makes it desirable to deal briefly at once with
the evidence for the death of him and his two companions.

In the summary published last November we noted a puzzling contradic-
tion. Colonel Fawcett's last letter dated 29 May 1925 begins "Here we are at
Dead Horse Camp, latitude 11° 43' South, and longitude 54° 35' West, the
spot where my horse died in 1920." This position is 2° north of the place
assigned to that camp by Mr. Dyott, as shown in the sketch-map illustrating
the original summary, and more accurately in that here reproduced from
Mr. Dyott's map. The first necessity then was to resolve this contradiction;
otherwise it might have been possible to suggest that Mr. Dyott had not
succeeded in following the Fawcett trail at all. In conversation with Mr. Dyott
the following facts are established:

In 1920 Colonel Fawcett was accompanied by an ornithologist from the
Carnegie Institute of Pittsburg, a Mr. Ernest Holt, who called upon Mr.
Dyott after his return in 1928 and confirmed the conclusion that Dead Horse
Camp was on the Batovi River, an affluent of the Xingu next west of the
"Kulisevu" in the sketch-map. Mr. Holt had no precise position for the
camp, but he was quite clear that his recollection confirmed Mr. Dyott's con-
clusions, which are strengthened by the fact that it always seemed impossible
that Colonel Fawcett could have got so far north as the latitude assigned to
the camp in his letter.

In 1925 a camarada named Bernardino accompanied Colonel Fawcett to the
camp on the Kuluseu (hitherto written "Kulisevu"), in approximate latitude
12° 50'. On the way they re-occupied the camp where, according to
Bernardino, Colonel Fawcett's horse slipped in a crossing of the river Batovi
in 1920 and broke its leg, so that it had to be shot. In 1928 Bernardino
pointed out the place to Mr. Dyott and recalled the fact that he had camped
there before with Colonel Fawcett in 1925.

There is thus strong evidence that the position of Dead Horse Camp given
in Colonel Fawcett's last letter is erroneous. It seems possible that he wrote
11° for 13°.

Bernardino accompanied Mr. Dyott's party beyond the point on the
Kuluseu west of the Anaquá village, where in 1925 Colonel Fawcett struck
across to the Kuluene and Bernardino turned back. If then his veracity be
accepted, and Mr. Dyott has no reason to doubt it, the route of the Fawcett
party as far as this point on the Kuluseu is established with little doubt.
From this point Fawcett is said by Indian reports to have struck across to the
Kuluene, visiting en route a large lake which lies between the two. There is
a circumstantial story that Fawcett would not cross the lake in canoes but went round by foot, while the Indians who were carrying some of his gear were taken across in the canoes. At a point north-east of the lake, where some Indian houses had been burnt down, there were the remains of powder flasks in the grass which Indians attributed to the Fawcett party. They reported that one of the party was lame and walked very slowly, which agrees with the

slow rate of progress that is a feature of the whole account. The evidence that the Fawcett party went five marches east of the Kuluene and were then massacred depends upon a careful sifting of Indian native testimony, in which the responsibility is placed by each man on some neighbouring tribe. Mr. Dyott explained on April 22, and has enlarged in conversation, the care which he took to verify statements obtained by unsatisfactory interpretation eked out with signs. He alone is in a position to make a considered estimate of this
testimony, and although he is the first to admit that it cannot be conclusive, he has every reason to believe in its general accuracy, and suspects that his particular informant was closely concerned in the tragedy.

Very few objects that could be part of Fawcett's equipment were recognised in the possession of Indians, and nothing of which with certainty it could be said Fawcett would never have abandoned it on the march. There is a short tin case which according to Indian reports had been carried for Fawcett by the Indians, and was said at the time of Mr. Dyott's arrival to contain farinha, but the contents were not disclosed. There was a small label of Messrs. Silver & Edgington which was worn as a locket by an Indian child, and the above-mentioned powder-flasks. A rather curious piece of metal tripod and leather found near the first camp on the Kuluseu cannot be recognized as Fawcett's, and very probably it is not connected at all with his expedition. It seems to be part of a shooting seat such as might have been employed by a collector.

As a result of Mr. Dyott's expedition there is only too much reason to believe that the Fawcett party were killed in 1925 east of the Kuluene: perhaps because they were unable to satisfy the ever-growing demands for presents, which Mr. Dyott also experienced and which very nearly led his party to disaster. Those who had the great advantage of hearing the lecturer on April 22 will appreciate best the care and skill with which Mr. Dyott brought his party so far with heavy impedimenta and extricated them from a very difficult position. All Fellows of the Society will feel grateful to him for his spirited and courageous attempt to solve the mystery of the fate of our distinguished medallist and will look forward to reading the full report of his expedition when it is published in the Journal some months hence. The Council have marked their sense of the value of the expedition by awarding Mr. Dyott the Gill Memorial, a fund established by Miss Gill in memory of her brother, Captain W. J. Gill, r.e., who was murdered with Professor Palmer in the Syrian Desert in 1882.
THE GREEK CENSUS OF 1928

A. A. PALLIS

Member of the Refugee Settlement Commission, Athens

In October 1925 I published an article in the Geographical Journal on the effects produced on the ethnical geography of certain regions of Greece (Macedonia and Thrace) as the result of the racial migrations which took place in the Balkans during the period 1912–1924. I was able to show, from the figures of the Commissions entrusted with the supervision of emigration between Greece and Bulgaria and Greece and Turkey, as well as from other official Greek and Turkish sources, how profoundly these Völkerwanderungen had modified the racial character of the provinces in question.

The political importance of the changes thus brought about did not fail to attract attention and were the subject of comment both in the press and at Geneva. Mr. Howland, the American President of the Greek Refugee Settlement Commission, had occasion, in a much-quoted statement which he made before the Council of the League of Nations at its session of September 1925, to emphasize the fact that the racial homogeneity resulting from the reshuffling of the Balkan populations would be a factor for peace by eliminating what in the past had proved a constant and troublesome source of friction. Statesmen and journalists noted with satisfaction that out of evil some good had come, and that the uprooting of the Greek population of Turkey, with all the immense sacrifice of human life which it had entailed, had at least had one compensating advantage in that it had automatically solved—as far as Southern Macedonia was concerned—a question which had been a chronic source of inter-Balkan conflicts and a threat to European peace for over a quarter of a century.

At the time when I published my article in the Geographical Journal the last census figures available for Greece were those of 1920. Normally, one would have had to have waited till 1930 for the next census. But the Greek Government felt that the events of 1922–1923, with the consequent territorial changes and influx of refugees, had produced such profound modifications that the figures of the census of 1920—taken when Greece was still in possession of Eastern Thrace as far as the lines of Tchataldja and before the influx of refugees from Anatolia—had become valueless for practical purposes. It was therefore decided to take a fresh census in 1928, that is, two years before the normal period. The figures of this census, taken on May 15 to 16, have now been published and give us the exact measure of the territorial and racial readjustments of the last few years. An analysis in explanation of these figures will certainly not be without interest to those who are students of conditions in the Balkan countries and of their possible reactions, all too frequent in the past, on the politics of Europe as a whole.

The census of 1920 gave a total population for Greece of 5,536,375. That of 1928 shows a population of 6,204,684, i.e. an increase of 668,309, or nearly 12 per cent. When one takes into consideration the fact that the Greece of 1928 is actually a much smaller country than what it was in 1920—the present
area is given as 127,000 sq. km. as compared with 147,634 in 1920, that is, a
diminution of about 20,000 sq. km.—one realizes at once how abnormal have
been the events which took place during that interval. The diminution of
area is due to the loss of Eastern Thrace, the Qaragach enclave in Western
Thrace, and the two Aegean islands of Imbros and Tenedos, which had been
occupied by Greece since the Balkan War of 1912 and were retroceded to
Turkey in 1923 by the Treaty of Lausanne owing to their strategic position
at the mouth of the Dardanelles.

The loss of territory should, in the natural course of events, have entailed
a corresponding diminution of population, but the former has been more
than compensated by the effects of the migrations. Although there have been
alternate waves of emigration and immigration, the latter has been on a much
larger scale than the former, with the result that, on balance, there has been
a considerable net increase of population. On the one hand, we have the
emigration of the Bulgars of Macedonia and Western Thrace and of the Turks
of Macedonia, Thessaly, Epirus, Crete, and the Aegean islands; this emigration
was the result of arrangements made under the Greco-Bulgar voluntary
emigration Convention of 1919 and the Greco-Turkish Convention of 1923
for the compulsory exchange of populations. In all, we have a total of 456,946
Turks and Bulgars emigrated. On the other side of the account, we have the
immigration—partly in virtue of the above Conventions and partly from
other causes—of nearly the whole Greek population of Bulgaria and Turkey.
To these must be added refugees from Russia and various other countries.
The total number of people who were registered as refugees at the census of
1928 amounted to 1,221,849, a figure somewhat lower than was hitherto
supposed. These were classified as follows:

<table>
<thead>
<tr>
<th>Refugees from Turkey</th>
<th>...</th>
<th>...</th>
<th>...</th>
<th>1,104,216</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refugees from Russia</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>58,526</td>
</tr>
<tr>
<td>Immigrants from Bulgaria</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>49,027</td>
</tr>
<tr>
<td>Refugees from Albania, Serbia, Dodecanese, etc.</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>10,080</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>1,221,849</strong></td>
</tr>
</tbody>
</table>

Of these, about 70,000 are refugees who arrived in the country before the
census of 1920, and the rest—1,151,849—came during the interval 1920–1928.

Even the Greeks of Constantinople, though expressly exempted, under the
Lausanne Convention of 1923, from the compulsory exchange of populations,
have notwithstanding been obliged to emigrate in large numbers owing to
the new conditions prevailing in Turkey, which are unfavourable to the
existence of the non-Turkish minorities in general and the Greeks in par-
ticular. It is estimated that there are still some 180,000 Greeks left in that
city as compared with about 230,000 before the war.

Thus, it is only by taking the census figures of 1920 as one’s starting-point
and then making allowance for all the subsequent flotsam and jetsam, that
the result of the census of 1928 becomes intelligible. The following table
shows how this result is obtained:
The Greek Census of 1928

Total population of Greece, 1920 census * 5,536,375

Subtract:

1. Population of the territories lost in 1923 514,585
2. Turks emigrated 388,146
3. Bulgars emigrated 68,800
4. Losses in men, Greco-Turkish War of 1920–1922 33,913

1,005,444

Add:

Refugees immigrated 1921–1928 1,151,849

5,682,780

The difference between the above total (5,682,780) and the actual total population recorded by the Census of 1928 (6,204,684) must be explained (a) by the normal increase of the old (non-refugee) population, that is, the excess of births over deaths during the period between the two censuses (1 January to 15 May 1928), which increase, as far as it is possible to judge from the published statistics, may be as high as 10 per thousand per annum; (b) by a certain number of persons, such as nomads, having escaped registration at the Census of 1920.

With a larger population and a smaller area, it naturally follows that the density per square kilometre has increased—from 37 per square kilometre, as it was in 1920, to 49. It is the exact opposite of what has happened in Turkey, where, as the number of Greeks, Armenians, and other nationalities emigrated far exceeded the number of Turkish immigrants (the emigrated Greek population alone numbered about 1,100,000 as compared with 390,000 Turks who came in as the result of the Exchange of Populations), the density of the population has diminished and is now only 17 per sq. km., on the basis of the Turkish Census figures of 1927.

The regions of Greece principally affected by the increase are firstly Macedonia and Western Thrace, where the bulk of the refugee agricultural population has been settled on the lands left vacant by the Turkish and Bulgarian emigrants; and secondly Attica, owing to the concentration of urban refugees in the two cities of Athens and the Piraeus.

The Census does not give details concerning the relative strength of the various racial or religious elements of the population. Consequently any such classification can only be based on outside information derived from sources other than the Census. We think that the following table, which is based on such figures as are available, is probably not far out, taking round numbers:

*This census took place on 19 Dec. 1920 (Old Style), or 1 Jan. 1921 (New Style).
Racial unit

<table>
<thead>
<tr>
<th></th>
<th>1920</th>
<th>1928</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greeks</td>
<td>4,458,000</td>
<td>5,817,000</td>
</tr>
<tr>
<td>Turks</td>
<td>770,000</td>
<td>103,000</td>
</tr>
<tr>
<td>Bulgars</td>
<td>139,000</td>
<td>82,000</td>
</tr>
<tr>
<td>Albanians</td>
<td>25,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Salonika Jews</td>
<td>70,000</td>
<td>70,000</td>
</tr>
<tr>
<td>Armenians</td>
<td>1,000</td>
<td>35,000</td>
</tr>
<tr>
<td>Foreigners</td>
<td>73,000†</td>
<td>73,000‡</td>
</tr>
<tr>
<td>Total</td>
<td>5,536,000</td>
<td>6,205,000</td>
</tr>
</tbody>
</table>

The increase of the Greek element is of course due to the influx of refugees from Turkey and Russia in 1922, as well as to emigration from Bulgaria.

The diminution in the number of Turks, who are now confined to the single district of Western Thrace, is due to the fact that the 1920 Census figures include some 300,000 Turks in Eastern Thrace which was then Greek territory, besides the Turks of Macedonia, Epirus, Thessaly, Crete, and the Aegean Islands (390,000) who emigrated to Turkey in 1923-4.

The diminution in the number of Bulgars is due to the emigration to Bulgaria under the Neuilly Emigration Convention of 1919. Thus in Western Thrace there are practically no Bulgars left. A small number still remain in Macedonia, in the westernmost part of that province, principally round Kastoria, Florina, and Edessa (Vodena).

Of the 94,000 Jews of Greece, only the Spanish-speaking Jews of Salonika can be said to constitute a distinct racial unit. As such, they enjoy special representation in the Greek Chamber. The remaining 24,000 Jews are included under the heading "Greeks."

The Albanian Moslems, who have been specially exempted from the exchange of populations with Turkey, live in a compact mass in the district of Chamuria on the Adriatic coast opposite Corfu; they belong to the Cham branch of the Albanian race.

The Armenians have increased owing to the influx of Armenian refugees from Turkey in 1922.

The Census of 1928 gives the following distribution as between the sexes: 3,128,449 women and 3,076,235 men. The excess of women over men, which was already apparent at the census of 1920, has been aggravated by the fact that among the refugees, particularly those from Asia Minor, there are quite an abnormal number of widows and girls, all the males of military age (eighteen to fifty) having been retained by the Turks as hostages at the time of the evacuation of Smyrna in August 1922; of the latter, many perished during the interval between the evacuation and the date of the release of the hostages, nearly a year later.

The Census of 1928 also shows an increase of the urban as compared with the agricultural population. The proportion is 33 per cent. urban to 67 per cent. rural.

*In my article published in the Geographical Journal of Oct. 1925, the Turkish population of W. Thrace was stated too low, viz. 84,000, owing to a mistake in reckoning Turks who had emigrated from the Bulgarian portion of W. Thrace under the Turco-Bulgar Convention of 1913, as having quitted the Greek portion of that province.

†, ‡72,991 in 1920 and 73,338 in 1928.
cent. agricultural, as compared with 26 per cent. urban and 74 per cent. agricultural at the Census of 1920. This is not due so much to the modern tendency—also noticeable in other countries—on the part of the inhabitants of the country to drift to the towns, as to the fact that, among the refugees from Turkey and Bulgaria, there is a higher proportion of town-dwellers than of cultivators, whereas the reverse was the case with the Turks and Bulgars who left Greece. Thus, of the 1,221,849 refugees, about 570,000, or 47 per cent., are cultivators, and about 650,000, or 53 per cent., belong to the urban class. Among the Turkish and Bulgar emigrants, on the other hand, the proportion of cultivators to town-dwellers was about 80 per cent. among the former and almost 100 per cent. among the latter.

One has only to take the figures for three or four of the principal towns of Greece and compare the results of the Censuses of 1920 and 1928 in order to realize how great has been this increase of the urban population. The following table shows this:

<table>
<thead>
<tr>
<th>City</th>
<th>1920 Census</th>
<th>1928 Census</th>
<th>Increase per cent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athens</td>
<td>292,991</td>
<td>452,919</td>
<td>54</td>
</tr>
<tr>
<td>Piraeus</td>
<td>133,482</td>
<td>251,328</td>
<td>85</td>
</tr>
<tr>
<td>Salonika</td>
<td>170,321</td>
<td>236,524</td>
<td>39</td>
</tr>
<tr>
<td>Volo</td>
<td>30,046</td>
<td>41,706</td>
<td>39</td>
</tr>
<tr>
<td>Kavalla</td>
<td>22,939</td>
<td>49,980</td>
<td>118</td>
</tr>
<tr>
<td>Patras</td>
<td>52,174</td>
<td>61,278</td>
<td>17</td>
</tr>
</tbody>
</table>

The six cities enumerated above being the principal industrial centres of Greece, it was inevitable that the refugee urban population should concentrate there, as they were thus assured permanent employment, which in the smaller towns would have been impossible.

