4 The Dalradian rocks of Jura

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Maps

Ordnance Survey map, 1:50,000, sheet 61.

The boundaries of the relevant geological maps are shown on (Figure 1).

Geological Survey maps, one inch to one mile: 27 (Portaskaig), 28 (Jura) and 36 (Kilmartin).

Introduction

General description of guide

The Middle Dalradian rocks of Jura (Figure 1) are of particular interest because, as a result of their mild deformation and metamorphism (lowest greenschist facies), a large proportion clearly exhibit original sedimentary structures. Although deformational structures and minor intrusions will be referred to, the main purpose of the excursions is to demonstrate the sedimentological features of a sequence of various marine facies. For the sake of simplicity the rocks will often be referred to as muds and sands although they are now mainly slates, phyllites and very hard quartzites. Exposure is good throughout the area, especially in the wave-cut benches of raised beaches from which many of the localities are described.

Travel details

Jura can only be reached by the car ferry from Port Askaig on Islay to Feolin Ferry. This connects with Western Ferries' service which runs several times a day from Kennacraig (Figure 1). There is also a frequent MacBrayne's boat to Port Ellen on Islay from "West Loch Tarbert and a bus service connects Port Ellen with Port Askaig. There is a hotel and some private accommodation in Craighouse but there is no public transport on the island. The Islay, Jura and Colonsay Tourist Association will provide much useful information on accommodation, transport, etc. Officially, camping is prohibited except at Kinauchdrach, but enquiries to specific landowners may elicit helpful replies. All the localities may be visited in a day from Craighouse, but much time can be saved in visiting localities 4 to 6 if one camps at Kinauchdrach. The only shop and petrol station on the island are at Craighouse.

Useful addresses

These are for guidance only and are liable to change. Addresses of landowners can be checked with the Tourist Association or the local authority. Argyll & Bute District Council, Lochgilphead, Argyll. Islay, Jura and Colonsay Tourist Association, Bowmore, Isle of Islay, Argyll. Caledonian MacBrayne Ltd., The Pier, Gourock, PA19 1QP. Western Ferries Ltd., Kennacraig, Tarbert (Loch Fyne), Argyll.

General geology

There are no really useful publications which describe the geology of the area. Most of the early work was stratigraphical and Bailey's (1916) summary and map are still the most authoritative. The Geological Survey memoirs (Peach *et al.* 1909, 1911) include much lithological detail and descriptions of the Caledonian and post-Caledonian dykes and sills. Anderton (1976) has recently discussed the depositional environments of the Jura Quartzite.The stratigraphical relationships of the formations are shown in (Figure 2). The Jura Quartzite is interpreted as having been deposited on a tidal-current dominated shallow marine shelf. As one follows the predominant palaeocurrent direction towards the NNE. the sediments change from almost entirely cross-bedded sands, deposited from migrating mega-ripples or sand-waves, to include an increasing proportion of laminated and rippled sands and silts. This is very similar to the change observed down the bedload sediment transport path in the present day Celtic Sea (Belderson and Stride 1966). There is no obvious relationship between such tidal palaeocurrents and the shoreline, but they may be very approximately parallel.

During the later part of the Jura Quartzite depo sition relatively rapid subsidence, possibly localized along faults, flexed the sea floor down to the north of Jura. From the resulting slope (5°–10° ?) rock falls, mass flows (Dott 1963) and turbidity currents poured detritus north into a (1–2 km?) deep basin to form the sediments of the Scarba Conglomerate from Scarba to Eilean Dubh Mor. Eventually, the rest of the shelf subsided (perhaps to a depth of a few hundred metres) and was inundated by turbidity currents which deposited the Scarba Conglomerate to the south of Barnhill. Although derived from different source areas and deposited in different environments the northern and southern parts of the Scarba Conglomerate are lithologically very similar and merge imperceptibly.

