7 Kinuachdrachd, Jura

[NR 694 953]–[NR 708 974], [NR 705 985]–[NM 700 012]

C.A. Bendall

Published in: The Dalradian rocks of the south-west Grampian Highlands of Scotland. PGA 124 (1–2) 2013 https://doi.org/10.1016/j.pgeola.2012.07.008. Also on NORA

7.1 Introduction

The Kinuachdrachd GCR site occupies a coastal strip in the remote north-east of the Island of Jura (Figure 2.16). The strata at this site are from the same stratigraphical interval as those described at the *Kilnaughton Bay* GCR site on Islay and the *Lussa Bay* GCR site on Jura. To the west of the site is the Jura Quartzite, which forms the spine of the island, but along the eastern coast are rocks of the overlying Scarba Conglomerate Formation. The rocks of Jura have been described by Peach *et al.* (1909, 1911) and more recently by Anderton (1976, 1977, 1979, and 1980). Anderton interpreted the succession as representing a change from shallow-water shelf sandstones (Jura Quartzite) to deeper water muds, slump deposits and turbidites (Jura Slate and Scarba Conglomerate). Exposed intermittently inland, and unique in the Scottish Dalradian, is a possible fossil slump scar (a result of erosion caused by material slumping down a marine slope) that forms the boundary between the Jura Quartzite and the Scarba Conglomerate (Anderton 1977, 1979).

Also cropping out at this site are dykes of metamafic rock. Whereas mafic sills are common throughout the Dalradian of the South-west Grampian Highlands, recognizable dykes are relatively rare.

7.2 Description

The Jura Quartzite Formation, which crops out inland from this coastal GCR site, has been described in detail by Anderton (1976). Sedimentary structures, such as cross-bedding, scours, possible synaeresis cracks, and sandstone dykes, are well preserved. At this north-eastern end of Jura, unlike at Lussa Bay or at Kilnaughton Bay on Islay, the Jura Slate Member is absent, and the Jura Quartzite is overlain directly by the conglomeratic facies of the Scarba Conglomerate Formation. The nature of the Scarba Conglomerate here was described by Anderton (1977). South of Barnhill [NR 7050 9705], the lowest part of the Scarba Conglomerate consists of pebbly beds, which pass upwards into fining-up sequences (metasandstone–metamudstone). These then pass upwards into a black metamudstone with a well-developed slaty cleavage, which is probably equivalent to the Easdale Slate Formation elsewhere in the South-west Grampian Highlands. Evidence of slumping may be found in the lower part of the Scarba Conglomerate Formation at [NR 702 966] where the succession is a chaotic mass of boulders, with slump folds and mass flows (Anderton, 1977).

North of Barnhill, the boundary between the Jura Quartzite and the Scarba Conglomerate has been interpreted by Anderton (1977, 1979) as a possible fossilized slump scar. This slump scar truncates both the Jura Quartzite and the lowermost Scarba Conglomerate (Figure 2.16). The debris flows found above the slump scar range from 1 m to 15 m in thickness and contain intraformational boulders up to 6 m in size. The matrix is a poorly sorted mixture of sand and mud. Soft-sediment deformation structures are common as are other sedimentary structures such as sole marks, rip-up clasts and small channel deposits, all indicative of high-energy dynamic sedimentary environments.

Structurally this site lies on the south-east limb of the Islay Anticline (Bailey, 1917; Roberts and Treagus, 1977c). Sedimentary structures tend to dominate over tectonic structures, the most obvious tectonic structures being the slaty cleavage found in the finer-grained lithologies. A spaced cleavage developed in the metasandstones shows marked cleavage refraction across beds that preserve compositional grading (Figure 2.17). The tectonic strain here is low, hence the retention of some rather subtle sedimentary structures.

Also exposed here are dykes of metamafic rock. These dykes are the predominant type of meta-igneous intrusion in north-east Jura, unlike in much of the younger Dalradian succession in the South-west Grampian Highlands where sills are ubiquitous. In northern Jura the dykes have been examined in detail by Graham and Borradaile (1984). They described the dykes as having a typical greenschist-facies assemblage of albite, epidote, actinolite and chlorite. Thinner dykes tend to be schistose, but thicker ones retain a relict ophitic texture in their centres. The dykes have a less-evolved chemical composition than the sills and metavolcanic rocks of the South-west Grampian Highlands, and Graham and Borradaile (1984) concluded that the dykes are likely to have been feeders to the more-evolved rocks. These authors also estimated that the pre-tectonic orientation of the dykes was north-west, and that they were intruded perpendicular to bedding.

7.3 Interpretation

The transition from the Islay Subgroup into the Easdale Subgroup on Jura demonstrates a distinct change in sedimentary environment from shallow-marine shelf to a deeper marine slope. This is clearly shown by the metasedimentary rocks that crop out at Kinuachdrachd. The rocks described above are probably contemporaneous with those described at the *Lussa Bay* and *Kilnaughton Bay* GCR sites and therefore demonstrate that there are lateral facies changes along strike. All of these three GCR sites provide evidence for rapid deepening of the basin from a shallow-marine tidal environment, where sedimentation was in approximate equilibrium with subsidence, to a deep-water marine slope (Anderton, 1977, 1979). Therefore, fault-controlled rifting probably had strong control on sedimentation during the deposition of much of the Easdale, Crinan and Tayvallich subgroups of the Argyll Group.