The above, incidentally, is one of the principal reasons why Greece will not consent to the compulsory exchange of the Greeks of Constantinople against the Turks of Western Thrace. It should be explained that the Lausanne Convention (1923) for the exchange of populations between Greece and Turkey specially exempted from its provisions the Greek inhabitants of the city of Constantinople and the Turkish inhabitants of the Greek province of Western Thrace. The Turkish Government, since then, has several times intimated its desire for a complete exchange which would do away with the two exceptions in question, but has always been met by a refusal on the part of Greece.

The attitude of the latter is quite natural. Apart from the sentimental consideration attaching to the retention of a Greek minority at Constantinople, the dumping of the Greek inhabitants of that city in Greece would mean another heavy addition to the already overflowing urban refugee population which has only been absorbed with great difficulty into the economic system of the country. Unemployment, with all the consequent social and economic evils which it entails, would be the inevitable consequence. The 180,000 odd Greeks of Constantinople practically all belong to the urban class, whereas of the 100,000 Turks of Western Thrace the great majority are cultivators. The settlement of 100,000 fresh cultivators in Turkey, where vast areas of land still lie unoccupied in Eastern Thrace and Anatolia, would not create,
for that country, anything like so serious a problem as would result from the arrival of 180,000 fresh town-dwellers in Greece. The latter may therefore be relied upon to resist to the last a demand which, at first sight, might appear theoretically desirable as a final liquidation of the question of the Minorities between Greece and Turkey.

The departure of the Turks and Bulgars from Greece and the substitution of Greek refugees in their place has been the occasion for an extensive change of geographical nomenclature. This is particularly the case in Macedonia, where the bulk of the refugee population has been established. The new settlers have been actuated by the very natural desire to perpetuate, in their new abode, the memory of their former homes. Thus we meet, scattered all over Greece, such names as Nea (New) Philadelphia, Nea Bafra, Nea Ankhi- alos, Neos Pyrgos, Nea Phokaia and Nea Apollonia. It was the same sort of feeling which made the first British settlers in North America give such names as New England, New Hampshire, New York, New Jersey, etc.

Out of the 1975 refugee settlements throughout Greece, 462 are entirely new settlements, while 1513 are former Turkish or Bulgarian villages whose original inhabitants have emigrated. In the latter case, the villages have been rechristened and Greek names substituted for the previous Slav or Turkish. Thus we have:

<table>
<thead>
<tr>
<th>Greek Name</th>
<th>Former Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anagennisis</td>
<td>instead of Tsitsilikovo (Slav)</td>
</tr>
<tr>
<td>Nea Santa</td>
<td>Volovod</td>
</tr>
<tr>
<td>Skydra</td>
<td>Vertekop</td>
</tr>
<tr>
<td>Mega Revma</td>
<td>Golema Reka</td>
</tr>
<tr>
<td>Agios Georgios</td>
<td>Kerech (Turkish)</td>
</tr>
<tr>
<td>Agia Trias</td>
<td>Baghche Chiftlik (Turkish)</td>
</tr>
</tbody>
</table>

Besides the above, there have been a few cases where the official designation of certain towns has been changed and the classical Greek name revived, e.g. Alexandroupolis instead of Dedeagach, Edessa instead of Vodena, Ardea instead of Subosko.

The new names now figure in all official maps, railway time-tables, postal and telegraphic directories, and railway stations. All future atlases should therefore be based on the new nomenclature, as the old names, besides no longer being in official use, are also rapidly falling into disuse locally.

Place-names are the permanent landmarks which indicate the various stages in the history of countries and nations. Thus, just as the Slav and Turkish place-names of Macedonia were the record of the great Slav incursions of the eighth and ninth centuries and the Turkish Conquest which followed in the fourteenth and fifteenth, so the new Greek names will mark the period of the great migration which, in the twentieth, brought the Greeks of Thrace, Pontus, and Ionia back to the countries which were the cradle of their race many centuries ago.
HISTORICAL ATLAS OF EGYPT


This sumptuous work is, we understand, being privately printed in one copy for Prince Youssouf Kamal, who is presenting a limited number of reprints to certain libraries and geographical institutions. The circumstances of its production account perhaps for a certain reticence regarding its aims, which are apparent only on a close examination of its contents. The place of printing is not stated, but is believed to be in Holland. The text is printed in two colours; the maps, even the smallest and least important of the modern reconstructions, are reproduced in collotype, many in colours, on a heavy paper. Except in one or two instances the sizes of the originals are not specified, so that it is to be presumed that the remainder are full-sized reproductions.

The work is designed most comprehensively. The Prince has aimed at assembling all maps of importance for Egyptian geography, and apparently every literary reference, for, unlike other "Monumenta," written as well as cartographic documents are included. When completed it will be of great assistance to the future author of a definitive history of African cartography. But it also possesses a wider interest, for many "world maps" are reproduced. The volumes covering the mediaeval period should be particularly valuable in this respect. The works of geographers are arranged chronologically, each group of maps being followed by modern reconstructions. This method has sometimes an odd effect, as when we find Humphrey Cole's map of the Holy Land, published in London in 1572, appearing in the first volume with the legend "Époque 1230 avant J.C.: date 1572," because it shows the conjectured route of the Exodus. This also raises a point of more critical interest, which will be discussed later.

The first two volumes reach the middle of the Graeco-Roman period only. From the absence of contemporary maps, and the fragmentary nature of the geographical material, the first is disjointed, and surpassed in interest by the second. It opens with documents dating from the "Epoch of the Pyramids," including a representation from a sarcophagus of the Nile "D'outre tombe," said to embody features of Egyptian topography, and an inscription containing cadastral details from a tomb at Beni Hasan, circa 3000 B.C. The maps in the remainder of the volume consist largely of reconstructions of Biblical, Homeric, and early classical geography. In two instances mediaeval maps are reproduced as the work of classical geographers "avec des additions postérieures." Thus a series of mediaeval world-maps of the type usually known as T-O which occur in manuscripts of Sallust are placed as though fundamentally his work. These maps, however, cannot be definitely associated with Sallust. They reflect ideas current among his contemporaries, and receive their final form in mediaeval times. Examples several centuries older than this Sallust group are extant associated particularly with Isidore. The same may be remarked of the world map assigned to Pomponius Mela (c. 40 A.D.). It occurs in the edition of his 'De Situ Orbis,' Venice, 1492, but its outline is apparently entirely Ptolemaic. These maps would be more conveniently placed later in the work. Of the reconstructions, particularly of the 'Periplus of the Erythrean Sea,' a representative selection has been made.

The second volume gains greatly in coherence when the era of Ptolemy is reached, and the section dealing with his work is the most valuable. Extracts
are given from his mathematical work, the Greek text being accompanied by the French translation of Halma, 1813, and from the introductory chapters of the ‘Geographia,’ while the African section is reprinted and translated in full. An interesting selection of Ptolemaic maps has also been made. There is the earliest manuscript, the Greek MS. of the early thirteenth century, the greater part of which is preserved at the Vatopéde monastery on Mount Athos. A reproduction by photolithography of this portion was made as long ago as 1867 by P. de Sewastianoff and was edited by V. Langlois. In parts this is clearer than that in the ‘Monumenta,’ which gives the impression of being an attempt at an improvement on this earlier copy rather than a fresh reproduction of the original. The world map from this manuscript, now in the British Museum, has not previously been reproduced: it appears here to be altogether more varied and lively in colour, the result perhaps of better methods of reproduction. Other Ptolemaic maps herein are selected from the two Greek MSS of the Urbinas Codex, and from the first Latin version prepared by Jacobo Angelo early in the fifteenth century. But the most important example is the world map and nine African sheets of the only known Arabic version, discovered at Constantinople in 1927. Attached documents associate it with the Sultan Bajazet II., thus dating it approximately 1450. A complete photographic copy was presented to the International Geographical Congress at Cambridge last year, but few details were then given. It is to be regretted that this was not remedied herein. Indeed, no concession to non-Arabic scholars is made, and it is even difficult to identify the areas covered by the various sheets. In parts the outline is particularly good; it probably embodies the best information then available, and is not merely a copy of an older manuscript.

The rest of the volume is comprised of extracts from the classical authors, such as Strabo and Pliny, the African portions of the Antonine Itinerary, lists of the African stations of the Roman legions and of bishops attending Church Councils, inscriptions from Abyssinia, and similar material.

Beyond indicating the date and provenance of the originals, there is no comment upon the maps. Some editorial matter accompanies the texts; it is not always clear whether or not this is being quoted from previous editors. The ‘Monumenta’ are therefore the raw material for a history of African cartography.

We understand that the editor of the work is Dr. F. C. Wieder, Librarian of Leiden University: the standard maintained throughout reflects much credit upon him and upon his collaborators. To Prince Youssouf Kamal, who inspired and made possible its execution, the Society is indebted for his generous gift.

G. R. CRONE.

The appearance of this book, coupled with the announcement that it is to be the first of a series of Oxford Memoirs of Plant Geography, is an event of outstanding importance. Geographers and botanists alike have much reason to be grateful to the author, to Prof. A. G. Tansley, the general editor of the series, and to the bodies who by means of grants in aid have made publication possible. An even larger public may well feel gratified to learn that the reproach, that even when suitable material was available no opportunity existed for the publication in England of monographs of this type, has now been removed. The hope of finding a place in the series will certainly be a stimulus to further researches by the younger plant-geographers, while the present volume is a valuable contribution to our knowledge of a region which, as the author shows, offers problems as interesting, and hitherto as imperfectly elucidated, as those of parts of the world regarded as remote. There is more even than this. “European” interference in Balkan matters has often been disastrous, because partisan and based on insufficient knowledge. Here we have a notable addition to the small number of books which give a strictly scientific survey of some of the problems. In particular, much space is devoted to discussions of the effects of the troubled history of the region upon its plant cover, with hints as to how the natural resources may best be utilized, and their progressive deterioration, so marked in certain areas, avoided in the future.

The author’s interest in the peninsula began during a period of war service, and has been stimulated by subsequent visits, which have given him a personal knowledge of most parts. His field-work has been supplemented by very wide reading, accompanied by examination of herbarium specimens, and by observation on living Balkan plants at Kew. The book contains a large number of references, though it is stated that it has been found impossible to publish a full bibliography which has been prepared. It is illustrated by a number of small sketch-maps, a small-scale uncoloured map of the whole peninsula at the end, and from photographs. The photographs of scenery, it may be noted, would have had their value increased if the year and season when they were taken had been stated, while the actual plants shown are not always named.

The size and scope of the book preclude any attempt to analyse its contents, and this notice must be restricted to certain general points. A long chapter is devoted to man’s influence on the vegetation, and here the old problem of the causes and consequences of deforestation comes up for discussion. Emphasis is laid on the fact that forest destruction in itself is of less importance than the causes which delay or inhibit re-growth. Here a point of much geographical interest is made. Forest destruction leads, as a first result, to the replacement of trees by brushwood. It is stated, on the basis of personal observation, that such brushwood associations, whether evergreen, deciduous or mixed, do not give rise to so deep a layer of humus as high forest. The fact that both chemical and mechanical weathering is slow in regions of Mediterranean climate has often been noted, but Mr. Turrill adds that the strong local winds, such as the bora and Vardar winds, are potent agents in carrying away exposed soils. These two facts, slackened humus formation and increased exposure to winds, cause the generally thin soil to “waste” rapidly when woods are cleared. Bare rock and stones tend to appear where there was once forest soil, and regions which have carried timber trees may cease to be able to support any but a thin plant cover,
natural regeneration of the forest being completely prevented. In the Karst areas of the north-west, where rainfall is heavy, winds strong, and the pure limestone yields at best but little residue, the effects of forest clearing are particularly disastrous. Of the goat, both as a destroyer of forest, and as preventing regrowth, the author has naturally much to say. He inclines to the opinion that the incoming of the Slavs increased the numbers of livestock, especially sheep and goats, within the peninsula, and so accelerated soil wastage.

To many, one of the most attractive chapters will be that on Endemic and Relict Species, in which it is shown that the area has served as an asylum for a number of beautiful plants of the Tertiary flora. Elsewhere, in their southern retreat during the onset of the Ice Age, many of these were brought up against barriers such as the Pyrenees, the Alps, or the Mediterranean Sea. Here they found opportunity not only for survival but also for the evolutionary processes which have made the peninsula so remarkable for its wealth of endemic forms. The detailed accounts given of some of the outstanding Tertiary forms are of great interest. The vine and olive are both regarded as occurring in truly wild forms, and the former certainly, the latter probably, had a much wider distribution in Europe in earlier times. Of other forms mentioned the account of the Judas tree (Cercis siliquastrum) may be noted. It is widely distributed within the Balkan Peninsula, and as a wild plant extends westward to South France and eastward to North Persia. Other species carry the present distribution of the genus from Eastern North America to China and Japan, making it an excellent example of the wide distribution of the characteristic genera of the Tertiary flora in the northern hemisphere. Generally indeed we may say that in this section of the book the geographer will find a fuller account of that flora upon which the present vegetation belts of Europe were superimposed than has been readily available hitherto.

In a final chapter the author's main conclusions are summarized, and if many parts of the book contain more detail than the geographer who has not also a fairly wide knowledge of both systematic botany and of ecology can grasp readily, this one at least deals mainly with purely geographical problems. The essential fact brought out is the individuality of the area as compared with the rest of Europe, shown alike by the wealth of species and the number of peculiar forms. These features, again, are related to the fact that two types of vegetation occur, the Mediterranean and Central European, associated with the presence of two sharply contrasted types of climate, with the highly diversified relief and with the variety of rocks and soils. Further, the effects of the coming of the Ice Age were much less marked within the peninsula than in Central and Northern Europe, and the changes in the flora correspondingly less.

In face of the long-continued labour which has gone to the making of the book criticism may well be dumb. Since, however, it is assured of a long career of usefulness, with probable re-issues, and is the first of a series, something must be said of the index. It may be admitted at once that the indexing of a book containing such a mass of detail presents a very difficult problem. Though an index of slightly over five pages is scant measure in a book of this size, our complaint is not solely against the brevity. The book is essentially a work of reference, and will be—indeed, should be—used by a much wider public than the purely botanical one. The author in his text has taken much trouble to make himself intelligible to that wider public by defining carefully terms likely to present difficulty. But he has not been adequately seconded by the compiler of the index, who has given little care to the selection of items. Two examples may be given out of a number noted. On p. 446 a precise definition of "relict species" is given. Three references to the term appear in the index, of which
this page is not one. Of the three one is to a chapter heading, the other two to sectional headings within it; and all are mentioned in the analytical Table of Contents, with the pages. The term is used in the text of the chapter before it is defined, and would naturally be looked up in the index by the careful reader on its first appearance. On p. 317 the word "vicarious" as applied to plant species is defined; it does not appear in the index, though used frequently in the chapter on Endemic and Relict Species later in the book, where a full comprehension of its meaning is necessary to grasp the argument.

Geographical place-names are treated in a similar fashion. The Rila region, as was indeed to be expected, is mentioned repeatedly throughout the book: it is omitted from the index. Five references are given to Albania; all are in the earlier part of the book and all save one appear also in the Table of Contents, with the relevant page. But in the latter part of the book much space is devoted, in various places, to the country, particularly to an account of the remarkable distribution within it of the Alpine or High Mountain flora. It is shown that north of about the latitude of Tirana (p. 408) true Alpines, in the sense of forms having their centre of distribution in the European Alps, are very numerous; to the south their numbers diminish rapidly. In the southern region the mountain plants are mainly endemics (p. 413). These facts form the basis of a lengthy discussion, of great interest, summed up in the statement (p. 481) that the most important temperature effects of the Ice Age had probably their southern limit in Central Albania. Not one of the numerous references to the country in this part of the book appears in the index, and cross-references are everywhere infrequent. It seems to us unfortunate that so little trouble has been taken to make the wealth of valuable material in the book more readily accessible, especially as the geographer, noting the mass of statistical and tabular matter, may be tempted to conclude that the book is at best on the margin of his sphere of interest. The purpose of this review has been to suggest that, on the contrary, he cannot afford to omit it from his library, even if it represents rather a mine in which he must do his own digging, than a garden in which he may wander.

