

THE CONNECTION BETWEEN THE DECOY AND BOVEY BASINS.

A C CATTELL.

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INTRODUCTION

Devon is cut from coast to coast by the north-north-west —south-south-east trending Sticklepath - Lustleigh fault zone (Dearman, 1963). Along the line of the fault zone a number of small sedimentary basins formed in Eocene - Oligocene times, apparently related to strike - slip movements (Holloway and Chadwick, 1986; Bristow and Robson, 1994). The most southerly basins are the Bovey and Decoy Basins, whose general geology has been described by Vincent (1974), Edwards (1976) and Selwood *et al.* (1984).

The Bovey Basin has a half-graben structure. On its eastern and northern margins the Bovey Formation dips gently westward over older strata. The western boundary of the basin is marked by the Western Margin Fault, which has an estimated downthrow of 700 m on the basinward side (Fasham, 1971). The southern margin of the basin is possibly thrust, Devonian slates being carried northward over the Bovey Formation (Bristow and Hughes, 1971; Selwood *et al.*,

1984). The Bovey Formation stratigraphy in the eastern and southern parts of the basin is illustrated on Figure 1.

The Decoy Basin lies south of the Bovey Basin and straddles the Torbay Fault (part of the Sticklepath - Lustleigh fault zone). The published British Geological Survey map (1:50,000 sheet 339) shows that east of the fault, Aller Gravel and Upper Greensand dip gently westward toward the fault, and no Bovey Formation strata are exposed. West of the fault, Upper Greensand, Aller Gravel and Bovey Formation strata dip inward, the dip direction swinging progressively around the basin from south-south-east on the northern margin to northward on the southern margin. Dips are relatively steep, up to 45°, particularly on the northern and western margins. Bedding in the Permian strata around the basin also dip inward toward the centre.

The solid geology of the connection between the Bovey and Decoy Basins is poorly known. The Bovey Formation is known to be present between the basins, but the area is mostly hidden beneath

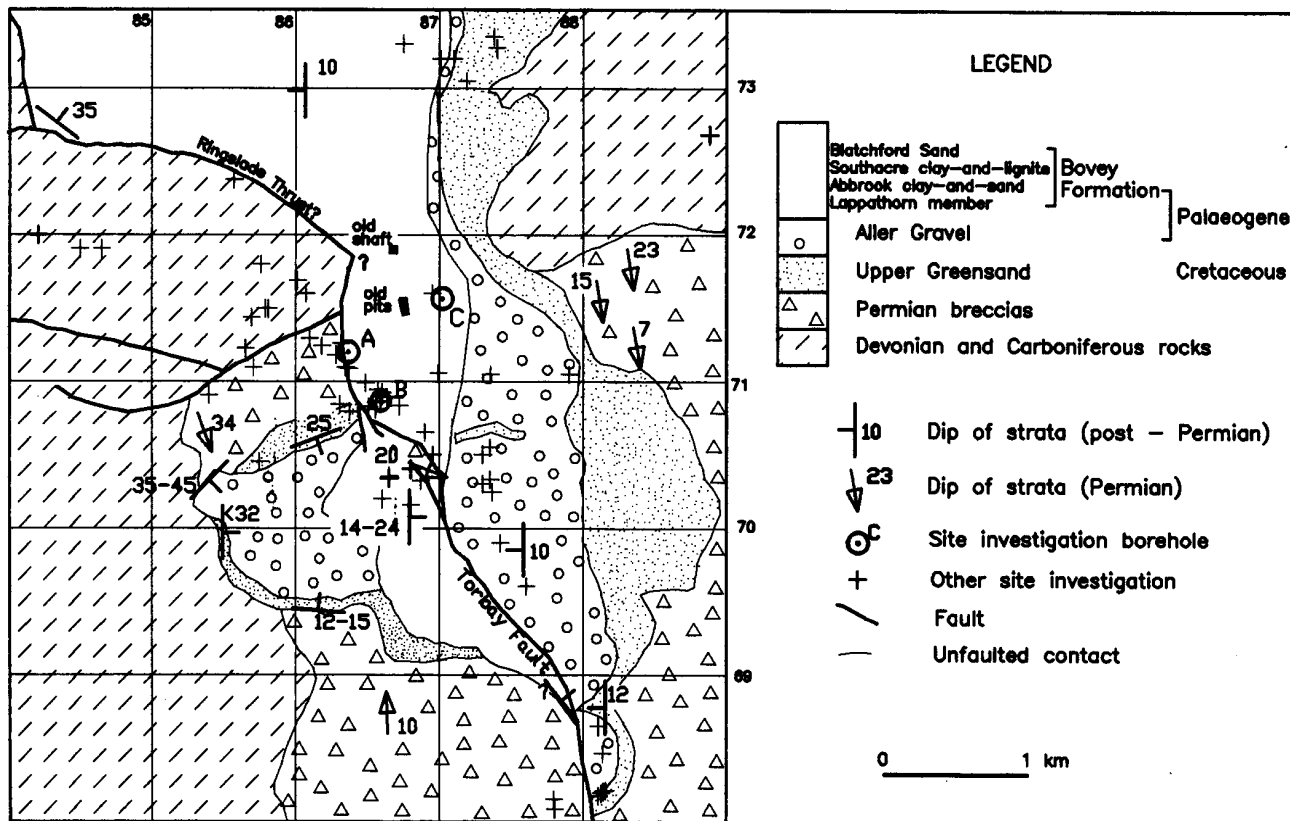


Figure 1. Geology of the connection between the Decoy and Bovey Basins. Based on published 1:50,000 BGS sheet 339, modified by results of recent site investigations.

alluvium, and beneath the urban area of Newton Abbot. The current published BGS 1:50,000 map shows conjectural boundaries and structures. This note presents new site investigation data for the area which allow a clearer understanding of the connection between the two basins.