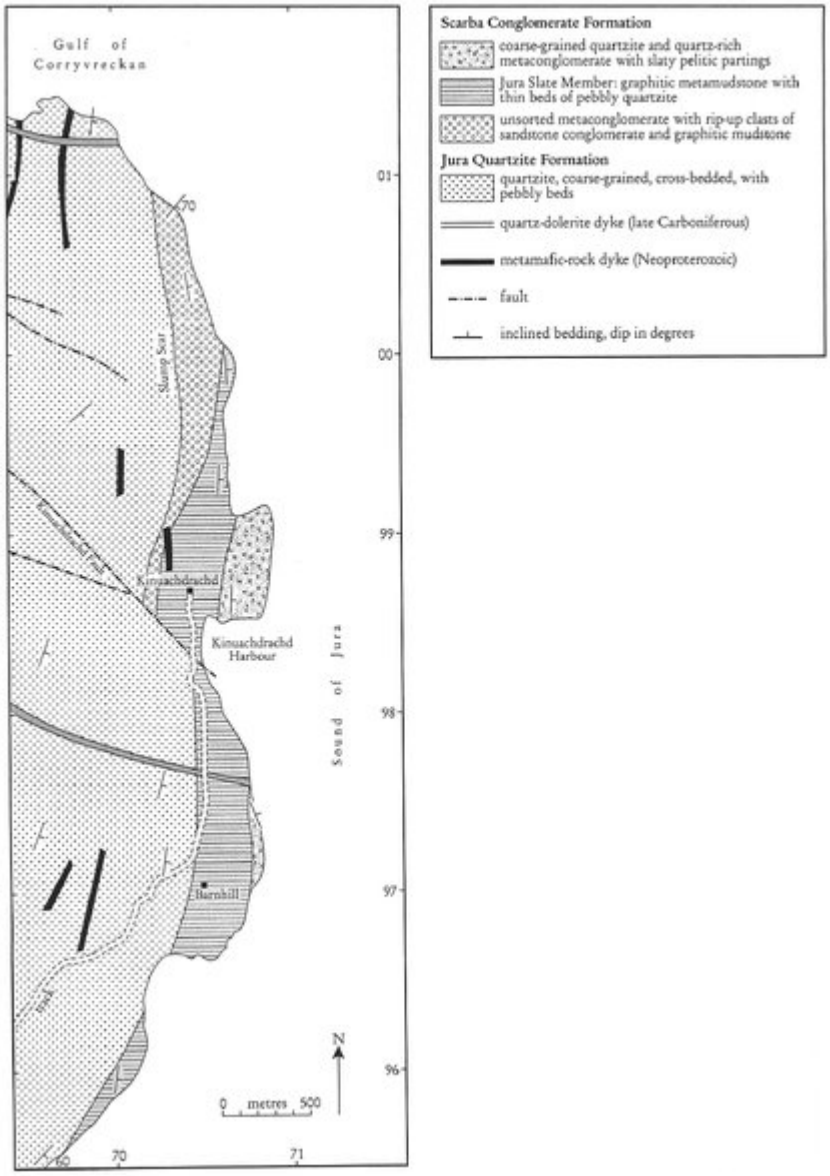
This rifting may have resulted in partial melting of mantle rocks, giving rise to the ubiquitous basic igneous intrusive and extrusive rocks evident in the Dalradian rocks of the South-west Grampian Highlands. For this igneous activity to have occurred, the extension of the Dalradian basin must have been in the order of a factor of 2; that is the basin was twice as wide as it was before rifting commenced (e.g. McKenzie and Bickle, 1988). The meta-igneous dykes on Jura probably represent the conduits through which the magma travelled upwards to higher crustal levels. From the pre-tectonic trend of these dykes (north-west), Graham and Borradaile (1984) proposed that the extension direction of the Dalradian basin was north-east–south-west at the time of intrusion.

7.4 Conclusions

Like the GCR sites at *Kilnaughton Bay* on Islay and *Lussa Bay* in central Jura, strata at the Kinuachdrachd GCR site in the north-east of Jura demonstrate the abrupt change in sedimentary depositional environment from shallow-marine shelf to deep-marine slope on the Laurentian margin in early Argyll Group time. Here, a putative fossil slump scar, which is an erosional feature formed by rapid erosion of sea-floor sediments by material slumping down a marine slope, forms the boundary between the Jura Quartzite and the Scarba Conglomerate. Evidence of sediment sliding down the marine slope has been preserved in the form of spectacular slump beds, which contain boulders up to 6 m in size. Other dramatic evidence of such high-energy sedimentation is provided by scours, and by material that has been ripped up from the sea floor and incorporated into the slump deposits.

In addition, this GCR site includes metamorphosed basaltic dykes, which were probably emplaced as a result of stretching of the crust and the upper mantle. They are thought to have been feeders to the sills that are ubiquitous in upper Argyll Group rocks of the South-west Grampian Highlands (e.g. at the *Ardbeg* and *Ardilistry Bay* GCR sites), and in the overlying Tayvallich Volcanic Formation (see the *West Tayvallich Peninsula* GCR site). The orientation of the dykes gives an indication of the direction in which the stretching took place (north-east–south-west) and suggests that by late Argyll Group time the Dalradian crust had stretched by a factor of two.

References



(Figure 2.16) Map of the area around the Kinuachdrachd GCR site, Isle of Jura (after BGS 1:50 000 Sheet 36, Kilmartin, 2003 and Anderton, 1977).

(Figure 2.17) Refracted S1 cleavage cutting near-horizontal bedding close to the hinge-zone of a mesoscopic F1 fold, in metasandstone beds, viewed to the north-east, Kinuachdrachd, Isle of Jura. Spirit level is 5 cm long. (Photo: P.W.G. Tanner.)