M. I. N.
RAINFALL FLUCTUATIONS IN THE BRITISH ISLES

BRITISH FLOODS AND DROUGHTS. By C. E. P. Brooks and J. Glasspoole, M.Sc., Ph.D. With an Introductory Note by Hugh Robert Mill, LL.D., D.sc. London: Ernest Benn, Ltd. 1928. 9 x 6 inches; 199 pages; maps and illustrations. 10s 6d

Those who want statistical information about the fluctuations of rainfall in these islands, and the larger number, perhaps, who are interested rather in the effects of the floods and droughts consequent upon the more extreme of such fluctuations, will find practically all they require in this volume of quite modest dimensions. The retrospect carries the reader past the modern period of systematic rainfall measurement backward through the centuries. After an Introduction on the general causes of rainfall in the British Isles the fourteen chapters are comprised in three parts: I. Great Rains and Floods; II. Droughts; III. Variations of Rainfall.

In Part I we find chapters on the causes of persistent rain, on the wet years 1903, 1924, and 1927, on the rainy seasons of the 'seventies, on historic rains, and on the Thames flood of 1928, with other floods. Of the different types of flood reviewed the most familiar, especially in winter, are the widespread river-valley floods that follow protracted heavy rainfall. They occasion much discomfort, but usually give timely warning to river-sidedwellers. Outstanding examples are the great Thames flood of November 1894 (illustrated), the Severn flood of May 1886, the Tees flood of September 1927, the memorable Norwich inundation (frontispiece) of August 1912 (when a cyclonic downpour yielded 8 inches of rain in twenty-four hours on the top of a wet month), the Morayshire floods of August 1829, which destroyed many houses, and the Highland thaw-devastations of January 1892. Incidentally we may note that the Morayshire floods figure in Dr. Mackay's collection, "A Thousand and One Gems of English Prose." In connection with the thaw-floods at the end of January 1892 which carried away bridges and parts of railways in the Scottish Highlands, it is stated that the foregoing snowstorm of 5 to 9 January 1892 caused the most serious drifting for thirty years.

More sudden are the localized floods due to "cloudbursts" or "waterspouts," which are sometimes a feature of heavy thunderstorms. The most tragic example of this type of flood is the Louth disaster of Whitsuntide 1920, when twenty-two persons were drowned (see Journal, 58, 396); but most parts of the country have suffered from such destructive storms in which anything between 5 and 10 inches of rain may fall in a few hours. It is of interest to note that a number of outstanding cases have occurred at points along the bold Pennine–Cheviot backbone of Northern England during the last half-century or so, viz. Todmorden, 9 July 1870, Glossop, 24 August 1884, Bloodybush Edge, Northumberland, 2 July 1893, Angerton, Northumberland 7 September 1898, and Rombold's Moor, Ilkley, 12 July 1900. The storm which burst over the Cheviots on 2 July 1893 ploughed up the peat to the depth of 5 feet from 40 acres of the hillside of Bloodybush Edge, whose name is most likely reminiscent of border strife.

Tidal floods appear to have caused appalling devastation and loss of life on the North Sea coasts both of England and Holland in the Middle Ages. In modern times the flood of 6 January 1928 along the Essex coast and Thames Estuary, taking toll of fourteen lives in London, has been the worst. The authors endorse the threefold explanation suggested in the official report (see Journal, 72, 184) namely, the concurrence of a high spring tide, gale in the North Sea, and thaw-water coming down the river. With reference to the second worst London tidal flood, that of 18 January 1881, they also speak of
thaw-water, but this seems to be a mistake. It was rather the absence of a thaw which probably prevented the flood of 1881 reaching the height of 1928; for the flood took place near the centre of a period of intense frost and on the very date of the great snowstorm which disorganized the life of the country.

In connection with the rainfall of 1903, London's wettest year, we are told that 58½ hours of absolutely unbroken rainfall in London, between 1 p.m. on 13 June and 11.30 p.m. on 15 June 1903, is the longest period of unbroken rainfall "on record for any part of the British Isles." In view of the scarcity of self-recording rain-gauges the authors would have done well to have italicized the words "on record" for those who realize the relentless character of bad weather in the high hills where rain that will cease for a time in the plains does but change its tune, so to speak, can hardly doubt that it sometimes rains in such districts for sixty hours on end, or even more.

In Part II we have chapters on the causes of drought, on the droughts of 1887 and 1921, on the dry years of the eighteenth century, and on historic droughts of the Middle Ages. The prolonged droughts of 1887 and 1921 led to great scarcity not only of water but of milk, the former being most acute in the north-west of England, and the latter in the south-east. The most intense drought while it lasted, however, was that of the spring of 1893, when London and some part of Kent and Sussex had two or more absolutely rainless months. It should be noted that dry weather while it lasts may be just as obstinate in the wetter parts as in the drier, but it has more clear-cut boundaries.

Part III contains a couple of chapters on extremes of rainfall and on cycles of weather. The largest annual rainfall at any station in the British Isles (247 inches) occurred in 1923 at the Stye Head, Cumberland; the smallest (10 inches) in 1921 at Margate, Kent, though the former year was only the wettest over a small area, and the latter was the driest only in the south-east of England. Such details illustrate the bewildering nature of rainfall statistics which yield "records" ad libitum. Somerset provided the two heaviest authentic measurements of rain in twenty-four hours, namely 9½ inches on 28 June 1917 in a cyclonic downpour, and on 18 August 1924 in a thunderstorm. In either case the area with more than 9 inches was highly localized. These "records" might have occurred anywhere in the British Isles, but their occurrence in Somerset is not without interest since this is a county prone not so much to violent thunderstorms as to peculiarly copious summer showers in broken weather. It has been noticed that in a westerly type of weather cumulus clouds that remain relatively small and undeveloped in and about Cornwall may tower up and spend themselves in torrential showers farther east, where the land begins to broaden and is favourable, under summer conditions, to instability.

In the concluding chapter we have the results of a mathematical analysis of curves with an eye to weather-periodicities, or, more correctly, recurrences, from which a hope is to be entertained, but no prediction hazarded, that the tide of wet weather that has marked the first quarter of the century, particularly since 1921, is about to turn. It is emphasized that much the greater part of weather sequence is controlled by irregular agencies and that the small periodic part is of use only in suggesting tendencies, not for basing forecasts.

The style of this book is attractive, and human interests are always kept well to the fore. Each chapter is headed with a quotation from some well-known source. If we might venture a criticism in this connection, however, it would be that the authors have laid a rather too constant emphasis on the "dismal" side of rainy summers like those of 1924 and 1927. Even these have their compensation in the greenness of vegetation, the limpidity of the atmosphere, and, above all, in the form and lighting of the clouds.

L. C. W. B.
REVIEWS

DER RHEIN, SEIN LEBENSRAUM, SEIN SCHICKSAL. Bd. I, Buch I, Teil I. By Dr. K. Haushofer, Dr. O. Wilckens, Prof. G. Fliegel, Dr. O. Maull, and Prof. P. Polis. Berlin-Grunewald: Kurt Vowinckel 1928. 10 × 7 inches; 244 pages; 37 illustrations and two climatic maps in colour

This is the first part of the first book of the first volume of a great work which is to deal exhaustively with the Rhineland in all its aspects, and the scale on which the whole has been planned may be judged from the fact that this section alone extends to 244 pages. Five authors have contributed to it, fifty-five collaborators will cooperate in the production of the whole work.

The volume begins with an introductory chapter on “Rheinische Geopolitik,” by Dr. K. Haushofer, which serves as a preface and in which the aim and plan of the work are expounded. He lays stress upon the unity of the region and emphasizes the fact that the Rhine is a connecting link rather than a dividing line. The rest of the volume is strictly scientific and deals with the geology, the geomorphology, and the climate of the area.

The geology of the Upper Rhine is described by Dr. Wilckens, and that of the Lower Rhine by Prof. Fliegel. In fifty-two pages they have contrived to crowd an account of the structure of the Alps, the Jura, and the whole of the area between the Fichtelgebirge and the Ardenne. In so small a space such an account can deal only with the broader features, but this part of the volume is well illustrated by maps and sections, and with the help of these the writers have succeeded in making the general structure of the area intelligible.

The geomorphology is treated by Dr. Maull, to whom seventy-six pages have been allotted. Like his geological colleagues he has evidently felt the restraint imposed upon him by the limitation of his space. Perhaps he might with advantage have followed their example by making more use of illustrative maps and diagrams; but he has endeavoured to meet the needs of those who wish for more than a general description by devoting a third of his space to notes and references printed in a smaller type.

Climate, by Prof. Polis, occupies ninety-six pages, of which twenty-nine are filled with tables of climatic data. Two coloured maps showing the distribution of temperature and rainfall are appended. In these the colouring is upon a transparent sheet attached to an underlying map which shows the observing stations with their altitudes.

A geologist or a meteorologist will wish for more, but as a general account of the physical geography of the area within a limited space it would be difficult to improve the volume, and it seems likely that the whole series will form the standard work upon the Rhineland for many years to come.

The book is well produced and is agreeably light to handle. Although it is printed upon unloaded paper the illustrations are remarkably clear, and are indeed much more pleasant to examine than if they were upon a glazed and shining surface.

P. L.

ITALY BEFORE THE ROMANS. By D. Randall-MacIver. Oxford: Clarendon Press 1928. 8 × 5 inches; 160 pages; illustrations and sketch-map. 6s

This little book is essentially a summary of the results of archaeological research in Italy that have been described at length by the author in his much larger works: ‘The Villanovans and Early Etruscans’ and ‘The Iron Age in Italy.’ It is commendably lucid, but so condensed that readers unacquainted with archaeology may not find it always very easy to follow: all the more so as it is very sparsely illustrated, a defect in an elementary work not likely to be
much lessened by the author referring the reader to his larger books for illustrations.

Dr. Maclver shows clearly how much archaeological discovery has done in throwing light on the prehistoric past of Italy. It has completely confuted the old idea that the civilization of Italy was due to the Romans, and that before them the country was inhabited only by a number of barbarous tribes. It has also shown that during the Neolithic and Bronze Ages Italy and Sicily had no influence over one another. Whilst both reached the zenith of Bronze-Age culture about the same time, Italy derived its inspiration from beyond the Alps, from Hungary and Bohemia, Sicily owed hers to the Aegean. Moreover there is not the slightest sign of Danubian, Hallstatt, or Etruscan influence in the island.

In comparison with the North archaeological research has not been very successful in Southern Italy. Recently discoveries in Calabria have however revealed important facts, and opened up an interesting line of inquiry. At Calane, on the south coast, have been found rock tombs precisely similar to those cut in the cliffs of Eastern Sicily by the so-called Siculans of the Bronze and Iron Ages. The plan and arrangement of these tombs on both sides are identical. How is this to be explained? Naturally one would say it was due to a migration of Sicilian Siculans to Calabria. Yet, extraordinary as it may appear, there does not seem to have been any intercourse between the two sides of the strait. The material civilization of the Calabrians owes nothing to Sicily. The prehistory of Sicily and Italy appears to remain still quite distinct, without the slightest dependence of one on the other. As the author remarks, they might as well be separated by an ocean instead of a strait a few miles across. Nevertheless, in view of the limited knowledge of Southern Italy's prehistoric past archaeology has yet disclosed, it may not be too sanguine to anticipate that future discovery will illuminate this paradox. It may well stimulate the Italian archaeologists to intensive research in these regions. E. A. P.

GEOGRAPHY: The Scientific Study of Human Settlement. Book IV. Europe and Asia. By R. E. Parry. London: Pitman & Sons 1929. 8 x 5 inches; x + 484 pages; maps and illustrations. 3s 6d

This is the last of four volumes designed for public, secondary, and central schools. It is brightly written, wide in outlook, and full of human interest. Footnotes and a bibliography pave the way for further study. The student who masters this volume should have a fair knowledge of Europe and Asia and find more in school geography than climate, production, and trade. He may however wonder if it is necessary or desirable to interpolate the study of Asia and even the North Pacific between that of Northern Europe and Central Europe, and why France should be mutilated to place most with Central Europe and a little with Mediterranean Europe. This seems to carry the conception of natural regions further than is wise.

R. N. R. B.

A NOMAD OVER ISLE, PENINSULA AND PLAIN. By BEN ASSHER. London: Heath Cranton Ltd. 1929. 9 x 6 inches; 128 pages; illustrations. 6s

The Isle is Cyprus; the Peninsula, the Iberian; the Plain, Belgium. The Cyprian Interlude is less banal than the Iberian Scenes or the Belgian Miscellany, which are written in an extraordinary iambic prose. The Index is a masterpiece.

SOME TRIBAL ORIGINS, LAWS AND CUSTOMS OF THE BALKANS. By M. E. DURHAM. London: Allen & Unwin Ltd. 1928. 10 x 6 inches; 318 pages; illustrations and maps. 20s

Travel and long residence in the Balkans have given Miss Durham a very intimate acquaintance with the tribes of Albania and Montenegro, the most
primitive in Europe, amongst whom the tribal system survived intact into the twentieth century. By recording in detail the knowledge thus gained regarding the practices and customs of these tribes, she has produced a work which appeals to the geographer, the politician, and especially to the anthropologist, for these customs show resemblances to those observed among primitive peoples in other parts of the world.

The tribes of Albania and Montenegro and their geographical distribution are described at some length. Until recently the tribes of Montenegro were, and up to the present day those of Albania are, strictly exogamic. No descendants from a male ancestor can intermarry. But the law applies only to male blood: women do not count. Whilst the Albanian tribes are probably descended from pre-Slav Balkan inhabitants, a study of the history of Montenegro presents a picture of the development of a group of tribes of mixed origin into a recognized nation.

After tribal law in Albania, and the old laws of Montenegro and Serbia, with the canons and codes on which they are based, have been explained, a number of practices and customs are described, illustrated, and commented on. Among these are Tattooing, Blood Feuds, Magic, Medicine, Soothsaying, and the ceremonies associated with Birth, Marriage, and Death. Tattooing is still largely practised, especially by women. As Herodotus refers to tattooing in the Balkans, the practice is evidently a survival from ancient times. It is certainly pre-Christian, notwithstanding that the cross is a common symbol. The designs are commonly made on the hands, the predominating symbols being the sun, moon, and cross. The crescent appears long before the advent of the Turk. Whatever religious significance therefore the symbols may have, they are neither Christian nor Moslem, but must have originated in connection with some earlier ancient cult, such as sun worship.

The account of blood feuds is a remarkable psychological study. "The blood feud is misunderstood when it is spoken of as vengeance, and regarded only as a punishment for a crime. It has almost a religious quality; it is an offering to the soul of the dead man." It is a solemn duty, recognized by both sides, and carried out according to rule. The blood taken must be male blood, for it is a general belief that no blood is inherited from the mother. A man cannot be attacked when protecting strangers as a guide, or sheltering them in his house. (Miss Durham is able to illustrate this from her own experience.) The barbaric methods of delivery, and the unhealthy treatment of infants account for the high infantile mortality, and refute the idea that the life of primitive peoples is naturally healthy. Marriage is arranged by the heads of houses, and betrothal may be made before birth. This system is the cause of many blood feuds. Among the burial ceremonies is that of cutting off the hair, and throwing it into the grave; probably a purificatory rite. In fact, the funeral rites of the Balkans differ very little from those of the time of Herodotus.

Under the head of Medicine a very interesting account is given of the primitive ideas of disease and its treatment current in the Balkans. Every herb has its disease, and every disease its herb. Disease is an inexplicable mystery which requires mystery to combat it. Wounds, on the contrary, are no mystery, and demand different treatment. Antiseptic treatment has been known for nearly a century, and is often very successful. The Balkan peoples are decimated by disease. Tuberculosis especially is widespread. On medical authority 30 per cent. of the population are badly infected with it. It is a mistake, says Miss Durham, to imagine that a rough simple life produces health. The apparent sturdiness of the survivors blinds the outsider to the intensity of the struggle for existence, and its mass of victims.
Space does not permit further reference to the many interesting facts and acute observations contained in this book. The reader will find much food for thought and his horizon widened by its perusal. It is illustrated by maps, sketches by the author, and a number of photographs. A bibliography is added.

E. A. P.

TRAVELS IN PERSIA, 1627–1629. By Thomas Herbert; abridged and edited by Sir William Foster. (The Broadway Travellers’ Series.) London: George Routledge & Sons Ltd. 1928. 9 x 6 inches; xi + 352 pages; illustrations and maps. 15s.

The opening years of the seventeenth century mark the advent of the English in Eastern waters. At first there was no intention of venturing into unknown Persia, since Portugal dominated the Persian Gulf by the celebrated fortress of Ormuz, situated on an island at its entrance, and would undoubtedly attack the new-comers. However the factors were unable to sell their large stock of broad-cloth in torrid India, and, hearing that Persia was a cold country where they might feel assured “of the vent of much cloth,” they boldly decided to send a trial consignment of their goods to distant Isfahan.

