

ment of twinning in the case of the polycrystalline state as well as in the single crystal state.

Preliminary measurements on cadmium indicate that whereas the heat evolved in the twinning is of the order of 0.1 calories per gram, less than one-tenth of this amount is produced during the whole extension accompanying gliding, although this extension is considerably greater than that due to the twinning. The measurements, which are being followed up with more accurate methods, give, at present, only rough approximations, but suffice to establish clearly this very much greater heating which accompanies twinning. This observation suggests that some of the mechanical energy that is supplied to the lattice to cause twinning is afterwards liberated as heat energy and, in particular cases, as sound energy, the cry of tin and cadmium being a manifestation of the latter.

It may be added that while a cry can be produced from zinc, which crystallises in the hexagonal system and twins readily, I have not been able to produce a cry with any metal crystallising in a cubic system, for which twinning does not take place.

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April 6.

¹ "Complete Treatise of Inorganic Chemistry", vol. 7, p. 296.

THE observations of Dr. Chalmers described in the above letter, which are being followed up, seem to me likely to prove of considerable importance for elucidating the problem of twinning. The generation of heat agrees with the view that, in twinning, the molecules, when sufficient energy is applied, slip from one equilibrium position to another, about which they then execute heavily damped vibrations, the energy of vibration dissipating itself in heat and probably in radiation of a frequency of the *Reststrahlen* order. The sound indicates that the twinning does not take place over the whole region of twinning simultaneously, for the sound frequency is much too low to be connected with the vibration of molecules or molecular units, but is propagated from layer to layer with a velocity or velocities of the order of sound velocity. It is possible that in the case of substances where sudden twinning is unaccompanied by audible sound, the sound exists, but is of too high a frequency to be heard.

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Climatic Changes in British Somaliland

THE alternation of climatic conditions in East Africa during Pleistocene time has recently been brought into prominence in connexion with the history of early man, and it accordingly became of interest, the opportunity presenting itself, to ascertain whether the results obtained in Kenya could to any degree be paralleled in Somaliland.

Fifteen months of almost continuous travel in the British Protectorate led to tentative first conclusions, which, if the coastal belt could have been included, would probably have been more definite. Evidence in the districts traversed was somewhat hard to find, but in the west, the Buramo district, tenanted by the Gadabursi people, steep V-shaped valleys give proof of an early and strong period of erosion, whereby bold, rugged scenery has been carved out of a complex of crystalline rocks. To this time may also be attributed sundry high-level deposits; that is, in the east on the Sorl Haud, and in the Gadabursi country, where conglomerates, often extremely coarse, were noted in several places, at various levels above the present surface of weak and spasmodic erosion.

It is interesting that, although the final movement of the coast-line was one of elevation, this was preceded, in the west at least, by subsidence, whereby deposits of coral and shelly sands and clays were laid down. At Zeilah, these proved to be about three hundred feet thick and were underlain by a spherulitic rhyolite. Some twenty-five miles to the south and about fifteen miles from the sea, these marine deposits are replaced by uniform sticky brown clays, containing occasional pebbles, doubtless deltaic and lagoon deposits. A bore put down in such a position did not reach the floor of crystalline or pre-Pleistocene rocks at 250 ft., but was probably not far off. It is to the later part of this period of steady deposition on the west that I would attribute the widely distributed infilling of the hollows and valleys formed by the earlier erosion with a remarkably uniform, slightly clayey sand, the 'tug alluvium',* of a reddish-brown colour, and sufficiently consolidated to stand in a vertical face. Occasionally small gasteropods, *Planorbis*, for example, are abundant.

This alluvium, although typically unbedded, shows evidence now and again of rapid deposition, for thin layers or strings of pebbles and local false-bedding can be seen in almost every section. In these sands occur, sparingly, artefacts which should afford an archaeological date.¹ Of the period between the erosion of the valleys and the infilling with tug alluvium there appears little evidence, but near Buramo the bottom of the tug section is a very altered basic rock, clearly the result of weathering of the hornblende-schists of the neighbourhood, but to a certain extent reconstructed, as pebbles are found in it.

The alluvium itself, probably seldom exceeding a hundred feet in thickness, has been cut to form the characteristic drainage channels or 'tugs' of Somaliland. Now, these only occasionally contain flowing water, and although spates may assume torrential proportions and carry much sediment, it is clear that the tugs were formed by true rivers, which preceding the present period of slow desiccation, indicate a wet phase. During this time, the final uplift of the coast may have taken place, amounting, according to Dr. Macfadyen, to 750 ft. in the Berbera district, although apparently much less in the west, where, however, more work is needed. A considerable thickness of alluvium forms the great plains characteristic of the south-central part of the Protectorate.

A well, put down fifty miles east-south-east by south of Hargeisa, passed through 112 ft. of calcareous terra-cotta alluvial clay, before reaching the white and brown marls and limestones from which it was doubtless derived. It contained, in this bore, no pebbles, and its deposition is concluded to be of a lacustrine nature and to belong to the period of the tug alluvium. Leakey's "Second major pluvial" I would correlate tentatively with the deposition of the latter; with the period of the erosion of those valleys in which the alluvium lies and the formation of the old conglomerates, his 'Kamasian' and probably somewhat antecedent time; the dissection of the tug alluvium with a post-pluvial wet phase.

The correlation is admittedly unsatisfactory, and it is probable that the variations of climates in British Somaliland will, when worked out, show differences from those of Kenya.

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Athenæum Club, S.W.1,
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* 'Tug': A sandy, usually dry, drainage channel, of very variable breadth and cross section.

¹ See R. A. Farquharson, "First Report on the Geology and Mineral Resources of British Somaliland", 1924, p. 18. I was unable to visit the 'tug' in which these implements were found. Also, M. C. Burkitt and C. Barrington-Brown, *Man*, 31, p. 157; 1931; and "Stone Age Antiquities", *Brit. Mus. Guide*, p. 186; 1926.