Kirkham's Silica Sandpits, Derbyshire

[SK 216 542]

Introduction

The Kirkham's Silica Sandpits GCR site mined (until recently) silica sands of the Miocene–Pliocene Brassington Formation, which occurs in karstic 'pocket deposits' located largely within dolomitized limestones of the Carboniferous Asbian Bee Low limestone Formation (Walsh *et al.,* 1972; see (Figure 4.25)).

The Brassington Formation was well exposed in a number of pits in the vicinity of the Kirkham's Silica Sandpits site. The formation includes silica sand that was of commercial value as a raw material for the manufacture of refractories. In addition to quartz-rich sands, the deposits contain kaolinitic clays, also valuable for ceramic purposes (Figure 4.26). From a scientific point of view, the Brassington Formation is important as it provides evidence for uplift since its deposition by perhaps as much as 450 m relative to the Trent Valley (Ford and Jones, 2007) to form the South Pennines, i.e. within the last 2 million years (Walsh *et al.,* 1980; 1999). The deposits exposed in the sandpits provide valuable evidence of the development of late Tertiary palaeogeography (Gibbard and Lewin, 2003), which in turn played a key role in the development of groundwater circulation systems responsible for the Derbyshire thermal waters (Brassington, 2007).

Description

Exposures in Kirkham's Silica Sandpits that were accessible in the 1970s are described in detail by Walsh *et al.* (1972, 1980). The Brassington Formation is divided into the lower Kirkham Member, overlain by the Bees Nest Member and then the Kenslow Member (Boulter *et al.,* 1971). Although its type locality is at Kirkham's Silica Sandpits, the Kirkham Member occurs widely in subsidence features throughout east Derbyshire.

The deposits at Kirkham's Silica Sandpits rest on Namurian mudstones (Chisholm *et al.,* 1988), and are dominated by fine- to medium-grained quartz sands, with angular–subangular grains and little sorting according to grain size (Walsh *et al.,* 1980). This suggests rapid deposition. Gravel horizons also occur, clearly with pebbles derived from the Sherwood Sandstone Group (Figure 4.27). A dominant source from the south-east is clearly demonstrated from cross-bedding measurements, with supply also from the south and ESE. Pebble orientations are consistent, predominantly north–south and ESE (Walsh *et al.,* 1980).

Kirkham's Silica Sandpits is also important for the occurrence within them of the clay mineral metahalloysite ($Al_2Si_2O_5(OH)_4$; Ford, 1963), which is less hydrated than the mineral halloysite ($Al_2Si_2O_5(OH)_4.xH_2O$). Chemically similar to kaolinite, the clay sheets in the halloysite family of minerals are characteristically coiled up (like a brandysnap biscuit; these are well illustrated by Robertson and Eggleton, 1991). In the sand pits, metahalloysite was observed by Ford (1963) to occur as bright white nodules, up to 30 cm in diameter, within a matrix of a strongly sheared red clay that occupies fissures within the Kirkham Member sediments. The metahalloysite nodules are reported as often encrusted with black manganese oxide ('wad'; Ford, 1963). The origin of the metahalloysite at this location is problematical. Weathering of kaolinite or illitic clay minerals derived from the Sherwood Sandstone Group is most likely (cf. Robertson and Eggleton, 1991), but would be expected to be associated with low-pH acidic waters. Ford (1963) suggested that these might have arisen as a consequence of weathering of sulphide mineral ores, given the close proximity of these. How metahalloysite then came to form nodules within a weathered clay matrix has not been resolved.

Interpretation

Although the Derbyshire pocket deposits are disconnected and patchy, they provide evidence of a large Pliocene (within the interval 5.33–1.81 Ma) river system, draining the Triassic Sherwood Sandstone Group to the south and east of the present-day Derbyshire hills. An origin from the Sherwood Sandstone Group is also favoured by the quartz-grain morphology, which shows evidence of quartz overgrowths like those observed in Sherwood Sandstone Formation sandstones (Walsh *et al.,* 1980).

The occurrence of metahalloysite reflects the specific conditions of weathering during the development of the pocket deposits, although the occurrence of metahalloysite as nodules within sheared mudstone means that its origin is not entirely clear.

Conclusions

The Kirkham's Silica Sandpits GCR site provides insight into the geomorphological development of the South Pennines, combined with mineralogical evidence of chemical processes associated with weathering conditions at the Miocene–Pliocene unconformity.

References

(Figure 4.25) Kirkham's Silica Sandpits, Derbyshire. (Photo: J. Aumonier.)

(Figure 4.26) Kaolinitic sand from Kirkham's Silica Sandpits, Derbyshire. (Photo: Photo: J. Aumonier.)

(Figure 4.27) Pebbly horizon within the Brassington Formation at Kirkham's Silica Sandpits, Derbyshire. (Photo: Photo: J. Aumonier.)