SOME SPECULATIONS ON THE SUDDEN OCCURRENCE OF FLOODS IN THE HISTORY OF LAKE MAGADI

By Dr. T. H. White.

Along what is apparently an old shore-line of Lake Magadi, at a level of about 35 to 40 feet above the present level of the soda, limestone moulds ("external casts") of logs and twigs are common. (Fig. 1). They are particularly abundant on the eastern shore of the eastern arm of the lake.

Recently, Mr. P.R.O. Bally, of the Coryndon Museum in Nairobi, gave me a similar mould from Lake Hannington, still containing the remains of a twig. He had questioned the local natives about the occurrence of such limestone-encrusted wood, and was informed that according to their tribal lore a great flood had occurred about thirty generations ago, killing many people and leaving the trees encrusted with stone.

I have never found more than a few fibres of vegetable material within the moulds from Magadi, but it is of some interest that over twenty years ago a twig was dredged up in mud from a depth of 10 ft. 9 in. below the soda. This gave rise to much speculation at the time, and it was sent to the Natural History Museum in London. The report of the Museum authorities was that the twig was, geologically speaking, very recent, and might have been buried for anything from a few days to some thousands of years ! (Stevens, 1932).

At and above the wood-mould level, shells of the giant snail *Achatina fulica* are common. Mr. B. Verdcourt of the East African Agricultural Research Organisation kindly identified these for me, and gave his opinion that they were probably not more than a few hundreds of years old. The species does not occur alive in or near Magadi now, and indeed the only living snail I have seen in Magadi was a solitary specimen of *Bloyetia.* I have, however, found a few fragments of a shell of *Achatina* of much more ancient date in some gravel below an old lake bed, about 100 feet above the soda, some three miles south of Magadi.

Parkinson (1914) and Temperley (1951) comment on the layer of black mud that lies beneath the soda at a depth of about 10 feet. Temperley refers to it as "accumulating at the bottom of the lake." Recent investigations by the Magadi Soda Company Limited indicated that the mud is not in fact at the bottom of the lake, but is merely a layer below which there is a considerable depth of soda.

All of these facts could be explained by a comparatively recent flooding of Lake Magadi, which, if it took place at the same time as the Lake Hannington flood, would have been about thirty *African* generations ago, say 500 years, i.e. about the year 1450. This would correspond more or less in chronology and level with one of the lake levels in the Nakuru area designated G6 by Nilsson (1952). An influx of fresh water would dissolve the top layer of soda, and on evaporating would leave behind it a layer

of mud beneath re-crystallised soda. The occurrence of *Achatina* would fit in with less dry climatic conditions then than now.

If it is accepted that the main pluvials of East Africa in the Pleistocene period were in some way analogous to the chief European and Indian glaciations, there seems to be no reason why lesser pluvials should not be associated with minor climatic changes in Europe. Pettersen (1912) states that the world's most recent period of rigorous climate occurred about the year 1433. This correlates pretty well with the estimated date of the Hannington flood.

Floods of the late Pleistocene pluvials have left considerable beds of silt in the Magadi area. Those that I have had leisure to investigate occur at heights of up to three hundred feet above the level of the soda. Some of these contain wood-moulds, but they also contain rootlet-holes far below the depth that any present-day plants reach. This seems to indicate that during the great pluvials the water of the lakes that formed was not highly alkaline, since no vegetation will grow in soil saturated with alkaline spring-water. Furthermore, compressions and sub-fossils of fish (kindly identified for me by Mr. H. Copley of the Coryndon Museum as *Tilapia nilotica*), which are considerably larger than the present-day small-species *Tilapia* that occur in the alkaline spring-water, are found in these beds and also bear out the conclusion that the water of Magadi was much less alkaline in ancient times than any flowing into the lake today.

Unless the vast soda-deposit of Magadi is of very recent origin this calls for some explanation. In the case of the higher and most distant beds (which extend to the Nguruman escarpment about 20 miles west of Magadi), the comparative freshness of the water could conceivably have been due to dilution. Dilution would probably not explain, however, the features of the lowest beds — the "High Magadi Beds" of Temperley — which do not extend for more than half-a-dozen miles from the edges of the soda, and that only in a north-south direction by reason of the echelon-fault topography of the area.