To the north of Jura, the Scarba Conglomerate fines up into the Easdale Slates, a predominantly muddy sequence probably deposited from dilute turbidity currents. During deposition of the Port Ellen (= Craignish) Phyllites the whole of Argyll again came under the influence of shallow marine currents and finely interbedded sands and muds were deposited.

Description of localities

Locality 1: Ardfin

A traverse from the Jura Quartzite through the Scarba Conglomerate into the Port Ellen Phyllites (Figure 3).

Take the track from the main road down through Ardfin Farm towards the shore, having first obtained permission to continue at the farm. From (A1) east to the top of the Jura Quartzite there are some silts and laminated sands as well as the medium-grained to pebbly, cross-bedded sands which form the rather monotonous section from (A1) NW. along the Sound of Islay. A 4 m unit of light grey slate marks the base of the Scarba Conglomerate at (B1) and is followed eastwards by patchy exposures of deformed slates and cleaved quartzites. The slate darkens in colour and the proportion of sand decreases eastwards. At (C1), just east of a Tertiary dolerite dyke, thickly bedded sands appear. They differ from those in the Jura Quartzite in having thicker beds, more persistent bedding planes, occasional grading and small shale clasts. The next section of the shore (D1–E1) consists of fallen boulders from Tertiary dolerite dykes with a few exposures of graded sands in the cliff. At (E1) is the abrupt boundary with the Port Ellen Phyllites. The Phyllites consist of highly deformed green and black slates and phyllites with thin, sometimes calcareous, sandstones. The proportion of sand increases eastwards to (F1) where 15 m of cleaved, fine grained, green sandstone is exposed. Some beds have a massive base and a cleaved top suggesting that they are graded. A fine series of epidiorite sills form the headlands east of (G1). Returning west the relationship between lithology and the intensity of deformation can be considered.

Locality 2: Tarbert

A section in deformed Scarba Conglomerate (Figure 3).

Tarbert village is reached down a farm track from the main road. Starting on the beach at (A2) traverse south along the shore across cleaved and folded friable, yellow and grey slates with thin sandstones. At (B2) are graded coarse sands (30–80 cm thick) passing south-eastwards into dark grey and black slates with sands and at (C2) into pure slate which has been quarried. At (D2) thick coarse graded units appear which to the east become thicker and include abundant shale clasts.

The tectonic minor structures seen here are similar to those found elsewhere on Jura. A NNE–SSW. trending cleavage, steeply dipping (usually at >6s°), is axial planar to folds of up to several metres amplitude in beds of quartzite. It is cut by a strain-slip cleavage dipping ESE. (usually at <30°) axial planar to much smaller folds.

However, one problem is whether the slaty cleavage, well displayed in the black slates, is a refracted equivalent of the steeply dipping cleavage in the quartzites or an even earlier structure.

Returning to the main road Loch Tarbert can be seen. A good traverse can be made west along its northern shore down through the entire 5.3 km maximum thickness of the Jura Quatuite. It is a long, hard -walk to the seawatd end of the Loch, but a bothy at Ruantallain where an overnight stop can be made enables one to make it a reasonable two day trip.

Locality 3: Lussa Bay

A relatively undeformed section from the top of the Jura Quartzite into the Scarba Conglomerate (Figure 3).

The Jura Quartzite exposed at (A3) exhibits cross-bedding (note its orientation, set thickness and the grain-size variation within foresets) lamination, silt interbeds and wavy bedding (Reineck and Wunderlich 1968). The base of the Scarba Conglomerate is marked by an upward passage into 30 m of yellow-grey slate with thin sands (distal turbidities?) followed at (B3) by thickly bedded, mainly poorly graded sands showing some load-casting, lamination and very rare large-scale cross-stratification. There is also at least one mass flow.

