Kinnesswood, Perth and Kinross

[NO 181 036]

Introduction

The Kinnesswood GCR site consists of a section in the gully of Kinnesswood Row (Figure 2.17), on the western flank of Bishop Hill [NO 181 036] and 6 km east of Kinross. It lies towards the northern edge of the main Carboniferous outcrop within the Midland Valley. It provides a classic section through the problematic Kinnesswood Formation (Inverclyde Group, Farrunendan to Tournaisian) across a regionally significant disconformity and into the Pathhead Formation (Strathclyde Group, Brigantian) and local equivalent of the Charlestown Station Limestone (Lower Limestone Formation, Brigantian). It thus provides important insights into the palaeogeographical complexities of the Midland Valley Basin. MacGregor (1968) has provided the best account of the site though useful information is also given by Chisholm and Dean (1974).

Description

The rock sequence within the Kinnesswood GCR site dips very slightly to the east so that as one ascends the gully of Kinnesswood Row one ascends the sequence. The site displays a thin development of Lower Carboniferous rocks resting on red sandstones and calcretes belonging to the Kinnesswood Formation (Inverclyde Group). This is the name locality and type section for the Kinnesswood Formation, which is here about 40 m thick. The formation consists largely of white-, yellow- or brown-coloured sandstones with thinner bands of siltstone and mudstone. Some of the coarser-grained sandstones are lenticular with erosive bases and large-scale trough cross-bedding whereas the fine- to medium-grained sandstones are poorly bedded or massive. Current directions from these cross-stratified beds indicate flows from the west. In places, fining-upward sequences can be recognized in which erosively based coarse sandstone grade upwards through finer sandstone into siltstone and mudstone. The sandstones are locally cemented with dolomite. The occurrence of probable pedogenic nodular dolomite concretions in these beds is characteristic of the formation. Fragments of these concretions are common in the coarser sandstones resting on erosion surfaces and show that the concretionary carbonates developed penecontemporaneously within the original sediments. The highest bed of the Kinnesswood Formation is a sandy calcrete (1.6 m). The overlying Carboniferous sequence (33.5 m) is made up of shales and siltstones with a few sandstone bands. In addition there are two coal seams and two limestone bands. The lower coal (15 cm) lies almost immediately on the calcrete. *Lingula* has been recorded from one of the dark shales. The upper limestone is about 3 m thick and both it and an underlying shale (7 m) codtain crushed marine fossils including brachiopods and bivalves.

Interpretation

The Kinnesswood Formation is of uncertain Devono-Carboniferous age although miospore evidence from New Cummnock (Browne *et al.,* 1999) suggests that it is probably largely of early Carboniferous (Tournaisian) age. It is interpreted as having formed in a fluviatile environment with river systems flowing off a rejuvenated upland to the north-west (Chisholm and Dean, 1974). The occurrence of calcrete palaeosols indicates a semi-arid environment. At Kinnesswood the formation has a reduced thickness duc to intra-Carbonifcrous crosion, which has removed the upper parts of the sequence (Chisholm and Dean, 1974; Browne *et al.,* 1999). This erosion surface can be followed along the outcrop from the Lomond Hills area eastwards into Stratheden (Chisholm and Dean, 1974).

The upper limestone is equated with the Charlestown Station Limestone (MacGregor, 1968), which lies at the base of the Lower Limestone Formation (upper Brigantian, P_2). The strata that lie between the top calcrete of the Kinnesswood Formation and the Charlestown Station Limestone horizon probably represent the local equivalents of the upper parts of the Pathhead Formation, which are also late Brigantian in age, and confirmatory miospore evidence for this has been obtained from the coal near the base of the sequence (Browne, 1980b). Thus although no discordance in dip can be

detected between the Kinnesswood Formation and the overlying strata, a very considerable gap in deposition is indicated during which over 2000 m of strata were deposited in East Fife (Forsyth and Chisholm, 1977). Elsewhere within the Stirlingshire, Kinross and Fife area the extent of the discordance appears to be less (Chisholm and Dean, 1974) and the relationship at Kinnesswood may reflect its position on a northerly extension of the Burntisland High. The beds of the Pathhead Formation appear to have formed in a distal deltaic environment and the presence of coals indicates a warm but humid climate.

Conclusions

The Kinnesswood GCR site is a unique site showing a regionally important unconformity between undoubted Lower Carboniferous strata and rocks of less certain Devono-Carboniferous age. Beds of the Pathhead Formation (Strathclyde Group) containing thin marine intervals rest with marked overstep on the type section of the Kinnesswood Formation (Inverdyde Group). Thus here there is evidence of a much less complete Lower Carboniferous rock succession than that proved in more easterly and southerly parts of the Midland Valley.

References

(Figure 2.17) View of Bishop Hill from the north showing the prominent gully of Kinnesswood Row in which the Kinnesswood Formation (Inverclyde Group, Tournaisian) and Pathhead Formation (Strathclyde Group, Brigantian) are exposed. (Photo: M.A. Whyte.)