

**SHORT COMMUNICATIONS***An occurrence of collophane in the lower Hyaena stratum at Tornewton Cave, Devon.*

DURING excavations at Tornewton Cave, Devon, Mr. A. J. Sutcliffe noticed in the lower Hyaena stratum of the cave a massive yellowish-brown mineral with sub-resinous lustre which was rather glue- or horn-like in appearance. This mineral, which has been identified as collophane (a fine-grained apatite of variable composition), occurred both as a cementing medium of the lower Hyaena stratum and as a component of small stalagmites about 4 in. high, which had formed on top of it. There were no succeeding deposits in this part of the cave, but it is thought that the collophane was contemporary with, or immediately followed, the deposition of the Hyaena stratum because broken drip-stone blocks with collophane occur in the deposit outside the cave that immediately succeeds the Hyaena stratum in time.

The collophane is often layered or banded, and coats a paler matrix similar to the cave-earth of most of the deposit. Where a thick crust has accumulated it is typically brown in colour with a vitreous appearance. In thin coatings it is usually golden brown and translucent so that fragments of cave-earth appear as though varnished over. A rather dark opaque variety is also found, on the surface of which dark, almost black streaks have been noted.

Satisfactory quantitative analyses of the collophane could not be obtained but the physical and chemical properties corresponded with published descriptions of the mineral. An X-ray photograph with filtered copper radiation was identical with published photographs of collophane from other sites (Dunham *et al.*, 1948; Ellis and Claringbull, 1950). Spectrographic analysis, using carbon-arc technique, indicated the presence of silicon, calcium, iron, aluminium, and sodium; no trace of manganese was observed either chemically or spectrographically. It seems likely that the aluminium and silicon can be regarded as impurities occurring with the collophane in the deposit. The sodium, however, may be incorporated in the structure of the mineral as a substitution for the calcium as in dehrnite and alkali-oxypatite.

It has been shown that apatite may be formed in southern Britain under normal weathering conditions (Nagelschmidt and Nixon, 1944; MacIntire and Hatcher, 1942) and it may be suggested that deposits of organic material such as bat and hyaena dung were converted into

mineral phosphate at Tornewton, under climatic conditions not necessarily different from those of today. Percolating solutions rich in phosphates probably assisted the formation of the collophane since little real weathering seems to have taken place. Had the collophane been due solely to the weathering of phosphatic material in a richly calcareous medium, it would have been expected that other weathering products—particularly manganese and iron compounds—would have been more prominent. However, the presence of aluminium and silicon with the collophane suggests the presence of a small amount of clay-like material, which might be a weathering product, in the stratum. Bearing in mind the evidence for weathering on the French cave sites at Quercy (Gèze, 1940, 1949), the position of the lower *Hyaena* stratum well inside the cave at Tornewton cannot be used as an argument against this process.

In view of the evidence from Quercy, where the collophane deposits seem to have been formed under rather warmer climatic conditions than at present—if not indeed under tropical conditions—it seems reasonable to suggest that the conditions at Tornewton were temperate during the time the collophane was formed. Under warmer conditions manganese and iron compounds would have been expected to form as at Quercy, but the former are entirely absent and the latter extremely rare.

In conclusion, it seems highly probable that the collophane was formed under temperate conditions similar to those prevailing in south-western Britain at the present time. The bearing this has on the faunal evidence and on the more general problems of climatic conditions in interglacial times is outside the scope of this communication.

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