Lussa Bay is eroded out of a thick band of black slate exposed around (C3) and (D1). At (E3) there is an abrupt change in facies where thick, poorly graded sands appear. However, proceeding NW. from (F3) to (G5) one can also examine many good turbidite structures, viz. well graded pebbly sands, amalgamations (Walker 1966), loadcasts and pseudonodules, shale clasts (up to 1 m plus) and mud fragments being ripped up from an underlying bed. There are also several mass flow deposits. These consist of incompletely mixed mud, sand and gravel, often with large disintegrating boulders of sandstone and shale. They were produced when beds of partly consolidated pebbly sand and mud having been disrupted, started to flow plastically downslope but were arrested before they could mix with water and develop into turbidity currents. Some, in fact, pass north into well sorted, graded units.

Locality 4: Glentrosdale Bay

Sedimentary structures in the Jura Quartzite (Figure 3).

There are excellent exposures of this formation all along the coast between the Gulf of Corryvreckan and Loch Tarbert (Figure 1). This traverse has been chosen as the most accessible. It is about a 1½ hour drive from Craighouse to Kinauchdrach (the last 8 km being a poor track) where it is often possible to camp (contact Mrs. Nelson, Ardlussa for permission). From Kinauchdrach head WNW. through a coll and then down Gleann Beag to the coast. At (A4) examine a wall of fault breccia where the Kinuachdrach Fault crosses the coast. Cross the beach, traverse round the headland to Glentrosdale Bay and proceed SW. along the coast as far as time permits before returning via Glen Trosdale to Kinuachdrach.

Along this traverse we see alternating units (metres to dekametres thick) of coarse fades (medium-grained to pebbly cross-bedded sands) and fine facies (rippled and laminated fine sands with silts and muds). In the coarse facies note climbing ripples, winnowed pebble horizons, pene-contemporaneous deformational structures (convolute lamination and overturned foresets), flat persistent erosional bedding surfaces every few metres and the size, shape, orientation and grain size of the foresets. The fine facies display wavy and lenticular bedding, thin laminated sands (possibly the storm-sand layers of Reineck and Singh (1972)), small channels, load casts and sand volcanoes. At (B4), underneath an overhang, is a bedding surface crowded with horizontal sand tubes in mud. Although the early workers thought that these were worm burrows they are more likely to be sand filled subaqueous contraction cracks called syneresis cracks. At (C4) is a steep-walled, 50 cm deep channel, in laminated sand, filled and overlain by a massive sand with silt clasts, also, possibly, a storm produced structure. At (D4) is one of many examples of broad shallow channels (usually 1 m or 2 m deep and up to 100 m across). These occur at the base of coarse or fine units indicating that the channel infilling is not always associated with the channel cutting.

Locality 5. Barnhill

The Scarba Conglomerate around the top of the submarine slope (Figure 3).

Proceeding along the coast or down the stream valley we see at (A5) thick, graded conglomerates and pebbly sands with shale clasts, load-casting, amalgamations, etc. The base of the Scarba Conglomerate is here marked by an epidiorite dyke and west of it at (B5) the Jura Quartzite is well exposed. North-westwards along the coast from (A3) the sands become thinner and finer, passing into distal turbidities and then at (C3) into black slate; continuing north the sequence is reversed and at (D5) are two 2 m units in which finely interbedded sands and silts are progressively disrupted by small thrusts and tensional fractures into a chaotic mass of boulders with slump folds and finally into mass flows. The Jura Quartzite/Scarba Conglomerate boundary north of Barnhill is thought to represent a fossilized slump scar. Although slumping from, and erosion of, the slope were initiated while tidal-current sedimentation continued on the shallow shelf to the south (Figure 2) we can see here that, as the slump scar truncates both the Jura Quartzite and the lowermost Scarba Conglomerate, the final episode of major slumping occurred after deposition of the first turbidites on the shelf. It is possible that the disturbed bedding at (D3) was produced at this time.