Jask, situated outside the Persian Gulf, was selected as the port, and the factors, on landing, were extremely well received by the local authorities and later by Shah ‘Abbas, and it was therefore decided to follow up this promising opening.

The Portuguese had attempted to capture the pioneer vessel. Consequently, in 1620, the entire squadron consisting of four ships sailed for Jask, where their rivals were awaiting them. There was no question of a parley. Both sides were evenly matched, but the English won the day, and the enemy “frigatts towed them auaie wonderfullie mangelde and torne.”

Shah ‘Abbas naturally wished to drive out the usurping Portuguese, and, hearing of the English success, realized that with their aid this could be done. He ordered the Governor of Shiraz to negotiate with the English. As a result a Persian force was towed to Ormuz by the English squadron, which then destroyed the Portuguese ships at anchor. Apparently the action off Jask had cowed their sailors, who made no attempt to fight. Ormuz was then besieged; an assault was delivered by the Persians, which was repulsed, but the garrison finally surrendered to the English. For our fighting ancestors the capture of Ormuz in 1622 represented their first great feat of arms in Eastern waters.

Shah ‘Abbas had sent an ambassador to England in the person of Sir Robert Sherley, an English knight, who had entered his service and had organized his army on European lines. His chief mission had been to arrange for the purchase, at a port on the Persian Gulf, of Persian silk, which, when it went overland to the Levant, swelled the customs’ receipts of the Turks, a state of affairs which was politically most disadvantageous to Persia.

Sherley, who had failed to settle the silk question, was anxious to return to Persia, when suddenly the situation was complicated by the arrival in London of Nakd ‘Ali Beg, a second Persian Ambassador, who declared Sherley an impostor.

In 1626 it was decided to send a return embassy to Persia. Sir Dodmore Cotton, a gentleman of the King’s Privy Chamber, was appointed Chief of the Mission, and Herbert was attached to it. Thomas Herbert was only twenty-two at the time, but was well educated. He kept a careful diary of his experiences, both on the sea voyage to India and, of far greater importance, on his travels in Persia, a new edition of which constitutes the book under review.

The Mission sailed in the spring of 1627 and nearly a year later landed at the port of Gombrun, which name was later changed to Bandar ‘Abbas. Herbert
describes the landing of the Ambassador in grandiloquent language: "The cannons vomited their choler, ten times roaring out their wrathful clamours."

The route in those days ran through Shiraz, which city delighted Herbert who, upon leaving it, wrote a charistery or "Song of Thanksgiving," which ended:

"Farewell, sweet place, for, as from thee I went,  
My thoughts did run on Adam's banishment.

Well indeed was great Sadi justified when he wrote:

"O joyous and gay is the New Year's Day, and in Shiraz most of all;  
Even the stranger forgets his home and becomes its willing thrall."

In April the Mission reached Isfahan, where, in the absence of the Shah in Mazanderan, it was welcomed by the Persian authorities and entertained. Herbert gives an excellent description of the palaces and parks, one of which he compares to Fontainebleau. He was especially struck by the Maydan, or Royal Square, which he describes: "as spacious and aromatic a market as any in the universe, resembling our Exchange, or the Place-Royal in Paris, but six times larger."

From Isfahan the Mission travelled north to Ashraf, close to the Caspian Sea. Herbert describes the various stages and especially the pass through the main range: "not more than forty yards broad and eight miles long; but the mountain on either side is precipitous." He identified it with the celebrated Caspiae Portae, and he was probably correct.

Sir Dodmore Cotton was given a poor reception by Shah 'Abbas. He had allowed Sherley to accompany him and took up his quarrel with Nakd 'Ali Beg, and this the Shah was bound to resent. Moreover he brought no promise to purchase the Shah's silk, and finally he was unprovided with presents, which were essential to success. The Mission suddenly ended in tragedy, both Cotton and Sherley dying within a few days of one another. Other members of the Mission also died, while Herbert only just escaped death from a bad attack of dysentery.

The Mission indeed failed in its immediate objects, but to it we owe the first account of Persia given by an educated Englishman. Herbert perhaps attempted too much, and we have to thank Sir William Foster for a ruthless pruning of many lengthy passages. His language was at times pompous, but not always. For instance, take the following: "Choava-berry (coffee) is much drunk, though it please neither the eye nor taste, being black as soot and somewhat bitter or rather relished like burnt crusts." Even better is his terse description of the Persians: "They are generally well-limbed and straight; the zone they live in makes them tawny; the wine cheerful; opium salacious. The women paint; the men love arms; all affect poetry."

To conclude, we may warmly congratulate Sir William Foster and the publishers of the Broadway Series on this new edition of a classic of travel.

P. M. Sykes.

AGRICULTURAL AFGHANISTAN. By N. I. VAVILOV and D. D. BUKINICH. Leningrad: The Pan-Soviet Institute of Applied Botany 1929. 10 × 7 inches; 610 + xxi pages; 318 photographs, tables, and 6 maps. 12 roubles

This is the 33rd Supplement to the Bulletin of Applied Botany, and is the outcome of an expedition sent in 1924 by the Institute at St. Petersburgh to investigate the agricultural resources and methods of Afghanistan. Between them the authors made a circuit from Herat through Mazar-i-Sharif, Kabul, and Kandahar, a direct cut across from Herat to Kabul, and additional tours in the north-
Any first-hand account of a country that is so much in the public eye must have importance. The subject-matter of this attractive volume is by no means confined to the crops and their cultivation; we are told and shown much that is of interest, not only in the scenery but in the inhabitants and their dwellings and even in their languages. The book is of course written in Russian; but there is a generous summary in very fair English occupying 76 pages, and an English translation is given of the titles of all the illustrations. The word “tables” in the English title of the book probably refers to figures in the text other than photographs. These last, especially in the whole-page plates, are artistically taken and reproduced in a somewhat blurry style that is far from being unpleasing. Particularly interesting is the chapter on Kafiristan, the geographical limits of which should according to the authors be considerably reduced from the estimate of Sir George Robertson in ‘The Kafirs of the Hindu Kush,’ 1896. In the last chapter a hope is expressed that the productive region of Northern Afghanistan may be developed under the stimulus of trade with the U.S.S.R., and it is pointed out that commercial relations should be made easier by the fact that the local tribes, Turkomans, Uzbeks, and Tajiks, overlap the frontier between the two countries. The special object to be attained is the extension of the acreage under cotton at the expense of wheat, which could be supplied cheaply from Siberia to Afghanistan. The actual details of the journey, with distances and altitudes, are given in an appendix in Russian only, and are plotted on a folding map on the scale of 1/2 M.

J. H. R.


It is an interesting question why, comparatively speaking, so little attention has been attracted to the adventures of the greatest of mediaeval travellers, for judging by the extent and variety of his journeys (estimated by Yule to have covered 75,000 miles) and the conditions under which they were made, even Marco Polo must take a second place. This is no doubt partly due to scepticism regarding the veracity of the traveller’s account of his wanderings, and to the belief that he readily succumbed to credulity and imagination.

The great service of this abridgment of Battuta’s travels is that under the guidance and criticism of an Arabic scholar of distinction, the subject is presented and discussed in such a manner as to enable the reader to form a fair and consistent judgment on it. Mr. Gibbs’ admirable introduction reproduces the atmosphere of the age and society in which Ibn Battuta lived and travelled. His account of the historical and theological background of the travels throws light on Battuta’s point of view, and his attitude and action in the many very varied situations in which he found himself.

It is remarkable, considering the great number of people of all kinds and conditions Battuta encountered during his wanderings, that there is hardly any known mention of him by any of them. We know very little indeed regarding himself and his family apart from the few references that occur in his account of his travels. But that he was a learned theologian and ardent follower of the Prophet, and acted as qadhi explains much that would otherwise appear sometimes fantastic. A careful consideration of the internal evidence of his story gives general support to its veracity.

In addition to the introduction, Mr. Gibbs has furnished each chapter with numerous useful and valuable notes which greatly help the reader to follow intelligently the itinerary, and to understand the allusions of the traveller. The book is well printed and is illustrated with maps and a few views.
fail to make the reader wish to see the more complete account which the editor is preparing for the Hakluyt Society. There is a good index. This volume will certainly enhance the reputation of the series of "Broadway Travellers" Messrs. Routledge are publishing.

E. A. P.

THE BAGHDAD AIR MAIL. By Wing-Commander Roderic Hill. London: Edward Arnold & Co. 1929. 9 x 6 inches; x + 328 pages; illustrations and sketch-maps. 18s

The conquest of the air has brought with it the conquest of the abandoned Euphrates route to the East, but it is well that the ordinary citizen, who is inclined to take these things as a matter of course, should appreciate the inveterate difficulties still existing. The intense heat, with swift variations, creating air conditions positively dangerous; the glare, trying to the eyes, and deceptive when seeking landing; high precipices and deep gorges with treacherous down currents; broken ground covered with boulders and camel-thorn that can tear tyres or wings, or, where clear, soft and boggy in the rains—these troubles are set before us in full detail. It has needed a cooperation of all the sciences and, not least, a very special human factor to overcome them.

It is a country suitable for broad impressions, such as can be obtained from a machine sweeping over it at from 60 to 80 miles an hour, and Wing-Commander Hill has a sense of the mystery and grandeur of the desert. The later chapters, however, are too drawn out, and much of the detail in them is rather trivial. The geographical information is naturally not very precise, but it is surely time to use it in its broad features for ordinary atlases. The reviewer has just glanced at some of date 1928, and they give quite an incorrect impression of the country east of the Dead Sea.

A. S. E.-S.

BAGHDAD AND POINTS EAST. By Robert J. Casey. London: Hutchinson & Co. [1929]. 9 x 6 inches; xii + 300 pages; and illustrations. 18s

An apology to Scheherezade prefaces this book: "So, my Queen, the time has come to give further attention to the affairs of the glorious Baghdad, to add a few more tales to the thousand and one." So "many of these stories are miniature Arabian Nights, for the lands of the East still cast the spell of the mysterious, the romantic, the exotic." The whole romance of 'Iraq—and what is 'Iraq without that romance?—is reflected in these pages. Tales of Zenobia and of Belkis, of Scheherezade and of Semiramis are interspersed with sketches of the history of the Assassins, the Caliphs, and the Yezidees. Each prosaic chapter heading has a subtitle which might be taken from the famous Eastern tales themselves. But all is not fairy tale. There is much vivid description of places visited, and History and Archaeology are laid under tribute. It is frankly not a book intended to be a traveller's guide, but one in which facts are seen through a romantic glamour and are detailed with cynical humour. The illustrations are very good, but are very ill arranged with regard to the text.

E. W. G. M.

FROM LEIPZIG TO CABUL. By C. Strattil-Sauer. Translated by Frederic Whyte. London: Hutchinson & Co. Ltd. [N.D.] 10 x 6 inches; 284 pages; illustrations and sketch-map. 18s

The author of this book set out in 1925 to travel through the Middle East on a motor-cycle. His eastern travels began at Trebizond, where he spent some winter months exploring the hinterland. This is perhaps the most interesting chapter geographically, though the results of his scientific investigations are to appear in a separate work. After passing through Tabriz and Tehran to Baghdad, and thence to India, the adventure came to an abrupt end in Afghanistan with an arrest for murder and nine months' imprisonment awaiting trial.
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In these sections the interest is mainly political. The observations on politics and culture to which the author has devoted a good deal of space are of varying value, but his remarks on the rôle of the motor-car in the new movements in the East are worth noting. The translation, which is slightly condensed, reads exceedingly well, but with a very little effort such German transcriptions as Katschdyn or Kewir could surely have been rectified, and clumsy phrases like "Rhizochanschen troops" (for "the troops of Riza Khan") avoided. The sketch-map is very poor.

H. A. R. G.

THE TRADE OF THE INDIAN OCEAN. By V. Anstey. (The University Geographical Series.) London: Longmans, Green & Co. 1929. 9×6 inches; xvi + 251 pages; maps and diagrams. 8s 6d

The object of this book is to give a brief account of the present-day commerce and commercial problems of the Indian Ocean. For this purpose Mr. V. Anstey, who is Assistant Lecturer at the London School of Economics, considers not only trade statistics but the economic resources, the political conditions influencing trade, and to some extent the history of each of the more important trading areas, of which India, British Malaya, and the Dutch East Indies account for 86 per cent. of the total trade originating or terminating in this Ocean. His method is thorough and scholarly and the result is a well-balanced and well-documented piece of work, admirably suited for students. At the same time it must be noted that it is not infallibly accurate on minor points. For example, it is not correct to say that Brunei was ever acquired by the British North Borneo Company, and twice on p. 194 one is astonished to find references to "Sarawak (British North Borneo)" as if the two territories were one and the same. The diagrams with which the book is plentifully supplied (by Miss Winifred Hunt) are excellent and contribute substantially to the elucidation of the text. The index is well arranged, and the author provides a bibliography which gives a very useful list of reports, year-books, and handbooks, but is curiously weak as to the standard works on the countries concerned. O. R.

IN JAVA AND THE NEIGHBOURING ISLANDS OF THE DUTCH EAST INDIES. By John C. van Dyke. New York and London: Charles Scribner's Sons 1929. 8×5 inches; xii + 310 pages; frontispiece and map. 8s 6d

These sketches and studies, made during a winter and spring in the Dutch East Indies, pretend, as the author declares, to nothing but a point of view. Professor van Dyke, who is a well-known American art critic, approached Java from Australia by way of Celebes, Borneo, the Moluccas, and Bali. His book is almost entirely descriptive; he avoids politics and does not profess to deal with ethnology. His impressions are those of a passer-by who is an artist with a power to convey his impressions in prose, and the result is a companionable little volume which any traveller to the Dutch East Indies would do well to take with him for the voyage. O. R.


This is a comprehensive work by an author who can speak with authority. It concerns the Low Veld of the Transvaal, a slender strip of virgin territory, 70 miles wide, 300 miles long, stretching north to south between Swaziland and Rhodesia. For twenty-six years Colonel Stevenson-Hamilton has been associated with this country. He was responsible for the administration of the Sabi Game Reserve, and it was through his efforts that the Kruger National Park became
established. He can therefore write with first-hand knowledge on matters that concern its wild life.

General Smuts supplies a foreword, and tells of the charm of this virgin region, and of the eerie spirit that broods over its expanse. Then we come to an account of its natural features, its mountains, rivers, climate, geology, which is the part of the book most likely to interest the student of geography. The vegetation is described in brief, and the animal-life in greater detail. Here Colonel Stevenson-Hamilton is particularly interesting, and we specially commend his first-hand observations on the oft-debated subject of animal colour. He also tells much about native life and customs, and relates what is known of the history of the region from the days of the Bushmen to present times. Thus the book is a complete and detailed guide, of special interest to the naturalist, the historian, and to those who watch the irreparable consequences of a clash between primitive and civilized peoples.

R. W. G. H.

THE BRITISH IN TROPICAL AFRICA. By Ifor L. Evans. Cambridge: University Press 1929. 8 x 5 inches; x + 396 pages; sketch-maps and diagrams. 12s 6d

The chief merit of this outline of the history of the British possessions and administered areas in Tropical Africa is that it gives in one moderately sized volume some account of all the territories concerned, including not only the West and East African colonies and protectorates, but Rhodesia and the Anglo-Egyptian Sudan. The book should be very serviceable to those for whom it is primarily designed—Colonial Service Probationers at Oxford and Cambridge, and also to all those coming fresh to an examination of the history of Imperial development in tropical Africa. It does not set out to tell the specialist anything new. It is fullest in its account of Nigeria; most brief in its dealing with Kenya since the advent of white settlers. This brevity is excused by the statement that “in an historical outline such as this” post-war Kenya problems cannot receive more than passing reference. The problems are indeed indicated, though there is no indication of one of the grievances of the Indians, namely, that the franchise is communal and not common.

Part I gives an introductory outline of African History. To condense such a story into thirty-seven octavo pages is a hard task, very fairly accomplished, but there are gaps and errors. The most summary account should have mentioned the founding of Cape Town and its consequences. Mistakes are made which it is hard to excuse. For example, it is said that when (in 1858) Speke discovered Victoria Nyanza, instead of returning to join his leader (Burton) he rushed back to England. In fact, Speke rejoined Burton a few days after sighting the lake, and told him of his discoveries and theories, which Burton disbelieved. It was only after reaching Zanzibar that Speke hurried to London ahead of Burton. There are other inaccuracies of a like kind, such as the statement that Lander accompanied Clapperton when he crossed the Sahara. These might have been avoided, for the facts are easily ascertainable.

