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# Ben Knowle, Somerset

[ST 513 450]

## Introduction

For more than 100 years, up until relatively recently, Britain was a major world producer of celestine ( $\text{SrSO}_4$ ). Economic deposits are almost entirely limited to the Triassic Mercia Mudstone Group and underlying rocks of the Bristol district and southern Mendip Hills (see (Figure 6.5)). Mining of the Somerset deposits ceased in 1914, and later operations were limited to an area around Yate, north-east of Bristol. Working of these deposits has now also ceased. In the Yate area celestine occurred as a more-or-less continuous bed, occurring below a 5–10 m overburden. South of the Mendips celestine was often found as field surface rubble and was dug from the underlying red marls, usually as celestine nodules. These nodules, found most often in the 'Tea Green Marl' (part of the Mercia Mudstone Group), were often associated with calcite and were especially common in the Dinder–Dulcote area, ESE of Wells (Symes, 1985).

Natural outcrops of celestine in Britain are now rare. The Ben Knowle GCR site is especially instructive in that contacts between celestine and the host rock ('Tea Green Marl') can be seen, and there are continuous exposures of 'Red Marl' and 'Tea Green Marl' on the escarpment nearby that illustrate the stratigraphical setting of the mineral deposit.

## Description

Celestine at the Ben Knowle GCR site occurs on the side of a hill 3 km WSW of Wells. Here the mineral occurrence can be studied at several places in natural exposures in gullies and paths. At these small temporary sections the contact with the host rocks can be studied. The celestine is hosted in the 'Tea Green Marl', of which there are continuous exposures on the nearby escarpment. Celestine in the Somerset/Avon area is either disseminated throughout the rock or occurs as discrete veins, sometimes forming large crystalline nodules (see (Figure 6.6)) and cavity infills, these having formed sometimes as a direct deposit from seawater or sometimes as a secondary replacement (see (Figure 6.7)).

The description below is based on the unpublished studies of W.I. Stanton (pers. comm.). The site includes the steep narrow ridge at the west end of the hill-top. It is here, at the western end of the field, that lumps of celestine up to 0.4 m in size project through the soil in a cattle path along the ridge top, and in another at the top of the escarpment on the north side, beside the hedge. Occasional lumps of the mineral may also be found at all levels on the north escarpment, having slipped down from the outcrop on the hill-top.

At this site the mineral is translucent to brilliant white, and occurs as irregularly shaped, sometimes cavernous masses with a sugary micro-crystalline texture. In some specimens it is interbanded with greenish marl or clayey marl, or it forms nodules or replacement masses in the host marl.

The 'Tea Green Marl' occurs as a layer some 10 m thick on top of this part of the hill. It mostly consists of soft greenish-grey mudstone and marl, with occasional thin beds of harder limestone. Some 300 m farther east, on the north escarpment of Ben Knowle (outside of the GCR site area), there are erosion gullies in which the marls are seen to overlie about 15 m of soft red marls, which contain no celestine. The strata are subhorizontal and slightly affected by cambering.

Elsewhere in the Mendip region celestine has been found in the 'Tea Green Marl' at this stratigraphical level, and also at lower levels in the 'Red Marl' and Dolomitic Conglomerate, all of Triassic age. In the latter, where it fills small cavities, it is sometimes very coarsely crystalline.