From here east to (E5) rather deformed turbidites with hardly any sedimentary structures are injected by Caledonian epidiorites, Old Red Sandstone porphyrites and Tertiary basalts. However, between (F5) and (G3) are turbidites with large clasts etc., a 3 m mass flow and many beds of brown-weathering, black ferrodolomitic limestone. Beds of this type can sometimes be seen being ripped up by and incorporated in overlying sands, indicating the mechanism of formation of the many calcareous sands also present. Returning to the hill at (H5) it can be seen that the lateral equivalents of the conglomerates seen at (A5) are truncated by the slump scar.

Locality 6: Kinuachdrach to Maol Eilean

The Scarba Conglomerate turbidites lying above the slump scar (Figure 3). This traverse takes one along the coast down through a fairly monotonous series of poorly graded or ungraded 0.3–1 m thick sands interbedded with slates. Although there are few sedimentary structures, cleavages, minor folds, boudinage and quartz-filled tension gashes are well displayed. The following localities show points of special interest. At (A6) are black limestones and load casts and at (B6) a unit of calcareous sands is overlain by a 2 m unit with disturbed bedding (similar to that at Locality 5, outcrop D5) containing boulders of sandstone, slate and black limestone. There are more calcareous sands at (C6) followed at (D6) by a sequence of turbidites showing parallel lamination, shale clasts, convolute lamination and ripples. The outcrop of the slump scar where it crosses the coast is disappointing (E6). It is found 20 m NW. of a small epidiorite dyke and is marked by a line of calcareous pebbles in a jointed and deformed quartzite. These are clasts in the basal turbidite. Around (F6) is a zone of intense shearing and at (G6) is a 15 m thick east-west trending dolerite dyke probably of Permo-Carboniferous age. If wished, one can continue along the north coast of Jura to examine the Jura Quartzite and the epidiorite dykes, returning via Gleann Beag.

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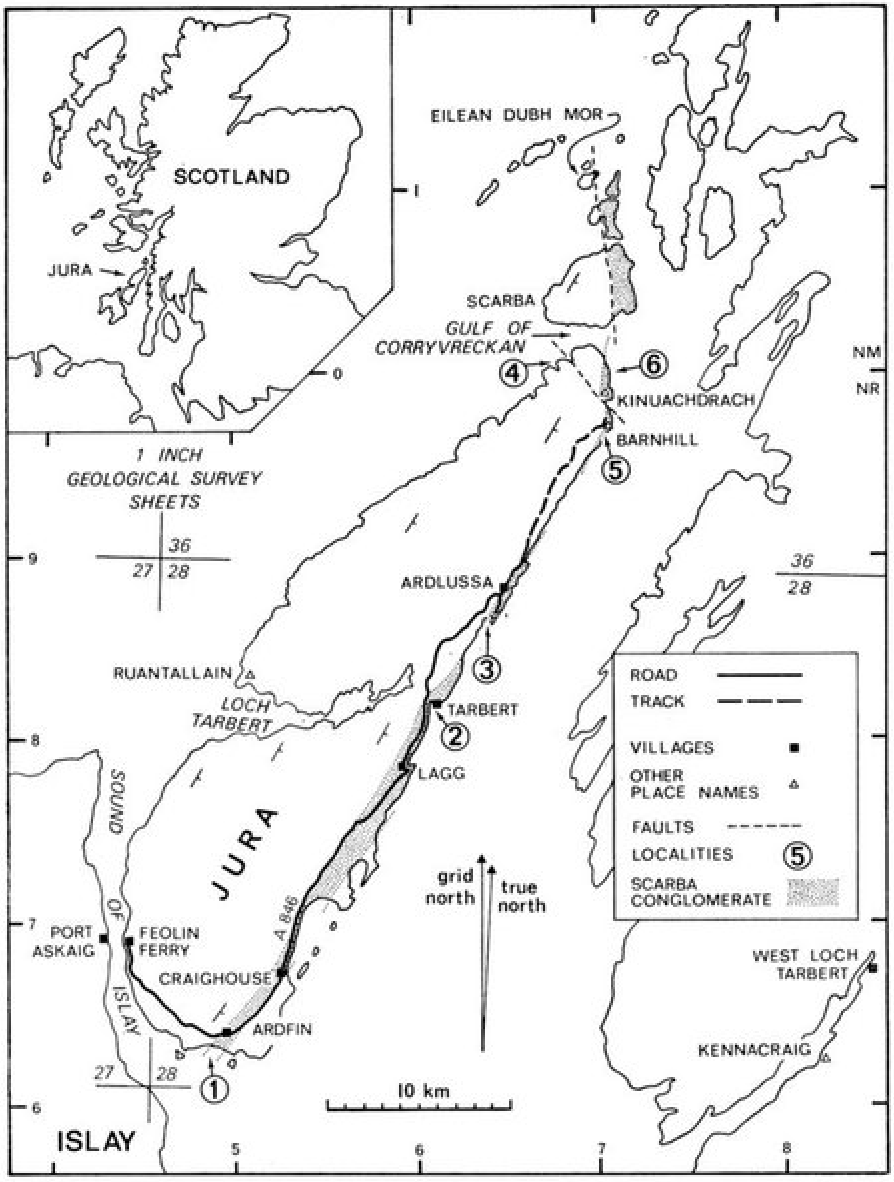
Figures