The book is furnished with good sketch-maps and a useful bibliography.

F. R. C.

FROM THE IVORY COAST TO THE CAMEROONS. By Alexander Jacob Reynolds. London: Alfred A. Knopf 1929. 9 x 6 inches; 298 pages; illustrations and map. 12s 6d

To readers of a book of travel it is important to know the qualifications of the author, what he was doing in the countries he describes, and when he was there. These questions, unfortunately, are not answered in the pages of the present
volume. A somewhat dictatorial manner of writing constantly provokes the question: "Who is this Mr. Reynolds?" He evidently spent a good many years on the Coast, and the extent of his travels is indicated by the title he has given his book.

In a prefatory copyright note we read that "The short stories are not to be used by Negro-impersonators, or others, without the consent of the Author in writing. All adaptations of negro scenes from its pages are forbidden, both on the stage or for padding stories used in cinema projections." From this we are led to expect a good deal of fun from a serious writer. The negro stories however are not more than typical of their immense class, and the risk of piracy would appear to be small.

Mr. Reynolds, however, had varied experiences, and was the witness of interesting scenes of both peace and war. These are often well described. His reminiscences of the war in West Africa and of German methods in trade and administration were also worth recording. The book is mostly anecdotal and provides light entertainment.

E. W. B.

BRITISH COLONIAL POLICY AND THE SOUTH AFRICAN REPUBLICS, 1848-1872. By C. W. de Kiewiet, PH.D. London: Longmans, Green & Co. 1929. 9 x 6 inches; x + 317 pages. 12s 6d

This survey of the history of South Africa from Harry Smith's annexation of the trans-Orange territory up to the annexation of the Diamond Fields is written, as the title of the book shows, with special reference to the motives which in that period moulded colonial policy in London. The period witnessed a marked change in the attitude of British statesmen to the colonies. For the greater part of the time they were endeavouring to limit their commitments, to avoid entangling alliances and to thrust responsibility—including financial responsibility—upon the colonists. The Sand River and Bloemfontein Conventions were typical expressions of this feeling. Yet throughout Great Britain felt herself the paramount power in South Africa, and consistently blocked the road to the sea to the Boers. M. de Kiewiet, whose volume is the third in the series of Imperial Studies published by the Royal Empire Society, has given us a very sound piece of work. The story is not overloaded with detail, and the point of view of the Colonial Office is never lost sight of, but it is manifest that the author is treating of a country and of peoples with whom he is familiar. It has, in short, the local colour needed. He brings out clearly the essential character of the struggle between the Europeans and the Bantus. It was a struggle for land, for a place in the sun sufficient for the well-being and comfort of each race. That is the true key to an understanding of the long contest between the Basuto and the Free State. Another point that the author does well to dwell upon is that with the white farmers on the frontier the troubles are not caused by a clash of British and Boer views: the farmers had a common outlook in most matters which concerned native policy. They needed land and security, and were little concerned with the rights of the natives. That in the end the natives were left with insufficient reserves is a main cause of the present troubles in South Africa.

Mr. de Kiewiet has had the advantage in preparing his book of consulting hitherto unpublished documents, notably a series of private letters written by Sir Philip Wodehouse, when Governor of the Cape, to the Secretaries of State and to his son. These are very illuminating. To the reader in general and especially the South African reader, whether of British or Dutch descent, a careful study of this book should help to clear away misunderstandings. The British Government wearied of the "humanitarian" policy towards the natives;
it tired of frontier wars and dreaded extensions of territory, but in the later part of the period under review it worked consciously towards the grant of self-government to the colonists, and Mr. de Kiewiet closes his narrative with the conferment of that responsibility on Cape Colony in 1872. The seeds of the Union of South Africa were then sown. It may be added that the author has a clear and engaging style and a firm grasp of his facts. There is a good bibliography, the index is more informative than is usual, and a list is given of the personnel of the Colonial Office in the period. We should have liked a similar list of the chief officials in South Africa. But the one serious drawback of the book is the absence of maps. Three or four are required to elucidate the text.

F. R. C.


The monumental work of Elisee Reclus, which so long held the field as the best general description of the World on a large scale, is naturally now out of date, and French geographers, who have long been noted for their excellent regional monographs, are turning their attention to the production of another large work of the kind, to be completed in about twenty volumes, the first of which was reviewed last year in the Journal (vol. 71, p. 482). Each volume is planned on the same lines. A general introduction deals with relief, structure, scenery, climate, vegetation, and people of the continent or region. In the present volumes these chapters are admirable in their broad views and synthetic outlook. We would especially call attention to Prof. Sorre’s general surveys of Central America and the West Indies, which fill a gap in geographical literature. The more general chapters are followed by detailed consideration of the geography of the states. Very wisely political states rather than natural regions are taken as units. Within each state natural regions are selected, but there is no attempt to ignore the significance of political frontiers in human associations. In addition to the usual aspects of geography these volumes pay much attention to problems of colonization, the position of native races and foreign influence in the states of Central and South America. These studies are admirable examples of the value of the geographical treatment of economic and political problems. So much has been written on Latin America from a partisan view, looking on it merely as a part of the world awaiting commercial exploitation, that it is refreshing to find an impartial treatment and an obvious desire to discover the truth in such problems as the difficulties of stable government in Mexico and Central America, the policy of the United States in Central America, the future of the West Indies, and the settlement of Brazil and the Argentine by colonists from Europe. Prof. P. Denis and Prof. M. Sorre have put geographers under a debt of gratitude for these excellent and beautifully illustrated volumes, which will be accepted as the standard geographical works on Latin America. The only suggestion we have to offer is that more attention might be paid to the larger towns, such as Buenos Aires and Rio de Janeiro, so as to give an impression of their life, colour, and plan of growth in addition to the reasoned analysis of their sites and trade.

A word of praise must be given to the production of these volumes, their clear type, many maps, and full indexes. Bibliographies are added to every chapter.

R. N. R. B.
ON THE BARRIER REEF. By S. Elliott Napier. Sydney: Angus & Robertson Ltd. 1928. 9 x 6 inches; 174 pages; illustrations and maps. 10s 6d
This is a most readable account of a "holiday" expedition of Australian scientists who visited the Bunker and Capricorn Islands at the south end of the Great Barrier Reef. It is written by a non-scientist, but a well-known journalist—most of the chapters having previously appeared in the Sydney Morning Herald. To any one unacquainted with the Reef it will give a picture of conditions there existing which is as happy as it is true. The Low Islands of the Bunker and Capricorn groups and their associated reefs are similar in many ways to other low islands which are found all along the reef waters. The geographer will read the book with pleasure in that it will give to him a description—strictly un-scientific, perhaps, but not misleading—of a part of the world which is comparatively little known. To one who has seen something of the Reef waters the book brings back many happy memories, and a strong sense of gratitude to Mr. Napier for bringing together in a chattily written and well-illustrated book much of the lighter side of travel which cannot find place in a scientific work.

J. A. S.

UNDER THE SOUTH. By James Norman Hall. London: Chapman & Hall Ltd. 1928. 9 x 5 inches; 244 pages. 15s
The author of this pleasant book went to the South Seas in a peaceful mood, having finished with the war, and being free to move in any available direction. Though he occasionally calls himself a journalist, and even wrote some articles which he sold for a fair price, he does not write in journalese. We can, moreover, follow him in his wanderings without anxiety, since it seems evident from the beginning that nothing sensational is likely to happen to him. Nor does it, but he has much of interest to say of the glimpses he obtained of the present conditions of some of the Polynesians under the influence of civilization. Of his own reactions to the environment, and of his success in dealing with the emergencies that occasionally confronted him, he writes moderately and well, and he rouses our interest in some of the human flotsam and jetsam of our own race that he encountered.

H. S. H.

WANDERINGS IN WILD AUSTRALIA. By Sir Baldwin Spencer. Two volumes. London: Macmillan & Co. Ltd. 1928. 9 x 6 inches; xxviii and xiv + 930 pages; illustrations and maps. 42s
Sir Baldwin Spencer has done more than any other man to place our knowledge of the Australian aborigines on a scientific basis, and his co-operation with the late Mr. F. J. Gillen resulted in the publication of such books as 'The Native Tribes of Central Australia' and others which are now standard works of reference. Whilst Sir Baldwin Spencer began his investigations in the capacity of zoologist to the Horn Expedition to Central Australia in 1894, he has between that time and this established himself as the leading authority on the aborigines of a large part of Australia. Beginning with southern central tribes, such as the Urabunna and the Arunta, he has by later journeys and sojourns, down to as late as 1926, carried his investigations farther to the north, amongst the Unmatjera, the Kaitish, the Warramunga, and other tribes, whilst his journeys to Bathurst and Melville Islands, and parts of the neighbouring mainland, have enabled him to study the culture of tribes living under conditions relatively free from the debasing influence of civilization.

As the title suggests, the two volumes of the present work are not so predominantly ethnographical as their predecessors, though they contain full and fascinating accounts of social manners and customs, rites and ceremonies, arts
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and crafts, met with through the many years of the author's intensive studies. Country and climate, in wet season and in dry, conditions of the explorer's life and travel, plants and animals and their adaptations to the alternating phases of rain and drought, the clash of peoples and cultures, the influence of civilizations of different types upon the aborigines, are all dealt with from the point of view of the scientific humanist. As Chief Protector, for a time, of the aborigines of the Northern Territory, the author had opportunities of observing, and attempting to alleviate, the results of the association of the black fellow with whites—not always as white as they might have been—Chinese, often very yellow, and Malays. His anthropology became an applied science, and we may be sure that it was applied successfully.

It need hardly be said that the book is lavishly illustrated, many of the plates being coloured, and that the maps are clear and adequate. Sir Baldwin Spencer has a record that is the admiration of all students of native peoples, and in publishing more of the contents of his notebooks—which must be innumerable—he puts the students of several sciences under a deep obligation.

H. S. H.

SAVAGE SOLOMONS AS THEY WERE AND ARE. By S. G. C. KNIBBS.
London: Seeley, Service & Co. 1929. 9 x 6 inches; 282 pages; map and illustrations. 21s

Although this book is designed more for the general reader than for the scientist, it is a useful complement to Mr. A. J. Hopkins's 'In the Isles of King Solomon,' issued by the same publishers last year. Mr. Knibbs has had some fifteen years' experience of the British Solomon Islands Protectorate, and is now Commissioner of Lands. His work has taken him into all parts of the islands, and he has come into contact with natives both primitive and sophisticated. He writes pleasantly and knowledgeably of old customs and beliefs, of native activities, of the police force; he describes the beauties and possibilities of the islands and shows the changes that have come about during the past two decades. Throughout runs a thread of entertaining personal reminiscence, and for many readers his most interesting chapters will be the description of a visit to those little-known islands, Rennell and Bellona, to which even the rudiments of civilization have yet to penetrate. The book is provided with an adequate index and a clear map, drawn by the author.

O. R.

THE SOUTH POLAR TRAIL: the log of the Imperial Transantarctic Expedition. By ERNEST MILLS JOYCE, with an Introduction by HUGH ROBERT MILL. London: Duckworth 1929. 9 x 5 inches; 220 pages and illustrations. 10s 6d

Mr. Joyce's narrative is virtually the log-book which he kept with the Ross Sea party of the Shackleton Antarctic Expedition of 1914-1917. It recounts an almost heroic feat, which in the stress of war passed almost unnoticed, but for which Joyce and two of his companions were ultimately awarded the Albert Medal.

Shackleton had picked on Joyce to lay depots across the Ross Barrier to the foot of the Beardmore Glacier for the benefit of the party with which he hoped to cross the continent from the Weddell Sea. The Aurora reached the Ross Sea in January 1915, but soon afterwards, with practically all clothing and sledge equipment still on board, she was carried away from her moorings by the pack-ice. Joyce then dug out the cast-off remnants of previous Scott and Shackleton expeditions, and so obtained a certain amount of makeshift equipment. Before winter set in he had already accumulated a small stock of provisions not far from Captain Scott's grave.
Next season sledging began on September 1, but it was not till January 27 that the Beardmore Depôt was finally laid. Tents, clothing, and sleeping-bags were almost in rags: it was only Joyce's ability as sledger and dog master which had made this great achievement possible. Worse however was to follow. After five months' sledging all of the party had developed scurvy in some form or other; one man had to be dragged homewards on the sledge for forty days, and two others, although at first able to walk, in the end also completely collapsed. The struggle went on till the middle of March; one died in sight of the base; but thanks to Joyce the other two were saved. They had been over two hundred days on the trail; and they brought back all their dogs after seven months' sledging and nineteen hundred miles of distance.

It was a magnificent feat, and the interest of Joyce's book is that it is told in his own words, set down from day to day, as a sailor writes, and without a touch of pride. It forms a most valuable addition to polar literature, and a most thrilling book to read.

A word of criticism is necessary in regard to the naming of the illustrations. Many of these were taken not in the Ross Sea but on Elephant Island, in South Georgia and in the Weddell Sea. The picture on the dust cover, for instance, shows Shackleton with the Endurance party, but the reader would naturally regard it as the Ross Sea party; King Penguins from South Georgia are described as Emperor Penguins; and so on. It would have been easy to have avoided these mistakes, which detract just a little from what is otherwise a really first-rate book.

J. M. W.


Mr. F. W. Harmer died in 1923 at the age of 88, and the value of his work upon the Pliocene and Pleistocene geology of England has long been recognized by geologists. In his earlier years he was associated with Searles V. Wood, Jun., in a survey of the glacial deposits of England, and himself mapped in detail the counties of Norfolk and Suffolk. But the death of his friend in 1884 came as a severe blow, and for some eleven years he disappeared from the geological world. In 1895 his enthusiasm was re-awakened by finding that their views were received with sympathy by younger men, and from that time he again devoted himself to geological research. He himself said that the advent of the motor car had given him a new lease of geological life, and, though he was no longer young, he was able to examine the glacial geology of the entire area between the Humber and the Thames and from the east coast to the Welsh borders; he thus acquired a personal acquaintance with the drift deposits unequalled by any other observer.

For his own use he prepared a contoured map of England and Wales, showing, by means of symbols, the distribution of erratics derived from different sources, and it is this map with its accompanying memoir which is before us. It was at the solicitation of Prof. Kendall that he consented to its publication, and that circumstance alone will be sufficient to indicate its high value. Both map and memoir were nearly complete at Mr. Harmer's death. Dr. Arthur Raistrick has searched later literature for further records, which have been incorporated; a more convenient set of symbols has been devised, and the map has been reduced to a handy size. At Mr. Harmer's request Prof. Kendall has put the memoir into final shape, but he has limited this revision as far as possible to a few verbal changes and an occasional footnote. Otherwise both map and memoir are as
Mr. Harmer left them. Their value will be evident to every one interested in glacial geology, and the thanks of all glaciologists are due to Sir Sidney Harmer and his fellow-trustees for bearing the cost of reproduction, and to the Yorkshire Geological Society for placing at their disposal this unique summary of Mr. Harmer's extensive knowledge.

P. L.


In the case of a theory such as that of continental drift a symposium of this kind is particularly valuable. Few will assert that the evidence in its favour is conclusive, few will deny that some of it is suggestive; and it is both interesting and useful to see how it appeals to different minds. Fourteen writers have taken part in the discussion, and the space available has been fairly divided between supporters and opponents. The subject is introduced by W. A. J. M. van Waterschoot van der Gracht, who is a supporter, and his introduction occupies nearly a third of the book. He is not dogmatic, and his chief concern is that the theory should not be dismissed as unworthy of consideration. He is himself convinced of the general truth of the hypothesis, though he does not follow Wegener in all his conclusions. He does not think, for example, that the present continental masses of Africa and South America were ever in actual contact. There has been a certain amount of foundering as well as drifting. He urges that although there are difficulties in detail, the theory explains so much that we should not be deterred from accepting it on that account. Perhaps he is not quite fair to other theories. The contraction theory explains much that the drift theory does not, yet he rejects it on account of difficulties. Like many writers he tacitly assumes that contraction and continental drift are the only alternatives.

Wegener himself contributes a short article. Of the other writers Joly, Molen graaf, Singewald, and F. B. Taylor are in favour of continental drift in some form or other. Joly thinks that it is likely to occur during his periods of revolution, when the sima is melted. Molengraaf stresses the inadequacy of a primarily westward drift, but otherwise is rather favourably inclined towards the theory. Singewald objects strongly to Wegener's mode of presenting the case, but thinks that there is sufficient sound evidence to give the theory a high degree of probability. Taylor, who advocated continental movement several years before Wegener, is allowed twenty pages in which to develop his theory that the Tertiary mountain-building was due to such movements and that these movements resulted from the capture of the moon during the Cretaceous period.

