LETTERS TO THE EDITOR

Origin of alabastrine gypsum

6th Sept, 1984

Dear Sir,

I write first of all to congratulate Dr Firman on his most interesting and valuable review of the history of English alabaster and its uses (Firman, 1984). His careful combination of historical and geological evidence can only increase our enjoyment, admiration and appreciation of one of the more beautiful ornamental stones to be found in this country.

However, there is one point with which I wish to take issue with Dr Firman; this concerns the origin of the alabastrine textures commonly found in gypsum rocks around the world. In this regard Dr Firman kindly quotes the work of myself (Holliday, 1967, 1970a) and Mossop and Shearman (1973), in Spitsbergen and Arctic Canada respectively, and draws the conclusion that alabaster in Britain has resulted from the hydration of anhydrite under periglacial conditions. However, in modern polar areas, hydration of anhydrite is generally limited in extent, even shallow penetration of groundwater commonly being prevented by permafrost. The importance of such areas is the clear proof they supply that alabastrine textures form near the surface and not necessarily at significant depth, as claimed by Ogniben (1957). The typical disordered textures of alabastrine gypsum result from rapid hydration of anhydrite at temperatures well below the equilibrium transition temperature (42°C) (Holliday, 1970a, Mossop and Shearman 1973) rather than as a result of mechancial crushing (Ogniben, 1957). That periglacial conditions are not essential for the formation of such gypsum is shown by a number of examples in modern tropical and sub-tropical areas where this explanation cannot apply; the extensive Eocene gypsum of Jamaica is one with which I am particularly familiar (Holliday, 1970b). The thickness and extent of English alabastrine gypsum thus points to non-glacial periods of formation, of which the Quaternary Interglacials or the later Tertiary period immediately spring to mind. Perhaps the most potent times of English alabaster formation were the periods of climatic and amelioration when the Quaternary glaciers became stagnant and rapidly washed away. At these times very large volumes of water were produced which, no longer inhibited by permafrost, could penetrate into the subsurface and quickly bring about the hydration of near surface anhydrite.

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25th September 1984

Dear Dr. Bryant,

I am grateful to Dr. Holliday for his kind remarks on the content of my paper (Firman, 1984). I am also most grateful to him for clarifying an ambiguity in my text which seems to have arisen from my ill-advised use of the word periglacial and the implicit, though unintentional, suggestion that alabastrine textures can only form in periglacial conditions.

That small quantities of alabastrine gypsum have formed by hydration of anhydrite in the active zone above the permafrost table has been amply demonstrated by Holliday (1967) and Mossop and Shearman (1973). I readily agree that this process cannot take place at depths comparable to that of much of English alabastrine gypsum unless and until the permafrost zone melts.

To extend the use of the term periglacial to environments in which the permafrost has wholly or substantially melted is, I agree, misleading although it might be noted that the presence of permafrost or even glaciers are not a necessary part of the definition of the term (Black, 1966). Dr. Holliday's reminder that alabastrine textures can form in modern tropical and sub-tropical areas is salutary but I hope he will agree that periglacial weathering (i.e. frost action), although not an essential pre-requisite, was nevertheless likely to have been more potent than Tertiary weathering in facilitating the subsequent formation of alabastrine textures.

In the absence of any accurate methods of dating the products of hydration interpretation of the chronology of hydration is difficult but the distribution of alabastrine textures and their inter-relationship with porphyroblastic gypsum in the East Midlands (Aljubouri, 1972) is consistent with an early phase (possibly Tertiary) of porphyroblastic gypsum formation followed by subsequent exhumation and deep weathering leading to the formation of alabastrine gypsum from anhydrite which had previously escapted hydration. The exhumation seems most likely to have been associated with the valley widening of the proto-Trent and its tributaries either before the onset of glaciation or during an interglacial period and the deep weathering seems to me to have most probably been periglacial.

Thus like Dr. Holliday I favour one or more interglacial periods as the most potent time for the formation of alabastrine gypsum differing only in believing that its formation was initiated, albeit on a small scale, in peri-glacial conditions, proceeding concomittantly with the melting of ice-sheets and was completed earlier rather than later in the succeeding interglacial period.

I trust this clarifies my views both for Dr. Holliday and for readers who may have been misled by my original all too brief statement.

Yours sincerely,

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