

Mercia Mudstone Group, Permo-Triassic, Bristol and Gloucester region

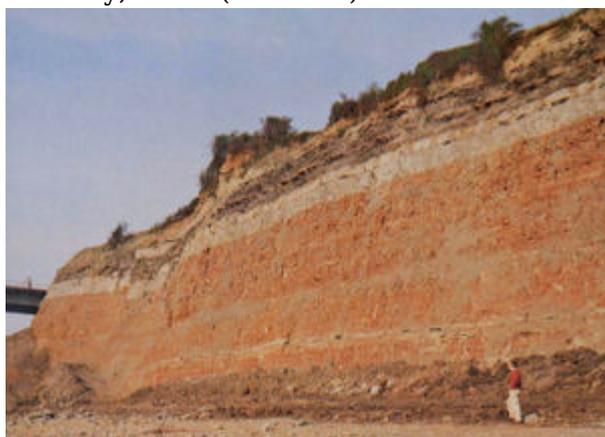
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Section of railway cutting south of Chipping Sodbury, Avon. (P948976)



Mercia Mudstone Group and Penarth Group successions (late Triassic) — Aust Cliff, Avon. (P210568)

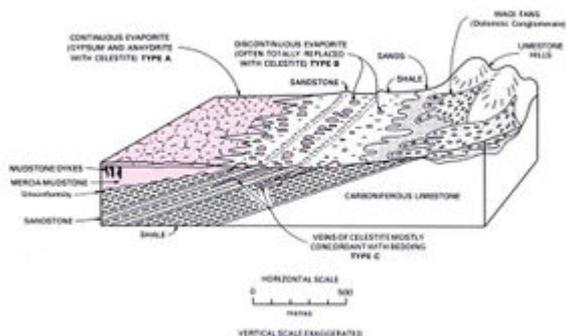


Diagram illustrating modes of celestite occurrences north of Bristol (after Nickless, Booth and Moseley, 1976). (P948975)



Mercia Mudstone Group and Penarth Group successions (late Triassic) — Blue Anchor, north Somerset. (P211340)

Mercia Mudstone Group

The Mercia Mudstone Group has long been known as 'Red Marl', a term often used synonymously with 'Keuper Marl'. The rocks consist largely of red dolomitic siltstone and mudstone with a starchy texture and a feebly conchoidal fracture.

Only slightly calcareous, these rocks do not warrant the use of the term marl. The red mudstones overlap the Sherwood Sandstone Group onto Carboniferous or older rocks round the sides of the Worcester and Somerset basins, and extend over much of the region either at outcrop or beneath a cover of later rocks. The greatest thicknesses, 450 to 550 m, occur in the central parts of the basins. In the western half of the region the Mercia Mudstone Group is variable in thickness because of the irregularity of the pre-Triassic land surface, which it masks. In the Bristol-Mendip area, it is locally absent where the overlying Penarth Group oversteps onto the remnants of the ancient hills ([P948976](#)).

In the Worcester Basin and areas to the north, up to 10 m of alternating mudstone and sandstone beds occur between the Sherwood Sandstone and Mercia Mudstone groups. These rocks were named 'Waterstones' from the fancied resemblance of their mica-spangled bedding surfaces to the shading of watered silk, and were formerly classified as the uppermost formation of the 'Keuper Sandstone'. Current usage incorporates them within the Mercia Mudstone Group and the name 'Waterstones' has been abandoned. Apart from the highly micaceous layers, the mud cracks and small-scale, often contorted cross-bedding are features characteristic of these transitional beds.