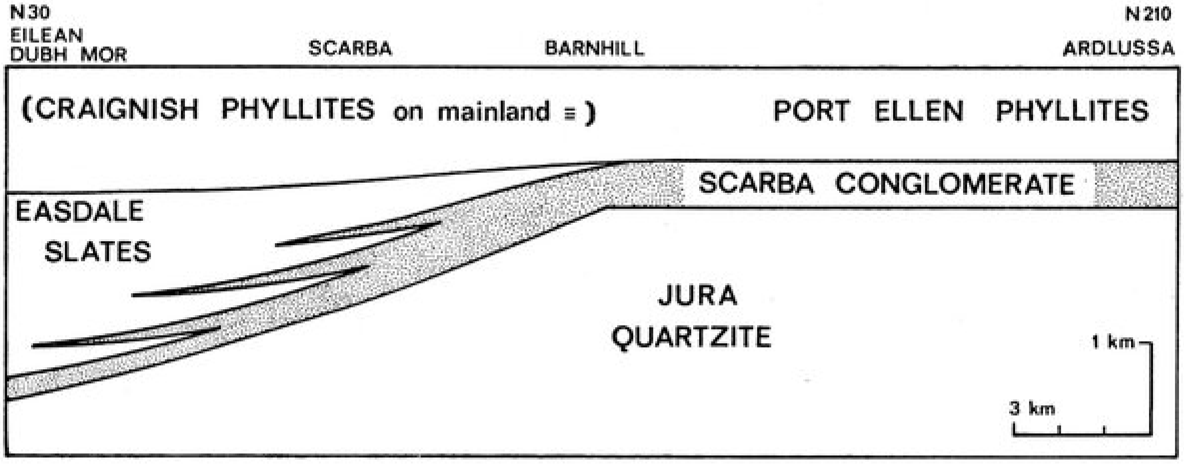
(Figure 1) General map of the area described in this guide. The Ordnance Survey 1:50,000 sheet 61 covers the whole of Jura.

(Figure 2) Stratigraphical relationships of the formations described in this guide.

(Figure 3) General map of the area described in text.



(Figure 1) General map of the area described in this guide. The Ordnance Survey 1:50,000 sheet 61 covers the whole of Jura. From: Anderton, R. 1977. 4: The Dalradian rocks of Jura. Scottish Journal of Geology v 13. p135–142.



