

Information Sheet 1B: Late Lower to Upper Carboniferous: Crackington Formation (Culm Basin 'autochthon' / 'parautochthon')

General description

The original, essentially unmoved, bedrock of central Devon north of the Meldon area, is dominated by the Crackington Formation, a thick sequence of interbedded sandstones and dark grey shales, of late Lower to Upper Carboniferous age (essential Namurian to basal Westphalian in a European regional context).

The Crackington Formation represents a classic 'flysch' sequence with the sandstones formed from sands which flowed into the deep Culm basin after being dislodged from its slopes by earthquakes associated with the rise of the 'Variscan Mountains' to the south, during the early stages of the orogeny. These 'turbidity currents' deposited their load as their velocity dropped on reaching the gentler slopes towards the bottom of the basin. The weight of these sands pressing down into the soft muds, which had settled quietly onto the sea-bed between flows, often created well developed lobe-shaped 'lode casts'. These structures are crucial 'way-up' indicators in the subsequently tightly folded Crackington Formation sequence.

There is no evidence of the mudstones of the Dowhills Formation (also known as the Ashton Shales *Member*) with its characteristic black shales, below the Crackington Formation in the Okehampton-Meldon area although this apparent absence can perhaps be tectonically explained.

Fossils are not common in the Crackington Formation as the unstable nature of the environment was not suitable for colonisation by most marine animals. What are more frequent, however, are small fragments of plants, washed in from the river deltas of the similarly aged 'Millstone Grit' of more northerly England and Wales. Occasional shale-dominated bands in the formation, however, yield the small coiled shells of ammonoid cephalopods ('goniatites'), which provide a very important biostratigraphic control on its age. Although none have currently been recorded in the Okehampton – Meldon district, elsewhere in the region these fossils indicate that alternating sandstone-mudrock portion of the formation ranges from the Chokerian Stage of the early Namurian to the Langsettian Stage of the early Westphalian series of the latest Lower Carboniferous and Upper Carboniferous (see geological time scale).

Magnificent exposures of the Crackington Formation are present on the coast of north-east Devon and North Cornwall, especially between Crackington Haven – the type locality - and Widemouth Bay, south of Bude (Cleal and Thomas 1996). Inland exposures are typically very small or overgrown, however, excepting a small number of working quarries, for instance Venn Quarry near Barnstaple (www.devon.gov.uk/geology/geodiversity) and Knowle Quarry near Okehampton (Page 2006). In the Meldon area, small exposures in the formation, for instance in the West Okement River (Locality CF5 below; Edmonds et al. 1968, p.65), lie mainly within the metamorphic aureole of the Dartmoor granite and consequently sandstone bands have been welded to form hard quartzites and mudrocks baked to form hornfels. Very locally as near Minehouse some mineral spotting may also develop, in this case as crystals of andalusite (Edmonds et al. 1968).

In the old railway cutting near Youlditch Farm, west-south-west of Meldon viaduct, the formation is less altered however, and a typical sequence of alternating sandstones and shales is recorded by Edmonds *et al.* (1968, pp.59, 177; Locality CF1 below).

The Crackington Formation responded to the compression during the Variscan Orogeny by developing tight, typically east-west trending folds. There is some evidence of low angle thrusting, but nothing like the well-developed nappes to the south. Compression of the Culm Basin also appears to have been aided by some over thrusting of earlier nappes, at its southern margin as suggested by Sellwood and Thomas (1984), possibly along a zone of weakness formed by the soft black shales of the Dowhills Formation (= Ashton Shales in earlier classification schemes) which are consequently now no longer recognisable in the area. Around the north-western margin of the Dartmoor granite, however, the typical Variscan east-west orientation curves around parallel to the edge of the Dartmoor granite, suggesting that the presence of the granite itself may have had more than just thermal effects, it may also have affected the structural style of the country rocks into which it was intruded (see Sheet 1G).

Representative exposures in the Meldon area

LOCALITY	NGR	DESCRIPTION	REFERENCES
CF1: Railway cutting near Youlditch Farm	55109191 - 55229198	Dark grey shale with numerous sandstone bands recorded in cutting sides (Crackington Formation, late Lower to Upper Carboniferous).	Edmonds <i>et al.</i> (1968, pp.59, 177).
CF2: Railway cutting near Bowerland Cross	55109270 - 55409262	Shale and silty micaceous shale with bands of fine-grained sandstone, also alternating pale silty shale and lenticular bedded sandstone at 55359269, sideritic concretions and lode casts at 55309277 (latter indicate right-way-up (dip 22o NW) (Crackington Formation, late Lower to Upper Carboniferous).	Edmonds and others (1968, pp.61).
CF5: West Okement River west of Meldon Quarry	c. 955929 area	Hard black shale and quartzitic sandstone dipping 30o-40o NW-NNW exposed in river (Crackington Formation, late Lower to Upper Carboniferous).	Edmonds <i>et al.</i> (1968, pp.65).

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