## Interpretation

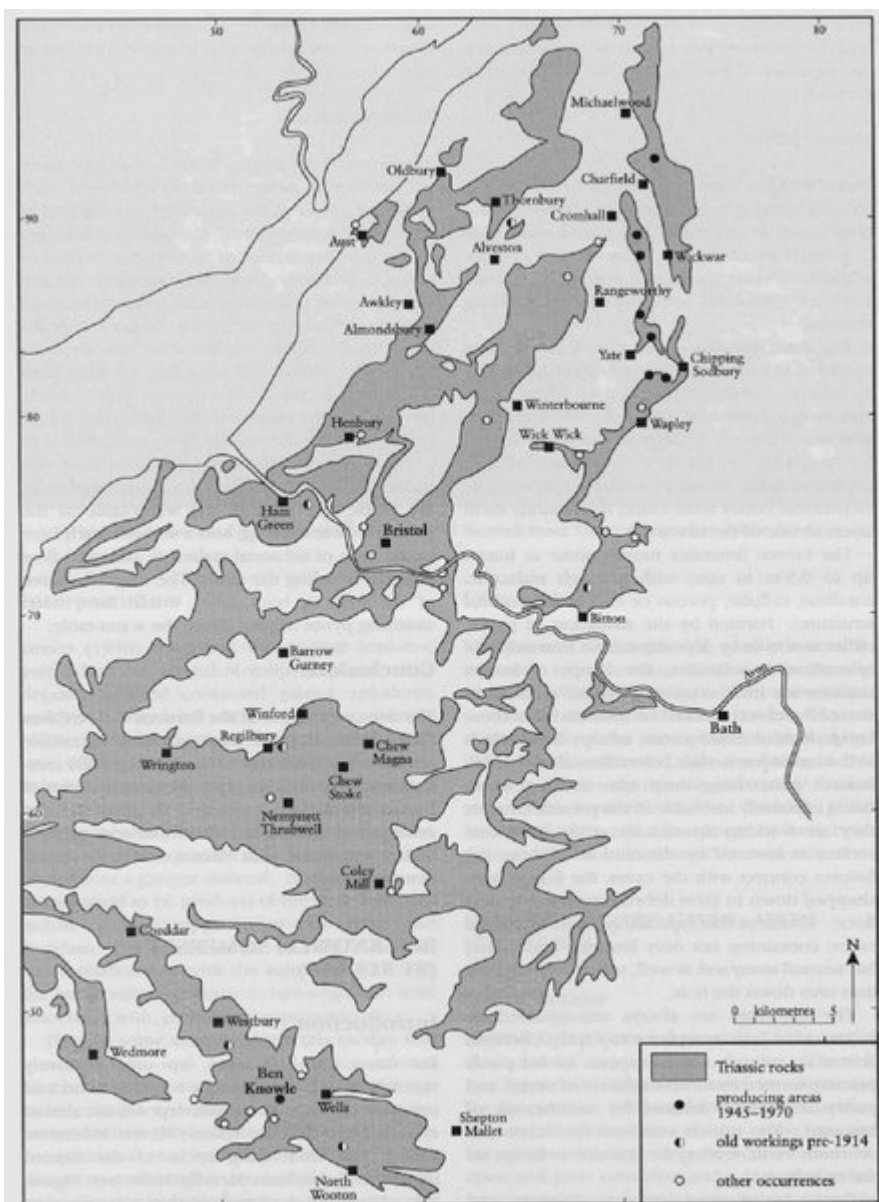
In parts of Somerset and Avon the Triassic sedimentary strata locally contain horizons rich in evaporite minerals such as halite and gypsum, while sometimes in the Mercia Mudstone Group deposits of celestine are found. Nickless *et al.* (1976)

described in detail the celestine deposits of the Bristol area and considered the celestine to be diagenetic after gypsum and/or anhydrite. Although the primary minerals probably formed in a supra-tidal environment, the strontium could have been derived from the conversion of aragonite to calcite in the Carboniferous Limestone, trace amounts of Sr being released into interstitial pore-fluids on this conversion. It has also been suggested that it is due to local discharge by thermal springs of Sr-rich fluids, subsequently concentrated in evaporite lagoons from which celestine was eventually precipitated. This theory is sometimes supported by the presence of barium in the celestine. However, in whichever way the strontium is introduced into the environment, the concentration of celestine appears to be associated with evaporitic lagoons.