The remaining writers take, on the whole, the other side, though several of them would not deny the possibility that continental drift may have had some effect. J. W. Gregory has no a priori objection to the theory, and has himself postulated movement of the crust, but he attributes the main features of the globe to vertical rather than horizontal movements. David White modestly disclaims the special knowledge necessary to form a decided opinion. He thinks, however, that the maps of Köppen and Wegener are open to serious criticism, and he asks why Wegener's Pangaea did not begin to break up till so late a period. Bailey Willis, Longwell, and Bowie object to the theory chiefly on physical grounds, R. T. Chamberlin partly on physical and partly on geological grounds, Schuchert and Berry chiefly on geological grounds. Apart from the introduction, Schuchert's contribution is much the longest article in the book. It is a detailed and critical analysis of the geological evidence and is altogether...
unfavourable to the hypothesis, though the writer thinks that some germ of truth may lie concealed within it.

Van der Gracht's reply to the discussion, which occupies thirty pages, is not equal to his introduction. In the introduction he seems to weigh the evidence and, rightly or wrongly, to come to a conclusion; in the reply he forces the evidence into conformity with the conclusion.

P. L.


The original edition of this book, edited by Dr. G. H. Fowler, appeared in 1912. Books on oceanography in English were then even less numerous than they are to-day, and Dr. Fowler's volume, with its authoritative contributors, was welcome. The present edition has been revised, enlarged, and recast, but the general arrangement remains the same and most of the original writers again contribute. Sir John Murray's article on the sea-floor has been reprinted with a few editorial footnotes. Prof. D'Arcy Thompson has largely rewritten his chapter on Whales, Seals, and Sea-Serpents, and Prof. Stanley Gardiner has contributed an entirely new article on tropical shore life and the problems of coral islands. The chapters on the air by Messrs. D. Brunt and L. G. Garbett, and on the water by Mr. D. J. Matthews and Dr. W. R. G. Atkins are new. Dr. W. T. Calman again writes on the life of the sea-floor, and the editor on dredging, trawling, and the preservation of marine organisms. A few improvements might be made in what is on the whole an excellent guide to practical work. Echo-sounding is too important to be relegated to a mere footnote. The Richard reversing bottle might receive more thanmere mention, although the new Copenhagen model gets full recognition. Tow-nets of bolting silk with narrow apertures should be specified as essential for the collection of phytoplankton from a ship moving at a speed of 6 or 7 knots or more. The maps showing the distribution of pressure and of currents should show polar conditions. There are several useful appendices giving conversion tables, lists of marine stations, and names of firms dealing in oceanographical apparatus, and there is a full index. The book deserves to be widely used and should be helpful in furthering research in oceanography.

R. N. R. B.


Since the publication of 'The Depths of the Ocean' by Sir J. Murray and Dr. J. Hjort in 1912 no general work on the biological side of oceanography had appeared until this volume by two naturalists of the Plymouth Marine Biological Association. The book is smaller than the earlier work, but it covers a wider area. Its outlook, as the sub-title indicates, is mainly biological, with some attention to fisheries and other economic problems. The physical side of oceanography is not neglected, even if it is regarded as merely a setting or background to the life of the sea. On the whole, however, the book is well balanced and gives an excellent summary of current knowledge of oceanography and marine biology, with notice of recent researches. Its inclusion in a popular series should not deter the serious student, for the book is popular only in the sense that it avoids technicalities where possible. Accuracy is never sacrificed for the sake of popularity. A few minor criticisms are not offered in detraction of the general excellence of the volume. It is not quite correct to say that the water of the North Atlantic drift, carried into the Arctic, sinks and "creeps back towards the
equator as a deep bottom current," and it is a pity that the currents of other oceans are scarcely mentioned. Icebergs appear only as phenomena of Arctic seas, but their real significance is in the Antarctic. The map of Atlantic bathymetry is too generalized; and there are no other maps of ocean contours. The profusion of illustrations deserves a word of praise. Among them are 167 in colour, most of which are good. The volume is cheap at the price.

R. N. R. B.

RICHARD HAKLUYT AND THE ENGLISH VOYAGES. By GEORGE BRUNER PARKS, PH.D. (American Geographical Society, Special Publication No. 10.) New York 1928. 10 x 7 inches; xviii+290 pages; illustrations and facsimile maps. $5.00

It is at first sight a matter for surprise that hitherto no full-length biography of Richard Hakluyt has appeared, while the present volume comes, not from England, but from America. The explanation may be found, in part at least, in that "romantic tradition" which Dr. Williamson exposes in his brilliant Introductory Chapter to the work under review. That tradition demands that all Elizabethans shall be men of heroic stature, governed by the heart rather than by the head, and such as fail to conform to type are left in obscurity. There is the further point, however, that Richard Hakluyt, an outstanding figure in the development of geographical science, can only be understood in relation to the history of Modern Geography in England, and that history has not yet been written. The elucidation of his story requires, besides, an intimate knowledge of maritime and colonial history, and the double equipment of historian and geographer is one which very few possess. A Professor of English has attempted to solve the difficulty by undertaking the task of this much-needed biography, and grateful as we must all be to Dr. Parks, it is probable that an element of disappointment will creep into the feelings of the historian as he reads this work, as it certainly does into those of the geographer who finds most of his particular problems still unsolved.

The opening chapter on Tudor geography is necessarily slight, and derived from secondary authorities, while the following chapter on The New Geographers shows but little appreciation of the work of Eden, Chancellor, and Dee, to name but three of the pioneers. But only an insufficient knowledge of the persons mentioned and of the publications cited can account for the following paragraph: "Geographical science must start with Ptolemy; and even if Sebastian Cabot read the Alexandrian, it is doubtful if Thorne or Roze [for Rotz] or even King Henry did. They may not even have read the editors and successors of Ptolemy, from Jacobus Angelus to Mercator. Much less did they edit or supersede him themselves."

The third and fourth chapters are devoted to the elder Richard Hakluyt, to whom the debt of the younger was so great, with the result that this earliest of economic geographers is, possibly for the first time, given the credit that is due to him. It is probable that only the most attentive readers of the Voyages have succeeded in disentangling the respective contributions of the two Hakluys, while the lawyer's correspondence with Burleigh, his early acquaintance with Oliver Dawbeney, and his work on the Dover Harbour Commission all deserve recognition. The elder Hakluyt was exceptionally well read in the botanies and herbals of his day, and saw the New World soberly as a fresh source of raw materials, and as a field for agricultural development and commercial expansion, rather than as a theatre of adventure, or an El Dorado. It is, indeed, a major theme of Dr. Parks' work, and one which is worth dwelling upon, that English overseas expansion took place not haphazard, but only after the most careful and anxious inquiry into geographical and economic circumstance.
The remaining three-fourths of the book are devoted to Richard Hakluyt the preacher, and although little that is new has been added to our knowledge of his private life or of his personality, his contributions to geographical knowledge and to geographical literature (for he was behind many of the translations of the '80's and '90's) are set out with a fullness of detail which will prove invaluable to scholars. More care might have been bestowed on following up the indications available as to Hakluyt's personal circle. He could hardly have been an "unknown correspondent" to Mercator in 1580, considering his earlier connections with the Flemish circle of London and Antwerp. More could have been learned of the help he obtained from Edward Dyer, John Dee's friend, and the patron of the John Frampton translations. Hakluyt's wife, as Dr. Parks shows, was the daughter of Richard Cavendish, uncle to the explorer, and Richard Cavendish, too, was an intimate of John Dee.

A matter on which Dr. Parks lays great stress, in developing his thesis, is that the writings of Hakluyt and his predecessors were planned as deliberate propaganda or "publicity" for overseas ventures. Thus Richard Willes (called Willis throughout) published his 'History of Travayle' as "publicity for the Frobisher voyages." This can scarcely be maintained, for the History appeared subsequently to the first voyage, and when the supposititious gold ore had given Meta Incognita all the publicity that could possibly be desired. Still less was Robert Thorne's letter to Dr. Lee written as propaganda, nor did Hakluyt print it in the 'Divers Voyages' for the sake of the "emotional turn, well known to students of publicity" which Dr. Parks considers that it supplied. Hakluyt's own marginal headings show exactly what points in the Thorne documents he considered to be important, and it cannot seriously be maintained by any one who has studied its context that the phrase "there is no sea innavigable, no land unhabit- able" was either written in the first instance, or printed by Hakluyt, as a slogan for expansionists.

The story of Richard Hakluyt involves naturally the legacy of his papers to Samuel Purchas, a writer towards whom Dr. Parks displays an extraordinary animosity. That his "style is a vapid and tasteless euphuism of a sophomoric sort" is a criticism coming strangely worded from a Professor of English; while it is equally curious to find him disparaged on the score of humble birth. "Instead of the gentleman born [i.e. Hakluyt], Purchas was the son of an Essex farmer or tradesman," "Instead of the gentleman, the poor man," and further, "Purchas was an outsider, a bookish clergyman, who came hat in hand to copy the records of trade." As an actual fact, Purchas was chaplain to an archbishop, he enjoyed the patronage of Sir Dudley Digges and Sir Thomas Smith, and he was in direct touch with Sir Walter Raleigh and Captain John Smith: he had further a numerous acquaintance among mariners and travellers. To say, as Dr. Parks does, that "Purchas was exclusively the antiquarian" while "Hakluyt met on nearly (sic) equal terms the captains of enterprise" is sheer nonsense. Purchas was a dull and sententious writer, and his editing was often disastrous, but he was in close touch with the exploring activities of his time.

The Appendices to the Biography, containing bibliographical and other material for reference, are well planned and likely to be extremely useful. It is curious, however, that Dr. Parks should say that Hakluyt's manuscript on Aristotle's Politics is not extant: there are copies among the Royal and the Sloane MSS. The date is September 1583 (not 1584), and the work is an academic exercise, written on the occasion of Hakluyt's closing his career as a Queen's scholar at Westminster and Christ Church, and taking up his appointment as chaplain to Stafford, the English Ambassador in Paris. There seems no documentary evidence to support Dr. Parks' contention that Hakluyt "went
to France to discover America. His mission was an exploring expedition. His geographical work was in addition to his clerical duties.

Attention must be drawn to a piece of careless bookmaking. The references to the figures made in the text appear to be directions to the binder only, and rarely afford guidance to the reader, while the specimens of handwriting of the two Hakluyts are in each case wrongly ascribed.

In re-reading this Biography one is struck afresh by the untiring enthusiasm, the omnivorous reading, and the enormous diligence of such men as Hakluyt and Purchas. Dr. Parks leaves untouched, however, the problem of Hakluyt's power to sift the documents which he amassed, to separate the wheat from the chaff: the problem, in fact, of his critical ability. To Richard Hakluyt we owe the bulk of the data for an Elizabethan geography, but was he himself a geographer?

E. G. R. T.

DER GANG DER KULTUR ÜBER DIE ERDE. Von ALFRED HETTNER Zweite umgearbeitete und erweiterte Auflage. Leipzig und Berlin: B. G. Teubner 1929. 8 × 6 inches; vi + 164 pages; sketch-maps. 6 Marks

As Prof. Hettner's sketch of the spread of cultures develops, it gradually resolves itself into an account of the Europeanization of the world. It is interesting to note how, in keeping with this theme, the economic motive tends to supersede all others. By interpretation, for he defines "culture" very widely, this should not be so, yet social, political, and religious motives soon disappear. In tracing the spread of European influence, and its manifestation in various forms—the true colonial type, as in the United States and Australia; the mixed or "assimilation" type, par excellence in Central and South America; and the "exploitation" type, as in the tropical African dependencies—he keeps geographical considerations always in mind. The ruling forces in each case are the contribution of the adventuring peoples, their human qualities and technical equipment, the state of development of the indigenous peoples, and the geographical conditions of the several regions, natural resources, climatic régime, and accessibility, particularly from the sea. Among all these considerations, the author preserves a nice balance, treating each case on its merits, thus avoiding the pitfall of "geographical determination." His chapters are necessarily little more than summaries, for in 150 pages he attempts what is little less than a geographical interpretation of world history.

G. R. C.

A HISTORY OF PERSIAN NAVIGATION. By HADI HASAN, B.SC., B.A. London: Methuen & Co. 1928. 11 × 8 inches; xiv + 176 pages; illustrations. £5

From early legend down to the sixteenth century Professor Hadi Hasan has extracted all references to Persian ships and sailing in the literature of Persia and its neighbours, with the object of refuting the current notion that the Persians are not a maritime nation. In this aim he has unquestionably been, up to a point, successful. The tone of his book is argumentative, and the relative value of his evidences not quite sufficiently discriminated. It would have been better, for instance, to omit the first chapter altogether, for the discussion of mythical voyages (and even then not from the oldest texts but on the basis of comparatively modern epics) gives so bad an impression that it is almost a surprise to find how good some of the later chapters are. The conclusion to which the author comes is not new, but has been at least strongly reinforced by his arguments. Between the Persian of the plateau and the Persian of the Gulf a hard-and-fast line must be drawn; the latter is a born sailor, the former abhors the sea. In the light of this distinction the material which Professor Hadi Hasan has collected will prove of the greatest interest and value to all students of the mediaeval East.

H. A. R. G.
REVIEWS


These are three more of the series of well-printed and well-illustrated little volumes in which the authors are endeavouring to explain and interpret the evidence that has accumulated in recent years regarding the prehistoric and ancient past. While admitting that exact chronology is difficult or impossible, they think it desirable to give some indication of time by adopting actual dates. The periods covered by these volumes are therefore approximately fixed at 6000-3500 B.C. for III, 3500-2500 B.C. for IV, and 2600-2200 B.C. for V. By marshalling and interpreting a great mass of varied archaeological discovery, which is handled with much facility, a bold attempt at synthesis is made, and the material welded into a more or less continuous narrative. The authors disarm criticism by pointing out that their conclusions are often tentative or provisional. They are so full of their vast subject and so well primed in recent research that at times they seem hardly to realize the difficulty those not already fairly well acquainted with the subject may have in assimilating so condensed an exposition. But there can be no doubt that for students of archaeology these little books will be most useful. A stimulating feature, however speculative it may seem to some, is the importance attributed to such geographical changes as the retreat of the ice-cap, the shifting of the westerly winds, and change of sea-level.

In the first of these volumes (III) the origin of Agriculture is discussed. Wheat is believed to be of Asiatic origin, and for the home of its first cultivators Breasted's Fertile Crescent is preferred to Egypt, the claims of which have been so dogmatically asserted by one particular school. The generally held view that a pastoral stage always intervenes between the hunting and agricultural is shown by reference to excavations at Susa and Anau to be untenable. From a review of the sources and probable seats of the domestication of animals it is inferred that all animals domesticated in the Old World were tamed before 5000 B.C. A consideration of the evidence from Susa, Anau, Predynastic Egypt, Neolithic Crete, and Mesopotamia leads to the conclusion that the first pottery was made from leather models, somewhere not far from the source of the Tigris and Euphrates, or between that region and Northern Syria.

In volume IV, after systems of chronology have been critically explained with the aid of chronological tables, the course of events during the millennium 3500-2500 B.C. in Sumer and Akkad, the old kingdom of Egypt, Crete, and the Aegean is summarized. In three chapters entitled "The Peasants of the Danubian Basin," "The Valley of the Alt," and "The Black Earth Lands," a condensed account is given of the most recent, and still little-known, discoveries in South-East Europe and Western Russia, revealing what are termed the Danubian Civilization, the Erösöd, Cucuteni, and Tripolje cultures. The people responsible for this early civilization are believed to have had an Eastern origin, but the route of their migration westwards is very problematical. A final chapter on the Races of the World is rather inconclusive, for the object in view is not to attempt a classification of mankind, but to picture drifts, and in a few cases more or less organized migrations.

