GEOLOGY

Carbon-14 Dating of Medieval Alluvium in Libya

Carbon-14 dating has confirmed estimates (based on archæological evidence) of the age of a recent stream deposit widespread in north Libya.

Deposition of alluvium derived largely from Pleistocene deposits occurred to a depth of 9–25 ft. in most of the streams draining the hills of north-eastern Tripolitania (Gebel Tarhuna and Msellata) some time after the collapse of stone dams built in Roman times[1]. A similar feature is found in the Gebel Akhdar of Cyrenaica, in wadis en Naga, Susa, Gla'a, Kuf and Bel Ghadir. In the upper reaches of the last-named, deposition continued until the beginning of this century, as shown by comparison of photographs taken in the 'thirties with the present situation.

Carbon-14 dating has provided a date for a mid-point in deposition in the lower Wadi Ganima (Tripolitania). A lens of charcoal halfway up a terrace 10 ft. high (grid point 321450 on Tripoli 1:100,000 map, 1945 ed.) gave a date[2] of 610 ± 100 B.P. Thus deposition, here at least, continued during the 14th century. Most of the wadis, including Ganima, are now engaged in eroding the mediæval alluvium.

A low terrace in the Rharb area near Rabat, Morocco, has given a carbon-14 date of 800 ± 200 B.P.[3]. Deposits of similar age are reported from Algeria[4] and have been found by me in Tunisia.

The belief of some historians and archæologists that widespread soil erosion occurred in parts of north Africa in post-Classical times now receives geological confirmation.

C. Vita-Finzi

Department of Geography,
Cambridge.

[1] Vita-Finzi, C., *Assoc. Intern. Hydrol. Sci., Helsinki*, **53**, 61 (1960).
[2] Godwin, H., and Willis, E. H., *Amer. J. Sci. Radiocarb. Supp.* 4, 60 (1962).
[3] Gigout, M., *Trav. Lab. Geol. Lyon*, **6**, 138 (1960).
[4] Boulaine, J., quoted by Gigout, *op. cit.*, 83.

A Striated Pavement beneath the Basal Gondwana Sediments on the Ajay River, Bihar, India

With the growing interest in ancient climates many geologists have questioned the validity, as indicators of glacial conditions, of those poorly sorted conglomerates which were called 'tillites' by earlier geologists. It is now recognized that very similar deposits can be formed by submarine slumping. Most geologists agree, however, that the presence of a striated surface beneath such poorly sorted conglomerates is strong evidence of a glacial origin[1]. To this criterion I would add the need to find several widely separated pavements of the same age.

The Talchir conglomerate, which is the basal member of the Gondwana succession and which is believed to be of glacial origin, is widespread in India. However, though it occurs over 17° of latitude there appears to be only one authenticated account of a striated pavement and a few passing references to polished surfaces beneath the conglomerate. None of these had been examined in recent years until in December, 1960, I visited the sole known pavement which is exposed at Irai, some 10 miles west-south-west of Chanda, Maharastra, Central India. It was Fedden's discovery of this pavement in 1872[2] which was taken as the final proof of Blanford's hypothesis[3] that the widespread Talchir conglomerate was of glacial origin. My re-examination of the large Irai exposure confirmed Fedden's interpretation and a detailed description is now awaiting publication[4].

When visiting the Talchir conglomerate exposed on the northern edge of the Raniganj Coalfield, Bihar, in January 1963, I was fortunate enough to find a second, hitherto unrecorded, striated pavement. It is exposed on the south bank of the Ajay River near the village of Sarasbad, some 11 miles due north of Asansol which is about 130 miles north-west of Calcutta. The pavement is only about 8 ft. by 1 ft. in size and is cut on a surface of Archæan schist. The surface is highly polished and is covered with a great number of striations of varying dimensions which are aligned north–south. Many of the larger striations are deepest at their southern ends and this, together with small marks which are thought to have been caused by plucking, indicate that the direction of movement of the striating agent was towards the north. There is no suggestion of a tectonic origin for the striations.

The conglomerate above the striated pavement is poorly sorted and consists of angular fragments of feldspathic gneiss, schist and pegmatite set in a brown–green feldspathic silt matrix. The angular fragments vary considerably in size, the largest exposed exceeding 3 ft. in length. Also set in the matrix are occasional small, well-rounded, pebbles of quartz. There does not appear to be any orientation of the fragments. A detailed description and illustrations of this pavement and conglomerate will appear elsewhere. A general description of the conglomerate and the overlying rocks, but without mention of a pavement at this place, appears in Gee's memoir on the Raniganj Coalfield[5].

There is little doubt that the Talchir conglomerate is a terrestrial deposit wherever it occurs in India. In many places it exhibits a fair degree of sorting which would suggest that at those places it is a fluviatile deposit, but in other places, particularly where it is seen to rest on a pavement, the deposit is poorly sorted. While such a pavement and poorly sorted conglomerate, with its occasional scratched pebbles, could have resulted from the action of a variety of agencies, the presence of two such pavements of the same age more than 600 miles apart strongly suggests a climatic control of the agent of their formation. Ice is the most likely agent.

No great regional importance can be attached to the direction of movement of the ice as indicated by the features which occur on the pavements since the controls of such movement may be quite local. It would thus be rash to make palæogeographic reconstructions on the evidence from only two localities. However, the discovery of a new exposure of a striated pavement beneath the poorly sorted Talchir conglomerate is of considerable importance in the present debate on the palæoclimatic significance of some poorly sorted conglomerates which have been called tillites.

The discovery at the Ajay River was made while I was in India as the guest of the Indian Statistical Institute. I thank the Geological Studies Unit of the Institute for assistance.

A. J. Smith

University College,
London.

[1] Flint, R. F., in *Descriptive Palaeoclimatology*, edit. by Nairn, A. E. M. (Interscience, New York, 1961).
[2] Fedden, F., *Rec. Geol. Surv. India*, **8**, 16 (1874).
[3] Blanford, W. T., Blanford, H. F., and Theobald, W., *Mem. Geol. Surv. India*, **1**, 33 (1856).
[4] Smith, A. J., *J. Sediment. Petrol.* (in the press).
[5] Gee, E. R., *Mem. Geol. Surv. India*, **61**, 343 (1932).

CHEMISTRY

Determination of Sedimentation Coefficients in Rapidly Equilibrating Polymerizing Systems

When systems undergoing a rapid chemical re-equilibration between monomers and a single higher polymer are examined in the ultracentrifuge, a bimodal reaction boundary is predicted, if the degree of polymerization is greater than two[1,2]. The sedimentation coeffi-