The red mudstones commonly have small patches, streaks and occasional bands of green or grey-green, the colour differences being ascribed to the oxidation state of iron in the constituent minerals. Occasional beds of sandstone and hard siltstone ('skerries') form topographic features in the otherwise flat landscape. The most notable arenaceous development is the Arden Sandstone Member which occupies a position about one-third down the Mercia Mudstone Group succession throughout most of the Worcester Basin. It is present at outcrop in the district between Newnham and Tewkesbury, where in former times it constituted a local source of building stone. The thickness varies from one to as much as 7 m. The lithology comprises mainly white to fawn, calcareous sandstone and grey, green, red and purple mudstone, which occur in every combination from thick beds to fine interlaminations. Mudcracks and small-scale cross-bedding are common. The depositional environment may have been deltaic or estuarine, with sands deposited in distributaries that traversed broad mudflats. In the Bristol-Mendip area similar sandstones are present in the

uppermost 8 to 25 m of the succession. The Stoke Park Rock Bed of the Bristol area and the Butcombe Sandstone north of the Mendips are the most widespread. In the Vale of Taunton, the North Curry Sandstone may be at approximately the same stratigraphical level. Palynological evidence indicates a Carnian age for these beds.

In the western half of the region the red mudstones pass laterally into a marginal facies that results from erosion of the older rocks. The most widespread facies, known as the Dolomitic Conglomerate, was mainly derived from the Carboniferous Limestone but where there are very extensive outcrops of Coal Measures, as in the Bristol-Pensford area, the marginal facies may comprise soft red and fawn calcareous sandstones. In the Bristol area, where they are named the Redcliffe Sandstone, these may locally exceed 50 m in thickness. The red sandstones gave rise to the name Redcliffe, a district of Bristol, where they form river cliffs along the Avon and are well exposed on the south side of the New Cut between Bathurst Basin and Ashton Gate.

Primary and secondary evaporite deposits are widespread in the Mercia Mudstone Group. The largest single deposit is the Somerset Halite, which has a widespread occurrence within the Central Somerset Basin and may extend south-eastwards into the Wessex Basin in Dorset and westwards under the Bristol Channel.

In the Burton Row Borehole, halite or rock salt (sodium chloride) was found in four main beds in the middle of the Mercia Mudstone Group, over a vertical thickness of about 95 m of strata, with veins extending a further 30 m below. The thicknesses in the Puriton Borehole were rather less. Clay 'pseudomorphs' after rock salt occur at a number of places and horizons in the Mercia Mudstone Group.

Apart possibly from dolomite, which occurs ubiquitously as minute interstitial grains and not uncommonly as a secondary cement, the most widespread evaporite mineral in the red mudstone is calcium sulphate, either in the hydrated form, gypsum, at outcrop and shallow depths, or in the anhydrous form, anhydrite, at greater depths. It occurs in nodules, nodular bands and veins, and can be seen at Aust Cliff ([P210568](#)), for example. The nodules are commonly about 30 cm across, but range from pinhead disseminations to large masses a metre or more across and weighing several tons. They are thought to have been formed by accretionary processes, just below ground surface, in a mudflat or inland sabkha-type environment under arid conditions with a high rate of evaporation. Both anhydrite and gypsum can form as primary minerals in this type of environment. The veins are due to secondary redistribution of calcium sulphate and re-precipitation in acicular or needle-like crystals normal to the sides of cracks and joints, both in the adjacent and underlying strata. The nodules are scattered throughout thicknesses of tens of metres of strata. Nodular beds, usually less than 30 cm thick, are occasionally present and apparently result from the coalescence of adjacent nodules. No thick, commercially mineable beds have been reported. Deep borehole evidence in the Worcester Basin suggests that gypsum/anhydrite nodules tend to be concentrated in two main horizons, one directly above and the other below the Arden Sandstone. In the Burton Row Borehole, in the Central Somerset Basin, although anhydrite nodules are particularly abundant in a 40 m-thick horizon directly above the Somerset Halite, nodules are scattered throughout the sequence.