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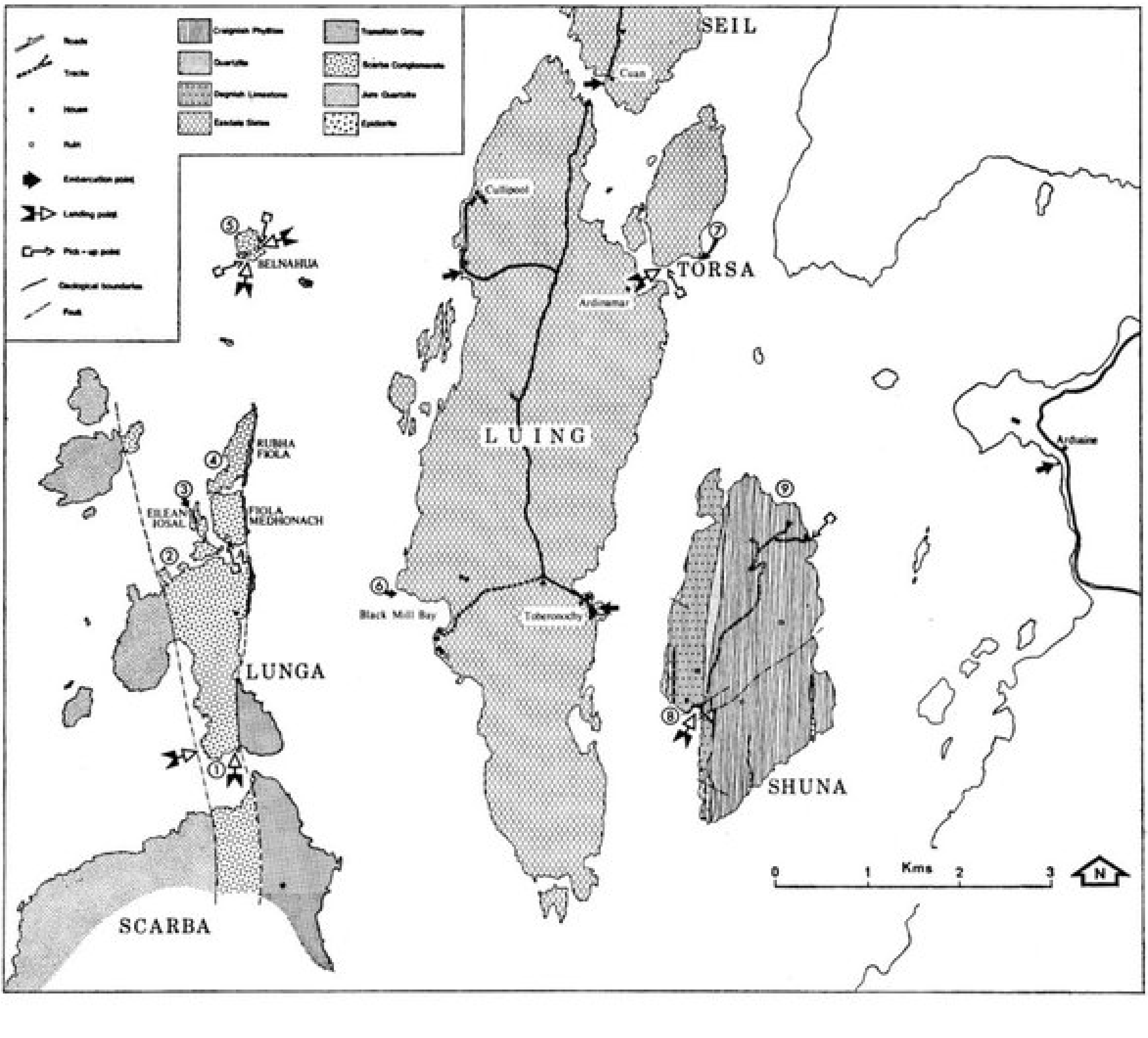

(Figure 3) General map of the area described in localities 4,5 & 6. From: Baldwin, C.T. and Johnson, H.D. 1977. 5: The Dalradian rocks of Lunga, Luing and Shuna. Scottish Journal of Geology v 13. p143–154.