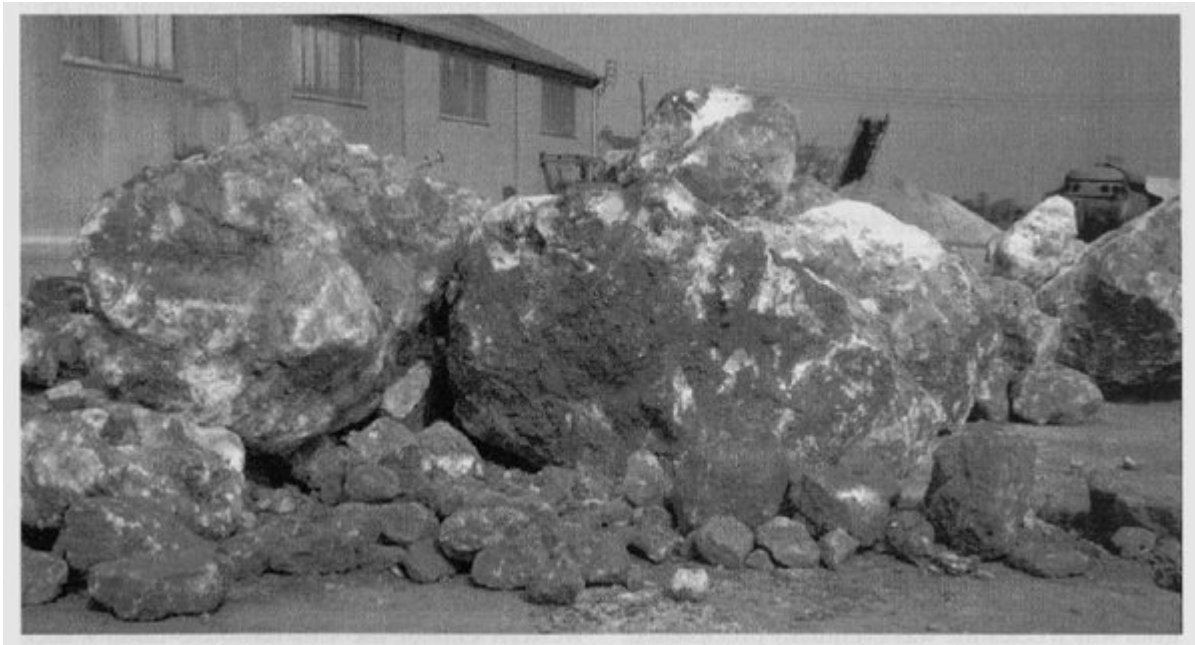
## Conclusions

The Ben Knowle site provides small but important instructive sections of, what is now rare, in-situ celestine mineralization within the Mercia Mudstone Group, of Triassic age. Its position and size precludes commercial working.

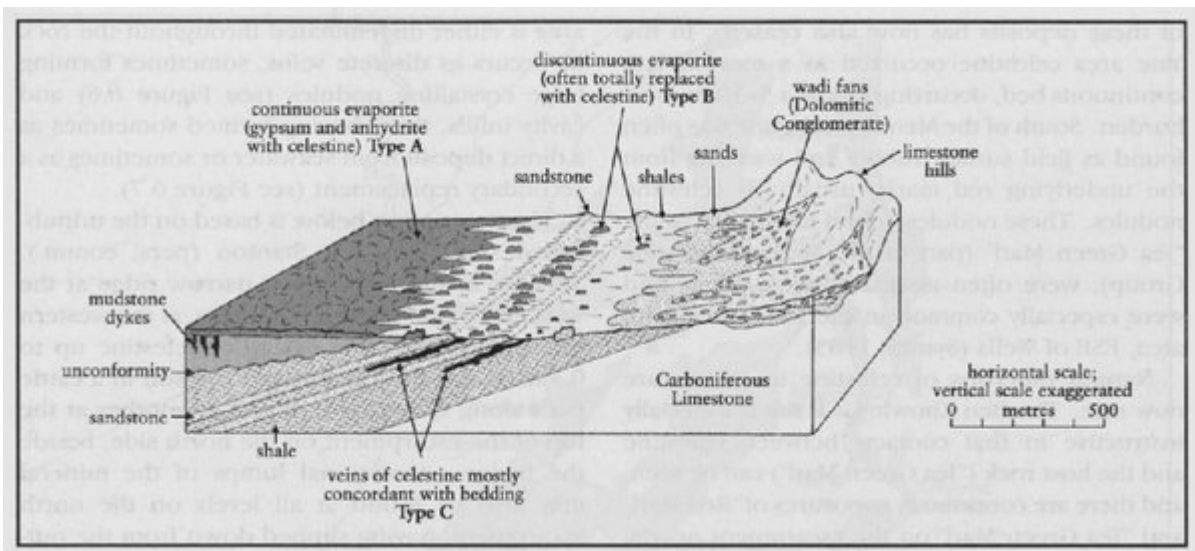
## References



(Figure 6.5) Celestine map of the Mendips showing the locality of the Ben Knowle GCR site. Based on Thomas (1973), and Nickless et al. (1976).



(Figure 6.6) Celestine nodules at Bristol Minerals Production Plant. From various sites. (Photo: R.F. Symes.)



(Figure 6.7) The horizontal and vertical relationships between the modes of celestine occurrence in the Mercia Mudstone Group of the Bristol/Mendip area. After Nickless et al. (1976).