The leading theme of volume V is the movement of the nomadic people of the Northern Steppe, the effects of which were "felt from the Atlantic Ocean to almost in sight of the Pacific." While admitting the force of Huntington's theory of periodic droughts, the authors call in aid the taming of the horse to explain this dispersal. Its influence on Mesopotamia, China, Turkistan, Western Russia, Hissarlik, Thessaly, and Greece are discussed, and the interpre-
tation of its effect on the Danubian civilization is interesting if speculative. When the nomads reached the Hungarian plain the Danubian peasants spread up the valley of the river, ultimately reaching the Rhine, and even Belgium. Some of them, passing through the Moravian gap, found their way to Galicia and Silesia; others going up the Save valley settled at Sarajevo, in Bosnia. This account is very condensed, but is helped by a series of maps. It is held that these migrating peasants were in a state of purely Neolithic culture, and the conclusion, decidedly controversial, is drawn that all we know as Neolithic culture in Europe was derived from the spread of Danubian civilization, or some other influence derived from regions in which gold and copper had long been known. The origin of the Lake Dwellings of Central Europe is attributed to certain of these migrants going south from Bavaria to the Austrian lakes. During this millennium occurred the great hiatus in Egyptian history from the VIth to the XIth dynasty. It was no doubt a time of disturbance (the authors call it chaos) due to foreign invasion, but opinions differ as to who the invaders were. That among them were Asiatics is indisputable, and their invasion of Egypt may with probability be referred, indirectly at least, to the great nomadic dispersal.

The illustrations in these books are many, good, and well executed, and there are no fewer than twenty-nine maps, perfectly clear and showing just those details which are required. At the end of each chapter a few books are mentioned, and these lists might with advantage have been considerably extended. Each volume is supplied with a full index.

E. A. P.

ABRIDGED MANUAL OF THE SYMBOLS AND ABBREVIATIONS USED ON CHARTS. Monaco: International Hydrographic Bureau 1928. 20 x 13 inches; 12 sheets. 1 dollar

This Special Publication No. 22 of the I.H.B. is an interesting compilation, the only drawback to which is its awkward size. Besides the symbols and their names there is a list of common terms found on charts and maps and a table giving units of measurement and other data. The information is tabulated in twelve columns under the headings G.B. and U.S., France, Italy, Spain (with the Argentine and Chile), Portugal (with Brazil), Germany, Netherlands, Denmark and Norway, Sweden, U.R.S.S., Greece, Japan.

Japanese terms are provided with a transliteration (apparently according to the new Nippon Romazikwai system), but not so Russian and Greek, though the two latter alphabets are shown in a special table with approximate equivalents. These attempt to be at the same time both French and English, e.g. shtch, you; but dj cannot be considered as even an approximate equivalent in either language of the seventh letter of the Russian alphabet. Russian orthography is in the old style, which looks out of place under the heading U.R.S.S. (anglice U.S.S.R.); no doubt the old Russian charts will be in use for some time to come, but a note on the new style would have been useful. Yugoslavia with its long coast-line deserved a column; other omissions are Bulgaria, Romania, Turkey, and the eastern Baltic countries.

J. H. R.

A REGIONAL SURVEY OF THE WORLD. By T. S. MUIR and J. H. BIRRELL. Edinburgh: W. & R. Chambers 1928. 8 x 5 inches; 592 pages; maps. 5s

The authors of this volume for young school children have succeeded within the compass of a moderate-sized and cheap volume in giving a sketch of world geography which should not weary the reader. That in itself says a good deal for the book. Furthermore, it contains much information, shows wise selection among many facts and avoids rash generalizations. There is a brief but useful
appendix on physical geography. Most of the sketch-maps are good, but some show relief very crudely. There are also several coloured maps. The book is also issued in two volumes or a number of parts.

R. N. R. B.

THE LIFE OF A SEA OFFICER. By JEFFREY BARON DE RAIGERSFELD. With introduction and notes by L. G. CARR LAUGHTON. (The Seafarers Library.) London: Cassell & Co. 1929. 9 x 6 inches; xlvi + 210 pages. 10s 6d

The author of this volume, who was the son of Baron de Raigersfeld of the Holy Roman Empire, was an officer in the Royal Navy from 1786 to 1831. He wrote the book about 1829 and printed it privately at the Kent Arms Press, Maidstone, probably in the following year, but the original title-page bears no date. The chief merit of the book lies in its rarity. The copy used for this edition is in the Admiralty Library, and the editor has been unable to trace any other copy in London. Raigersfeld was a zealous and conscientious officer, somewhat exclusive and occasionally rather touchy. His naval career was useful but not distinguished, and his lack of literary style makes his autobiography heavy and tedious in parts, although there are some chapters of interest. In the hands of an abler writer the material at Raigersfeld’s disposal might have made a more interesting volume. It does however give a view of life in the navy at the time of Nelson, and the picture of Cuthbert Collingwood, who was Raigersfeld’s first captain, is of value. Eight blocks of old prints and paintings illustrate the volume.

R. N. R. B.

ATLANTE INTERNAZIONALE DEL TOURING CLUB ITALIANO.


This magnificent atlas was published by the Touring Club Italiano in September 1927. It was executed in the Cartographic office of that institution, under the direction of L. V. Bertarelli, the late O. Marinelli, and P. Corbellini; it appears to have owed its inception to the first named of these gentlemen. There is a dedication to Sr. Benito Mussolini, written by the President of the Touring Club, Sr. G. Bognetti. It is stated in the Preface that it was prepared so as to be in readiness for the Tenth (Italian) National Geographical Congress, which was held in Milan, and also for presentation at the International Geographical Congress, which took place at Cambridge in July 1928.

The atlas measures about 19½ inches by 13½ inches, and contains 169 plates, double pages counting as two. It contains an index of about 200,000 names. The spelling of the place-names of those countries employing the Latin alphabet follows the custom of the countries concerned. In another matter, also, the atlas is in conformity with the system of the International Map; the initial meridian is that of Greenwich. An admirable feature of the atlas is that on the back of each map is given a list of the sources of information from which it was constructed; on the same page is also given a useful list of the terms employed, a classification of the town signs, and a short table of conventional signs.

The plates are skilfully executed and printed, and bear the stamp of thoroughness. The work is reliable and up to date, clear and easy to read. The names have been carefully selected and the lettering well chosen. The physical maps are excellent specimens of cartography; but in these there is a curious inversion of the usual custom. The great depths of the oceans are coloured with a light tint of blue, whereas the shallow seas are shown by a dark shade. There is one other matter in regard to which, perhaps, in a new edition, improvement might
be made, and that is that nowhere, so far as the writer of this notice can ascertain, is there any mention of the projections used. But these are but small points; the work is of outstanding value and must find its way to every geographical library. We heartily congratulate those responsible for its production. The gratitude of all geographers is due to the Touring Club Italiano.

C. F. C.

BECAUSE I'VE NOT BEEN THERE BEFORE: extracts from the correspondence of Oswald Lewis. London: Duckworth 1929. 9 x 6 inches; 264 pages; illustrations and sketch-map. 21s

"Because I've not been there before" may be an adequate answer to the question why a man should want to go somewhere, but it makes a queer title for a book. It serves, however, as well as another for a pivot round which to assemble the twenty-five letters that constitute this leisurely record of an uneventful saunter round the world, for the most part by well-trodden routes.

Borne on the seas in sumptuous ships, whisked over the land in luxurious trains and expensive motor cars, the author visited, by easy stages, parts of British India, the Dutch and French Indies; China, Japan, and Siam; the Philippines, Malaya, the South Sea Islands, and Australasia; staying in the pretentious hotels that now adorn so many of the far places of the Earth or enjoying the hospitality of Rajas, Governors, Merchant Princes, and others.

The letters are easy-flowing and pleasant to read, but having so much ground to cover, they give little more than a superficial consideration of the appearance, manners, and institutions of the many races with which the writer came into brief contact, but, such as they are, the descriptions will entertain the reader, and not least when they are slightly inaccurate. Of places the accounts are also scanty. Few of the innumerable wonders seen occupy more than a page or so, while glories such as the Taj Mahal or the beauties of Myanosh'ta are disposed of in half a dozen lines to each. Except for a passing glance at Borobudur, the numerous and impressive remains of ancient Hindu Java are unnoticed, but Angkor, in French Indo-China, offers an exception, the beauty and grandeur of these vast ruins surprising the traveller into an unwonted enthusiasm. For New Zealand, Tasmania, and the South Sea Islands unstinted praise is expressed, but Australia is, as Anstey's Baboo puts it, "praised with faint damns."

Details of shipboard and hotel life and of the amenities of European society in the Orient are frequent, amusing, and instructive. As a guide-book the work has value (though hotels, with the possible exception of the "E. and O." Penang, are rated too highly); and not the least useful parts are the Itinerary at the beginning and the bibliography at the end. The incidents of travel are well told, and anecdotes, though present, are not too many. There is a marked absence of comment on political problems, then (1926), as now, ebullient in almost all parts of the East, which in this sort of book is all to the good.

In regard to a few errors it may be noted: That Kachins do not frequent the bazaar at Taungyi; that Fort Stedman is named after the general who organized, and for long commanded, that fine force the Burma Military Police; that the Chinese in Bangkok are not merely "a number of residents," but amount to nearly half the population of that great city; that Lady Raffles is not buried at Buitenzorg but at Veltevreden; and that Saigon is at best the third rice port of the world, not the first.

There is a map on the inside of the covers that indicates most of the places visited. The illustrations are unusually good and well selected. W. A. G.
MEDALS AND AWARDS, 1929

His Majesty the King has approved the award of the Royal Medals as follows:
The *Founder's Medal* to Mr. Francis Rennell Rodd for his journeys in Air
and his studies of the Tuareg people; the *Patron's Medal* to Mr. C. H. Karius,
Assistant Resident Magistrate, Papua, for his crossing from the Fly River to
the Sepik. The Council have awarded the *Murchison Grant* to Mr. C. S. Elton
for his three seasons' study of the distribution of life in Spitsbergen; the
*Back Grant* to Mr. C. P. Visser for his exploration of the Hunza-Karakoram
glaciers; the *Cuthbert Peek Grant* to Mr. Donald Cameron (Lieut. Royal
Scots) for his journey across the Sahara from Nigeria to Algiers; the *Gill
Memorial* to Mr. George Dyott for his recent expedition in search of Colonel
Fawcett.

PRESENTATION TO MR. REEVES

On May 15, in recognition of his fifty years' work on the staff of the Society,
a presentation was made to Mr. Reeves at a gathering of old pupils and other
friends presided over by Mr. Douglas Freshfield at the Society's House. The
gift took the form of a cheque for £100, accompanied by a letter of congratulation
engrossed on parchment and already signed by a large proportion of the sixty
contributors to the fund. Before making the presentation on their behalf the
chairman read a letter from Sir Charles Close, expressing his warm sympathy
with the objects of the gathering and his regret that he was unable to be present
himself. Mr. Freshfield then said that while Mr. Reeves was celebrating his
golden jubilee as an official of the Society, he was himself this year celebrating
his diamond jubilee as a Fellow of sixty years' standing; no one was therefore
better qualified than himself to bear witness to Mr. Reeves' valuable services to
the Society during the past fifty years. He had long ago personally benefited by
Mr. Reeves' competent help on returning from explorations in the Caucasus,
when, in view of the inaccuracies of existing maps, Mr. Reeves undertook the
heavy task of compiling an entirely new map from the scattered data available.
The original MS. of this map was a work of art of which Mr. Reeves might well
be proud, and which was now to be seen framed on the wall of the Instruction
Room. Sir Francis Younghusband said that although he could not claim quite
so long an acquaintanceship, it still went back some forty-three years, and he
added his hearty appreciation of the unfailing courtesy and helpfulness shown
by Mr. Reeves to all who needed his aid. Other speakers in the same sense were
Col. H. H. P. Massy, one of his first pupils in surveying; Dr. H. R. Mill, his
oldest surviving colleague on the staff of the Society; Mr. Heawood, who said
that he had been a colleague for thirty-five years, during which his relations with
Mr. Reeves had never failed to be of the happiest; and Mr. Hinks, who as a
colleague of more recent date, dwelt on the great interest of Mr. Reeves'
researches into an obscure physical phenomenon, and hoped that the fund now
presented might be a help towards their further prosecution.

In replying Mr. Reeves expressed his very sincere thanks to the donors, many
of them friends of very long standing for whom he felt the warmest regard, for
this valued token of their appreciation of his work. He said that the sum so
generously presented would be most useful to provide more delicate apparatus
for his experiments, and that when it was spent, the letter would remain as a
treasured means of recalling friendships of old days.
RECLAMATION ON THE FIRTH OF FORTH

In a paper on 'Land reclamation in the Forth Valley,' printed in the *Scottish Geographical Magazine*, Nos. 1 and 2, 1929, Mr. H. M. Cadell deals, from personal experiences, with a subject which has been engaging public attention recently. The physiographic and hydrographic features of the Forth, the wide valley formed by a much larger river decapitated by the Clyde in pre-Tertiary times, the vast quantities of detritus deposited during the glacial period, and, in the estuary, the strength of the flood tide over the river flow, present special problems in reclamation. These are of two classes: the removal of the peat morasses which cover the fertile morainic soils of the wide river valley, and the reclamation of the estuarine foreshore. The destruction of the peat morasses has been carried out since the eighteenth century, until checked by the decline in the value of land. The early practice was to cut away the peat and allow it to float down the river, to the annoyance of riparian owners and fishermen. If the removal of the Flanders Moss as a relief scheme is proceeded with, Mr. Cadell suggests that the best method would be to burn it away by degrees. The greater opportunity, however, is presented by reclamation of the foreshore. He gives an interesting sketch of past schemes from which valuable lessons are to be drawn. As the mud is deposited by the flood tide, the sole work required is the building of a wall behind which the mud may settle, and the gradual increase of its height with the growth of deposition. The simplicity of this operation made it profitable in the eighteenth century: for example, Lord Dundas reclaimed 200 acres near the mouth of the Carron, for the low price, when all allowances are made, of £1 per acre. On this initial outlay he was soon drawing an annual income of £800. This was exceptional, for in the Second Tulliallan Reclamation, where the bank was very long in relation to the area of foreshore, and much stone was required for its construction, the cost rose to £60 per acre. Altogether, 1581 acres had been reclaimed by 1840. Since then the decline of agriculture has made such operations prohibitive, and until the formation of the Clyde Conservancy in 1921, small areas for industrial purposes only have been reclaimed. It is obvious that reclamation can only be profitable where cheap materials are present and labour-saving devices are employed. Mr. Cadell describes how this has been done by the Forth Conservancy in their Kinneil scheme. There a bank, approximately 1 1/2 miles long, was built by direct labour, largely with colliery slag, and faced by stones from blast-furnace slag blocks. These were cemented together by dust from the foundries, containing iron particles which in contact with salt water rusted into a tenacious mass. The bank was raised 6 feet above Ordnance Datum, and it is calculated that 200,000 tons of silt were deposited behind it in the first two years. When this has been continued until the high-water level of neap tides is reached, 310 acres of rich agricultural land will have been formed. The estuary will also have been clarified to the amount of the silt deposited, and Mr. Cadell urges the desirability of placing dredgings behind such reclamation dykes, instead of dumping them out to sea, whence they are ultimately carried back again.

ANCIENT FORESTS IN CENTRAL EUROPE

That a large part of Central Europe was forest-clad in ancient times is a well-established fact, and something has been done of late years towards reconstructing their old extension by the study of place-names and other evidence. The latest contribution is an article in *Petermanns Mitteilungen* (1929, Heft 1/2), by Dr. W. Maas, who deals from this point of view with the ancient and existing forests in the old German province of Posen. He points out that ancient records are here of little help owing to the difficulty of identifying the places named, and
that it is unsafe to trust too much to place-names, for a place whose name contains, for example, the word for "beech" need not necessarily have possessed abundance of beeches, but may have received its name from the presence of a single beech in an area where the tree was otherwise absent. He depends instead on a knowledge of the settlements established under German law, German settlers having been brought in in early days for the express purpose of clearing the forests, which was not done to any extent by the Slavs. He gives a map of the former province in which all such settlements are distinguished, the areas occupied by them having, he holds, been forest-clad down to 1300 A.D. These settlers, whose numbers must not be over-estimated, were quickly absorbed by the Poles, while the later settlers, known as "Hauländzer" (a name said to have been due to a popular confusion of "Holländzer" with "Hauland") maintained their German characteristics. Their settlements are also shown on the map. It is to these early immigrations that the transformation of the area in question from forest to agricultural land was mainly due, though certain tracts were no doubt always devoid of forests owing to the nature of their soil. This is shown, e.g. by the survival, in limited areas, of "Pontic" plants, which found their way in during a steppe-period, and for whose growth forest conditions were unsuited. At the present day the forests occur chiefly on the terraces of the great diluvial valleys and the "Sandr" in front of the end moraines of the old ice-sheet. Their distribution is also shown on the map, and there is a table showing the probable percentages of present to former forests in each Kreis of the province.