The High Magadi Beds contain silt of two main types. There is a lower layer, un-varved with an earthy fracture, and an upper layer, varved with a shaley cleavage. Where they overlie the chert series the lower layer rests upon what is apparently a thin layer of colloidal silica, varying from an inch to ten inches in thickness, interspersed with narrow bands of black mud containing black compressions of *Tilapia* in vast numbers. The earthy layer of silt contains only sparse and fragmented fish-remains that require prolonged searching for. In the upper varved layer there are numerous *T. nilotica* compressions at various levels (Fig. 2).

These features are not easy to explain, but it occurred to me that they might be accounted for as follows: Initial intermittent floods brought fresh-water fish into contact with the siliceous springs that then existed, killing them in large numbers and leaving the lower compressions in and just above the silica. Then there occurred a massive flood, bringing down with it the soft unconsolidated lacustrine deposits of an earlier period

FIG. 1.—*Limestone Twig Moulds.*

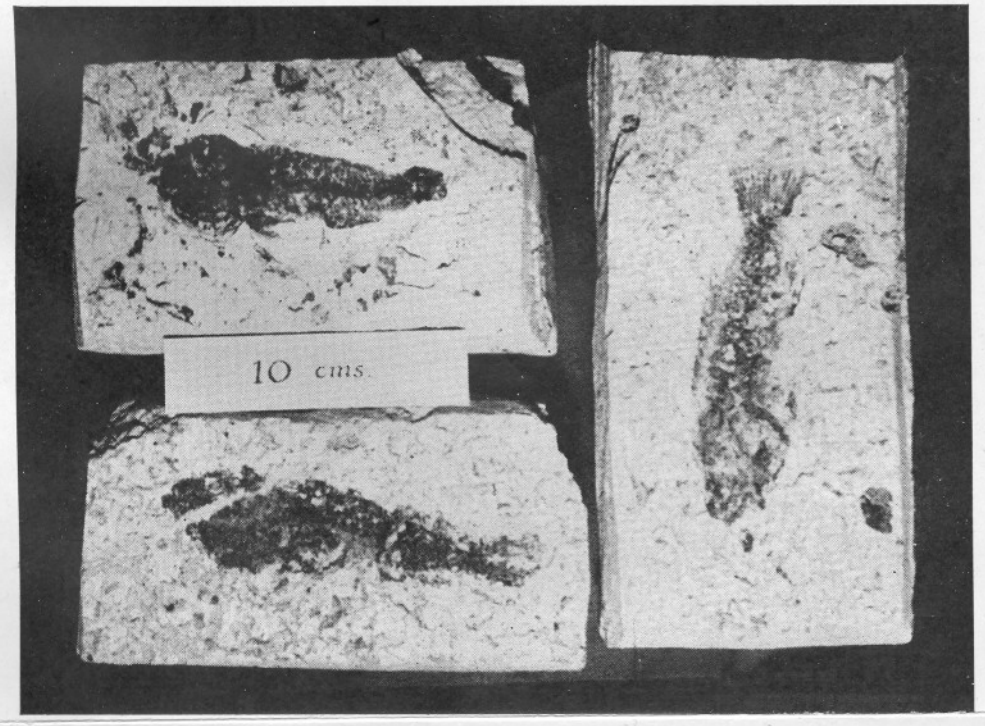

FIG. 2.—*Tilapia nilotica Compressions.*

from the surrounding country, with their fish-remains that became fragmented in the process. This silt rapidly sealed off the silica and the soda so that a comparatively fresh-water lake formed, which in time deposited the varved silt in which the fish that died in dry seasons were well-preserved. A rough estimate of the number of pairs of light and dark bands in the upper layers of the High Magadi Beds is 15,000.

Still earlier floodings could have caused the beds of cherty gravel, partially consolidated into a breccia by siliceous material, that occur near the Hospital at Magadi. Temperley points out that the chert series was probably laid down before the faults that formed the "Magadi Scarp" occurred. These faults probably raised the gravels to their present level. They shew several layers entrapping menisci of alluvium that contain silicified roots and twigs.

The hypothesis of *sudden* floods — much greater than the recent Hannington flood — is not a new idea. Gregory (1921) suggests just such a cause for cenozoic fossil beds of a different nature elsewhere. Such floodings in the Magadi area, over a period of perhaps half a milion years, could account, by frequent recrystallisations, for the extraordinary purity of the soda deposits in Lake Magadi.

A cogent question is "Will the lake be flooded deeply again?" for such a calamity would be of serious economic importance. The answer is yes — but, if the climatological deductions of Pettersen are correct, and if pluvials in East Africa are related to European climates, not for four or five hundred years!

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