

Manganese

From the late 19th century onwards manganese was used extensively in steel production as an additive, which assisted in removing both sulphur and oxygen during the Bessemer process and as an alloy which toughened the steel. Its deoxidising properties were, however, also in demand for a number of other processes which predate its use in the steel industry. The addition of small amounts of manganese dioxide or calcium manganate to glass, only a few kilogrammes per 1000 tonnes, removed residual iron oxides found in some glass sands which discoloured the glass.

When used in larger quantities the manganese could provide colour to the glass, from purple through to black. Other applications included its addition to oil based paints as a drying agent, as an oxidising agent in the manufacture of bleaches and dyes, and its use as a colorant in pottery glazes (Wilkie & Burt 1984, 19-20).

By far, the majority of the manganese ores mined in England came from the county of Devon but there are numerous other, lesser sources in Derbyshire and Warwickshire, which have contributed to production (for recorded production levels in the second half of the 19th and the early 20th centuries, see Burt et al 1984, xxvii). After the late 1880s production from English mines was eclipsed by that from mines in Merioneth and Carnarvonshire, in north-west Wales. The latter are, however, outside the remit of this project but details can be found on-line (Linton nd.).

Geological background

There are a number of manganese minerals which have been worked economically in England. Pyrolusite (MnO_2), manganese dioxide at around 63% manganese, and rhodonite (MnSiO_3), a manganese silicate with around 42% manganese, along with psilomelane, a basic oxide of barium with manganese ($(\text{Ba},\text{H}_2\text{O})_2\text{Mn}_5\text{O}_{10}$) having a manganese content of 70-80%, have been worked in Devon. Rhodochrosite, also known as dialogite, (MnCO_3), the manganese carbonate, was the principal ore worked in north-west Wales but was not of economic importance in England (Dewey & Dines 1923). An impure mixture of hydrous manganese oxides, known as 'wad', has also been worked in Derbyshire and at Hartshill in Warwickshire. Manganese oxides are also found in combination with cobalt and other minerals in the sandstones on the rim of the Cheshire Basin, where they were also known as 'wad', but worked primarily for their cobalt content (see assessment for cobalt). Manganese oxides are also found in combination with iron oxides as umber, the earth mineral pigment, worked in a number of locations in Devon, and across England (Beer & Scrivener 1982, 144-45; also see the assessment for gangue minerals and pigments).

The manganese minerals described above are all secondary deposits and their origins in Devon are 'a matter of speculation'. They are much earlier than the Cornubian granite emplacement and found as replacement deposits in chert beds and as cement in sandstones (Beer & Scrivener 1982, 143-44). The origins of the 'wad', impure deposits of manganese oxides mixed with iron oxides, worked in limestone of the Elton - Winster area, and the area north of Brassington, in Derbyshire are also unclear. They are discussed in detail by Ford (2006, 200-01; and 2001, 43-44) but appear to be secondary deposits derived from adjacent strata.

Historical background

The properties of manganese minerals as colorants and oxidising agents appear to have been known since antiquity and they were probably first worked in Britain during the Roman occupation (Burt & Wilkie 1984, 20, citing Down 1980). From the Roman period through to the post-Medieval the use of manganese minerals is primarily linked to glass production but it is not until the late Medieval period that there is clear evidence for glass production in England (Crossley 2012; English Heritage 2011, 29). Prior to that glass was largely imported from continental Europe, with some examples of manganese glass from the Near East turning up in the south-east of England (Williams 1983).

There is, as yet, no evidence that English sources of manganese were used prior to the late 18th century and the development of mines at Upton Pyne, near Exeter in Devon (Russell 1968-70). There is also documentary evidence to suggest that manganese was also being worked in Warwickshire at the same period (Cole 2013, 2). The Upton Pyne mines had probably closed by the mid-1820s but new workings had already been opened up a short distance to the north at Newton St Cyres and those were to continue in operation into mid-century. By that date, however, the focus of manganese mining in Devon, the only production area of any significance in England, had shifted to the Teign Valley and West Devon. Burt and Wilkie (1984) provide a comprehensive account of the development of manganese mining in the south-west of England which identifies the numerous small mines around Milton Abbot as being the principal source of manganese ores well into the mid-1880s, with the Chillaton Mine being by far the largest producer. A scatter of small mines in Cornwall, North Devon and Somerset also made a much lesser contribution to production (*see* Hamilton Jenkin 1969 and Claughton 1975 for detail on those lesser producers). Thereafter they were quickly eclipsed by production from mines in North Wales, in the counties of Carnarvon and Merioneth (Burt & Wilkes 1984, 34; *see also* Linton and Down 1980 for more detail on the North Wales mines).

The requirement for manganese as a deoxidising and toughening agent in steel production from the late 1860s onwards resulted in a wide search for suitable ores. The North Wales mines made a significant contribution in that respect and, although there was little expansion of manganese production in England as a result of the new demand, the south-west did contribute significant

amounts of manganese-rich iron ores, particularly from the Brendon Hills in West Somerset, used in the preparation of speigeleisen (containing 15-25% manganese) used in the deoxidising process (Burt & Wilkie 1984, 19; see, also, the assessment for iron).

The infrastructure and technology of manganese mining

The mining of manganese was very small scale when compared with other mining operations in England and it placed no great demands on the country's industrial infrastructure. Short tramways were built to serve individual mines, as at Greystones Mine in East Cornwall, but the bulk of its transport needs were met by river and coastal shipping. Quays on the rivers Tamar and Exe were the shipping points with Exeter the principal port used in the late 18th / early 19th century.

In much the same manner, the techniques of manganese mining drew on the wider technology of mining and ore dressing. One element which does, however, stand out is treatment of the ore is the establishment of preparation sites close to the shipping points, particularly on the River Tamar at Morwellham Quay (Waterhouse forthcoming) and Slimeford, in Calstock parish. There the ore would be crushed and concentrated using gravity separation in water. In other parts of the south-west of England that preparation was carried out on the mine and dressing floors can be a significant feature, even on small mines like Fullabrook, near Braunton, in North Devon.

The archaeology of manganese mining

Little attention has been paid to the archaeology of manganese mining and its associated infrastructure. It features in the Rapid Identification Survey (RIS) for the parishes on the Cornish bank of the Tamar Valley where a number of small mines, including Greystones and Wheal Leigh, were noted along with some elements of the transport infrastructure at the former (Thomas & Buck 1994, 17, 22). Although surveys were recommended none appear to have been carried out.

Surveys have, however, recently been carried out on the sites of the manganese dressing mills at Morwellham Quay and at Shillamill near Tavistock (Waterhouse 2008a & 2008b). The manganese quarry at Hartshill Hayes, in Warwickshire, was included in a survey of the castle and its environs (Brown 1997) and underground workings close by, at Purley Chase, have been explored and mapped by Cole (2013).

Acknowledgements

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