The Bristol area has long been noted for the occurrence of celestite (strontium sulphate) which has been exploited commercially at numerous localities during the last 100 years. The main stratigraphical occurrence is within or immediately adjacent to the Stoke Park Rock Bed and the celestite-rich unit is named the Severnside Evaporite Bed (Nickless et al., 1976)^[1]. The thickness varies from 0.5 to 2 m. The outcrop has been traced over a wide area extending from Bitton in the south to the Thornbury and Charfield areas in the north. The primary mineral is thought to have been gypsum and/or anhydrite, and all stages of its replacement by celestite can be seen. The source of the strontium is unknown, although proximity to the Palaeozoic basement appears to be

important. The various modes of occurrence are illustrated in [P948975](#); in the first two the celestite occurs as nodules, fine-grained disseminations and veins, either within the Severnside Evaporite Bed itself (type A), or on the contemporaneously exposed land surface of Palaeozoic rocks (type B). Type C comprises veins, sheets and vuggy infillings apparently secondarily redistributed in the underlying strata, which may be either the Mercia Mudstone Group or the Palaeozoic basement.

In the Bristol-Mendip area, the strata adjacent to the sub-Triassic unconformity commonly contain masses of coarsely crystalline calcite, sometimes with specks of galena or sphalerite or, more rarely, bright green copper secondary minerals. Geodes or hollow nodules ('potato stones') lined with red, yellow and amethystine quartz crystals have achieved fame in the past under the exciting name of 'Bristol Diamonds'. Celestite, barytocelestite, barite and gypsum are commonly associated with these various mineral occurrences, both as primary constituents and as secondary replacements.

Blue Anchor Formation

In west Somerset a series of magnificent coastal sections between Blue Anchor ([P211340](#)) and Lilstock displays the Triassic succession from the upper part of the thick red Mercia Mudstone deposits to the basal Lias. The junction between the predominately red rocks below and the superincumbent grey and green strata of the Blue Anchor Formation is transitional, with the proportion of red beds diminishing upwards over some 50 to 60 m. The base of the Blue Anchor Formation is taken somewhat arbitrarily above the highest prominent bed of red mudstone, where the transition to green-grey coloration is complete. In the Central Somerset Basin, the Blue Anchor Formation is 20 to nearly 40 m thick and comprises alternating dark grey mudstones, some of which are shaly, and greenish grey or buffish grey silty mudstones and siltstones. The latter may be dolomitised and weather out as strong ribs in the coast sections. Finely laminated beds displaying burrows are present in places. Gypsum often occurs as nodules and veins, which, in the coast sections, are best developed at two main levels in the middle of the sequence.

Traditionally the formation has been divided into Tea Green Marl below and Grey Marl above; the latter has been distinguished from the former by the presence in it of dark grey mudstone bands. On the coast, the Tea Green Marl, as so defined, is rarely more than 5 m thick. Inland it is not usually possible to separate the two. The uppermost few metres of the Grey Marl were formerly separated as the Sully Beds, because they locally contain elements of the same fauna as the overlying Westbury Formation. However, the 'Sully Beds' are lithologically identical to the remainder of the Grey Marl and markedly different from the Westbury Formation, and the term has been abandoned.

Within a few kilometres south of the Mendips, along the northern edge of the Central Somerset Basin, the Blue Anchor Formation thins rapidly and on the Mendips it is mostly overlapped by the overlying Penarth Group. North of the Mendips the formation is 12 to 13 m thick in the Uphill-Locking area, where it includes some dark grey mudstones of 'Grey Marl' type in its upper third, but the transition to the red mudstone below is sharp. In this area, and in the marginal areas south of the Mendips, local occurrences of small masses of coarsely crystalline calcite and/or quartz and celestite, at about the base and the middle of the formation, may represent altered evaporite deposits.

Elsewhere in the region the formation is rarely more than 2 to 5 m thick. In the Worcester Basin it measures no more than 9 m and the dark grey mudstone facies is absent. The boundary with the underlying red mudstones is sharp and may represent a nonsequence. Beds of finely interlaminated mudstone, siltstone and fine-grained sand are usually present in some parts of the sequence but evaporite minerals are rare.

Reference

1. Nickless, E F P, Booth, S J, and Moseley, P N. 1976. The celestite resources of the area north-east of Bristol with notes on occurrences north and south of the Mendip Hills and in the Vale of Glamorgan. *Mineral Assessment Report Institute of Geological Sciences*, No. 25.

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