DENSITY OF POPULATION IN TURKEY IN 1914 AND 1927

Until the end of 1927 no reliable figures were available for the population of Turkey. On October 28 of that year the Turkish Government carried out a systematic census, the first to be made in that country in accordance with the requirements of modern statistics. M. Th. Lefebvre, in the Annales de Géographie for November 1928, makes an interesting study of changes in population density in Turkey, based on a comparison between the figures for the 1927 census and those for an approximate assessment made in 1914. The total population of present-day Turkey shows a decrease from 15,702,663 in 1914 to 13,660,275 in 1927. This is largely the result of the Great War, the War of Independence (1920–1922), and the exodus of Greeks and Armenians out of Thrace and Asia Minor between 1922 and 1924. Of the 63 vilayets of Turkey 49 show a decrease of from 6 to 75 per cent. on their 1914 population. The regions of normally scantiest population have suffered greatest losses, especially the Bitlis, Van, and Hakkari vilayets of the mountainous south-east. The more densely populated regions have been less affected; for example, the Black Sea littoral east of the Qizil Irmagq, the rich alluvial plains of Western Asia Minor, where losses of Greek and Armenian population have been compensated for by an influx of Turks and Jews, and, above all, the Istanbul vilayet. The city of Constantinople has suffered through the removal of the capital to Angora, but the Istanbul vilayet as a whole has remained a focus of population for all Turkey. In five vilayets, mainly in the north and west of the Anatolian plateau, the population has remained stationary. In eight it has increased by from 1 to 26 per cent. The main zones of increase are Zonghuldaq, where coal-measures are under exploitation, the southern vilayets of Malatiya, Mersin, Adana and Jebel Bereket, and three northern vilayets, Bozq and Bolu, owing to railway construction, and Angora since the transference of the capital thither from Constantinople.
PROPOSED GERMAN RESEARCH EXPEDITION TO GREENLAND

Through the courtesy of the Foreign Office we have received details about a proposed expedition to Greenland, under Prof. A. Wegener, the expenses of which are to be defrayed by the German Government through the Notgemeinschaft der Deutschen Wissenschaft. Prof. Wegener, who before coming prominently before the public as the author of the theory of Continental Drift, had taken part in the exploration of the Inland Ice of Greenland, arrived in Copenhagen in February to make arrangements for a preliminary expedition this year in preparation for the main undertaking planned for 1930, the object of which is the detailed study of the ice-sheet. For this purpose three stations will be established in the same latitude, but at wide intervals. The first will be at Perdlorfik in the Umanak district in West Greenland, about 20 km. within the border of the ice. The second will be dug into the central part of the ice-sheet, and three or four men will winter there. The third will be on Scoresby Sound in East Greenland. By this means the temperature of the ice in its different strata will be investigated. The expedition will be provided with all modern appliances, including, in addition to dog sledges, motor sledges with air propellers, and Icelandic ponies will be used for forming the depots on the ice. Radio and weather-forecasting stations will be established at the various stations.

CHANGES IN NAMES OF POLISH RAILWAY STATIONS

The Polish Ministry of Communications has issued a Spis zmienionych nazw polskich stacyj kolejowych (List of changed names of Polish railway stations) covering the period from 1918 to November 1928, for which we are indebted to the Commercial Secretary, H.B.M. Legation, Warsaw. The majority of the old names that have undergone alteration are either Germanized forms that have been restored to Slavonic (Grätz—Grodzisk) or true German names that have been changed to Polish more or less by translation (Gross Neudorf—Nowawiés Wielka), but occasionally by a sort of transliteration (Scharnhorst—Szarnos). There are cases, however, where Polish spellings have been changed, and more than once (Andrzejowice—Andrzejowce—Andrzejowicze—Andezejewicze); this aptly illustrates one of the troubles that beset the Permanent Committee on Geographical Names. We are sorry to lose the homely English name of Fanny (a mine), but welcome the alteration of Szczebrzeszyn to Klemensów as an act of pure humanity.

POLISH PLACES NAMED AFTER TREES AND ANIMALS

In the Studia Regionalne z Geografji Polski, Zeszyt X (Etudes de la Géographie Régionale de la Pologne, Livraison X), 1928, one of the numerous publications of Prof. E. Romer of Lwów, twenty pages are occupied by an article on Polish place-names derived from certain trees and animals. There are a dozen lists of names, derivatives from eight trees and four animals, with a sketch-map for each showing the distribution: (1) cis (Russ. tis), yew; (2) jodła (Russ. yel'), fir; (3) grab, hornbeam; (4) świerk, spruce; (5) buk (buczyina), beech; (6) modrzew, larch; (7) jasnor, maple; (8) wino (adj. winny), vine; (9) bóbr, beaver; (10) tur, wild ox; (11) żubr, bison; (12) niedźwiedź (Russ. medwyed’), bear. Some of these words, especially grab, buk, bóbr, are very common in place-names. Derivatives from the Russian, Lithuanian, and German equivalents are also given; but it is a little difficult to see why, for example, Egliny, Egliszka, etc., are grouped under both cis and świerk and Stumbry, Stumbrysaki under both tur and żubr, and it is not clear why Goniądz and Żeremianka appear under bóbr.
PALESTINE EARTHQUAKE OF 1927

This interesting earthquake has recently been described by two writers who studied its effects on the spot. Prof. Bailey Willis (Amer. Seis. Soc. Bull., vol. 18, 1928, pp. 73-103) gives a list of more than two hundred earthquakes in Syria and Palestine. He considers that the earthquake of 11 July 1927 probably originated beneath the Mediterranean, and was propagated into the mass of the Palestine plateau along internal fault-planes, for wherever these planes come to the surface the shock attained destructive intensity. Mr. N. Shalem (Ital. Sism. Soc. Boll., vol. 27, for 1927, pp. 169-183) describes the earthquake in greater detail. On his map are shown four isoseismal lines, the innermost of which, including Nablus (Shechem) and Jericho, has its centre about 20 miles to the north of the Dead Sea and 7 miles west of the river Jordan. This point lies about 60 miles south of the epicentre of the last great Palestine earthquake (in 1837), and it is interesting to notice that the strong after-shock of 22 February 1928 showed a further shifting of the focus to the south.

VELD-T-BURNING IN SOUTH AFRICA

The controversy over the results of veldt-burning in South Africa has been advanced a stage by the results obtained from a two-year experiment at Stellenbosch by Mrs. M. R. Levyns. She has published the results in the Transactions of the Royal Society of South Africa, 17, 1929, 61-91. Six plots, 50 by 36 feet each, of veldt, which had been undisturbed for many years, were isolated, and a census of the vegetation taken. Of the larger shrubs, the predominant was the Rhenoster bush, and in the other conspicuous class, shrubs smaller than 2 feet, Erica imbricata was outstanding. More attention has been paid to the Rhenoster bush than to the other constituents of the Rhenoster veldt because the spread of this undesirable bush has given so much trouble to the farming community. Three of the plots were burnt in April, one was cleared but the soil left undisturbed, and the fifth was kept untouched as a control. It had been intended to plough in the scrub on the last, but this proved impracticable. In the following July and August there was growth on all plots, but not markedly on the control. There was an increase of Oxalis species due to burning, and in September geophytic monocotyledons were also growing and flowering vigorously. It was also noticeable that some seedlings, particularly of the Rhenoster, were entirely confined to the burnt-over ground. The following year the features were the low mortality among the Rhenoster seedlings, and the large number of grasses on the cleared plot. On one of the burnt plots there were 694 Rhenoster seedlings, contrasted with 11 on the cleared, and none on the control plot. On another burnt plot there were 52 Erica seedlings, on the cleared plot 5, and on the control plot, 8.

Other observations were also made: it is shown, for example, that, as might be expected, immediately after burning, the burnt plots had the highest soil water content, but that all other readings were consistently lower than those for the control plot.

Mrs. Levyns concludes, after these admittedly limited experiments, that Rhenoster bush, which is invading large areas of country, is not a "climax" community—that is, the seedlings fail to establish themselves in the shade of the older bushes, so that some other community must ultimately evolve. This, however, will take time; therefore it is useless to leave the veldt untouched in the hope that it will regenerate itself. It has been shown that the chief result of burning is increase in the Rhenoster bush and certain other plants. Clearing, on the other hand, does not favour the rapid increase of the Rhenoster bush, and induces growth among the grasses. Though expensive, clearing is probably
the best method of checking the spread of this bush. It has to be taken into account that conditions introduced by grazing were not considered in these experiments.

SURVEY EXPEDITION IN CENTRAL PERU

During the compilation of the 1/M map of Hispanic America by the American Geographical Society, it was found that for certain areas accurate data did not exist. One of these was the region north and west of Cerro de Pasco, on the eastern side of the Amazon–Pacific divide in Central Peru. Accordingly in 1927–28 Messrs. O. M. Miller and K. M. Hodgson carried out topographical survey there, and the former has contributed a general account of the work and of the country to the Geographical Review for January 1929. The area covered extended from the watershed of the Cordillera on the west to the Pachitea river on the east, including the divide between three important tributaries of the Amazon, the Marañón, Huallaga and Mantaro, and portions of their upper courses. Cerro de Pasco is on an isolated erosion remnant of plateau between the two latter rivers. To the east the foothills rise to heights of 5000 metres and over: to north and south the topography is varied. The Huallaga and its tributaries on the north are deeply incised and descend rapidly through “quebrado” country. To the south, the rivers meander gently through swampy “llano” country. The eastern side of the Pacific divide is not now glaciated, though evidence of past glaciation is plentiful: here are the deep glacial troughs of the Rios Colpa Grande and Anamaray, and numerous lakes, including Lago Santa Ana, which Mr. Miller agrees in regarding as the true source of the Amazon. Here were also encountered the characteristic high upper valleys between parallel limestone ridges, often without exterior drainage. Existing maps of this region were found to be defective: the omission of a string of lakes west of Lago Patarcocha, the omission also of the deep gorge between this lake and Lago Lauricocha, and a considerable underestimation of the extent of the latter lake, are among the defects noted. While in this mountainous section, the party experienced extremely sudden changes in weather, sometimes from warm sunshine to a heavy snowstorm in a short time. Here and elsewhere they were surprised at the number of people encountered, especially around Yanahuancu in the “quebrado” region, where livestock and crops, particularly potatoes, were abundant. Mr. Miller also describes a visit to the dry montana country to the north-east. At Huanuco, on the Huallaga river, extensive artificial irrigation is carried on in the deep broad quebradas, and alfalfa, pineapples, and other citrous fruits, sugar-cane, cotton, and coffee are grown. He also visited a settlement of South Germans on the Pozuzo river established some seventy years ago. Although not confirming the depreciatory reports current in the vicinity, he found the settlers, of a stock accustomed to a rigorous climate, somewhat devitalized by the languorous climate, and handicapped by the inaccessibility of their home. It lay formerly upon the main route between Lima and Iquitos, but the building of the La Merced road has diverted the traffic via Tarma and La Merced. The final portions of routes to Iquitos being by river, it is a handicap that the Iquitos mail steamer is sometimes unable to ascend above Puerto Victoria, through a sudden fall in the river. The paper is accompanied by an appendix on the survey work, with a table of coordinates of the control points, some excellent photographs, and a map of the sources of the Marañón and Mantaro rivers on the scale 1/200,000.
OBITUARY

SIR GEORGE FORDHAM

Sir George Fordham, who died on February 21, was a pioneer in "Cartobibliography"—the term introduced by himself for the cataloguing of maps on a systematic plan. Born in 1859, his first hobby was geology, and when only nineteen he read a paper before the Geological Society on "The Structure of Chalk," his audience including David Forbes. For six years he worked in the family business. In 1885 he was called to the Bar, and for three years went on circuit. In 1891 he inherited the family estate in Hertfordshire, and for the rest of his life land-owning and farming were included among his duties. From 1904 to 1919 he was chairman of the Cambridge County Council, being knighted in 1908. He twice stood, unsuccessfully, for Parliament.

Fordham's first work in map cataloguing was 'Hertfordshire Maps—a descriptive catalogue, 1579–1900.' This involved years of research. It was published in parts in the Transactions of the Herts Natural History Society, 1901–1907. In 1907 the parts, with some additions, were bound in one volume, of which only fifty copies were issued. In 1908 a similar catalogue for Cambridgeshire and the Fens was published by the Cambridge Antiquarian Society. During the next twenty years Fordham published some fifty books, pamphlets, leaflets, and catalogues, describing the maps, roads, road-books, itineraries, both of the British Isles and of France. The principal books are: 'Studies in Cartobibliography' (Oxford, 1914); 'Maps, History and Uses' (1921); 'Road-books and Itineraries' (1924); 'John Cary, 1754–1835' (1925); 'Hand List of Cartobibliography' (1928), and 'Notable Surveyors and Map-Makers of the 16th, 17th and 18th Centuries and their work' (1929), all published by the Cambridge University Press, and 'Les Routes de France 1552–1850' (Paris, 1929). The minor publications are mostly out of print, suffering the usual fate of specialist writings. I must mention one pamphlet, 'Roads and Travel before Railways in Hertfordshire and Elsewhere.' This delightful little paper gives the mingled thought of the antiquarian and the county councillor.

An interesting instance of Fordham's genius in "smelling out" an old map is the "Carte d'Italia 1515." For some years Fordham had been familiar with a rare little guide-book entitled 'La Totale et Vraie Description de tous les Passaiges ... passer et entrer des Gaules es Ytalies ...' written by Jacques Signot and published by Toussain Denys in Paris in 1515. The book gave a description of Italy and the passes through the Alps from France. The government approved its publication. Fordham's searching eye discovered among the pages a few words in which approval was extended to the publication of a "Carte," but amongst the known copies of the book no map could be found. Some years later (in 1913) visiting a map-show in the Bibliothèque National at Paris, he saw a printed map labelled "Anonyme—la Carte d'Italia—Fin du XV° siecle." This he at once identified as the "Carte" missing from the book, and the identification was accepted by the authorities of the Bibliothèque. In the library of the Royal Geographical Society there is a full-size photo-copy of the map, which has not yet been reproduced or monographed. Signot was probably one of Francois Premier's diplomatic agents and lived some time in Italy under the protection of the Duke of Ferrara.

Of the minor publications some sixteen were written in French and read before French societies. Some were reprinted in England. On 5 February 1929 the Société de Géographie in Paris decided to award to Sir George Fordham their gold medal in recognition of his French Bibliocartography.

Fordham was generous in gifts. He presented rare atlases to the British
Museum, valuable old maps to the Cambridge University library, and had recently made over the sum of £200 to this Society to be held in trust for the advancement of Carto-bibliography. He has also bequeathed to the Society his extensive collection of early road-books. He realized that his leisure and his opportunities for travelling and collecting imposed on him the duties of a trustee for the advancement of learning.

Fordham was that rare combination, a student and a man of affairs. The thoroughness of his search after truth, however minute and however tedious, might almost be called Teutonic. Moreover, his work was disinterested—a labour of love—he had no axe to grind. He knew that his long labours could receive very little recognition except from a few specialists, and he was always ready to help fellow students.

Until his last short illness he had shown no abatement of energy, but had been full of schemes for continuing his work.

D. MILLS.

MEETINGS: SESSION 1928–1929

Twelfth Evening Meeting, 29 April 1929. The President in the Chair

Elections: Lt.-Col. R. Bingham, D.S.O.; Lt.-Col. the Hon. Mildmay Thomas Boscawen, D.S.O., M.C.; Capt. Even Glendinning Dalziel, M.C., R.A.M.C.; John Paul Cussons Done, P.A.S.I.; Mrs. Amanda Constance Dickson, B.A.; Edward Harry Norris Dowlen; Mrs. L. Harvey French; Arthur Olney Friel, B.A.; Richard Mervyn Glasson; the Rev. David G. Graham; Capt. Claude Stephen Hewlett; F. R. Land; Leonard Harry Livingston; Capt. William C. Luper; William Laxon McIsaac; Norman Roderick McKenzie; Lt.-Col. Andrew MacMunn, o.B.E.; Raymond Andrew McNally; Miss Margaret M. McNeil; K. O. Manning; Mrs. Grace L. Morrow; the Rev. F. A. Pollard, B.Litt.; Charles Murray Pollock; Percy William Affleck Scott; Miss Dorothy Stanier; James Martin Thomas; Prof. Payson Jackson Treat; Thomas Linthwaite Tudor; Francis Stephen Wells; John Emmett Woodall; W. Wynne Williams; W. J. Worth

Paper: The Alai-Pamirs in 1913 and 1928. By Mr. W. R. Rickmers

Seventh Afternoon Meeting, 6 May 1929. The President in the Chair

Paper: The Importance of Climatic Stations in Polar Regions. By Dr. G. C. Simpson

Thirteenth Evening Meeting, 13 May 1929. The President in the Chair


Paper: The Life of the Albert Nyanza and Lake Kioga. By Mr. E. B. Worthington
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