NEW SITE INVESTIGATION DATA

Numerous site investigations have been carried out in the area over the past five years (Figure 1). In most cases they yield data of only very local interest, and these are not reported here. However the data from such sites do help to constrain outcrop patterns. For example, the trace of the Torbay Fault through the area is well defined (often within 100 m) by sites in contrasting lithology, and the trace so constructed agrees well with that shown on the published survey sheet.

A strip of Permian strata is shown on the published BGS 1:50,000 map (sheet 339) extending from Decoy northwards to the River Teign. Permian breccias are exposed in an old quarry at Decoy [SX 8695 7025], dipping at 20° towards the east-southeast. A driller's log of a shallow borehole at Keyberry Park, Newton Abbot [SX 868 704] recorded 3.6 m of 'red clay' over 2.4 m of 'red marl'. Such a description probably records completely weathered Permian slate

Newton Abbot [SX 863 712], less than 100 m east of the Torbay Fault. The borehole proved 4.0 m of pebbly, coarse-grained, angular granitic sand, resting on 0.5 m of interbedded sand and stiff clay. The lithology is similar to that described from the Blatchford Sand Member of the Bovey Formation (Edwards, 1976; Selwood *et al.*, 1984). A nearby borehole [SX 863 715] is described (Selwood *et al.*, 1984, p.140) as proving 12.1 m of coarse-grained sand over 2.5 m of brown clays which were assigned tentatively to the Abbroom Clay and Sand Member. However the sequence seems more likely to represent the Blatchford Sand.

Borehole B was sunk at Buller Road, Newton Abbot [SX 865 709] about 100 m east of the Torbay Fault. Beneath overburden, the hole proved 8.0 m of interbedded grey sandy clays, silty clays and coarse granitic sands, overlying laminated pale brown clay. Some clay beds contain horizons of clay-breccia. The sequence is typical of the lowermost part of the Blatchford Sand sequence, but is not diagnostic.

Borehole C was drilled at Forde Road [SX 871 716], just south of the River Teign. Beneath 10.7 m of fill, alluvial silts and gravels, the borehole proved 2.0 m of stiff plastic grey and red mottled clay. The material is typical of clays assigned to the Lappathorn member in clay pits in the main Bovey Basin to the north. The published survey sheet shows Devonian slate sub-cropping beneath the alluvium at this

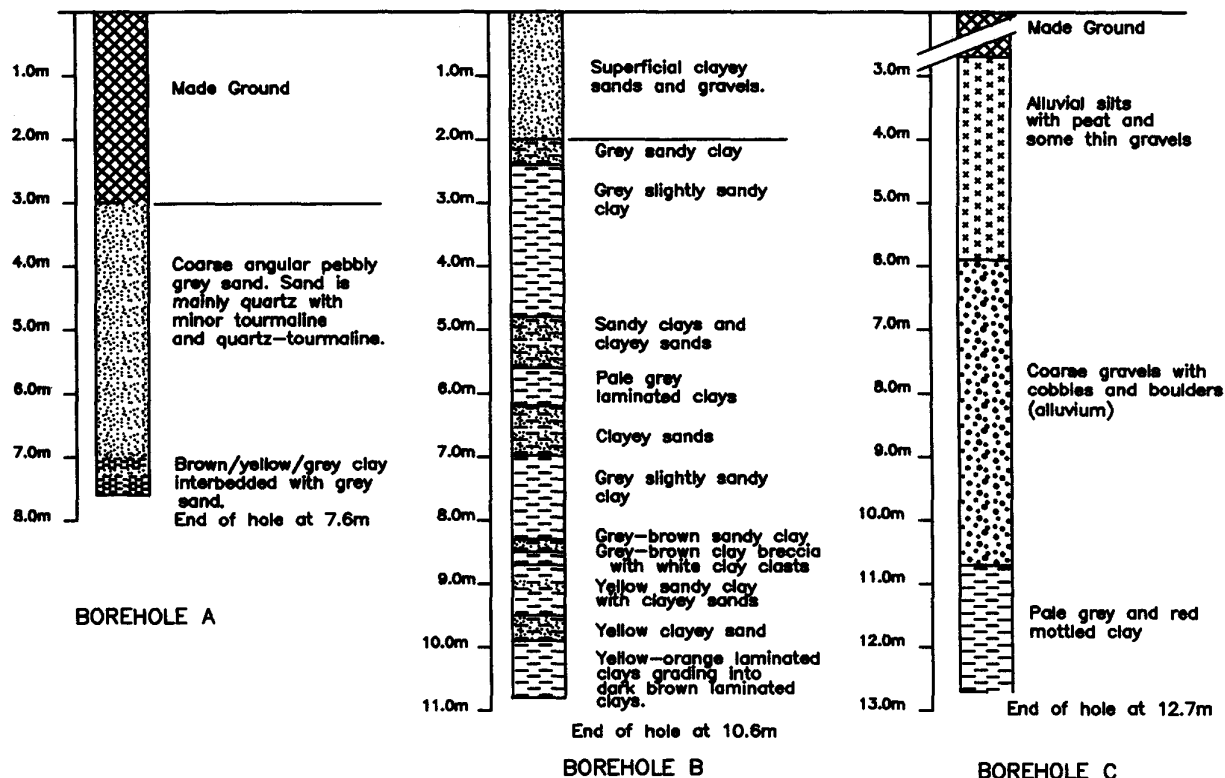


Figure 2. Logs of boreholes penetrating the connection between the Bovey and Decoy Basins. a) Prospect Terrace, Newton Abbot [SX 863 712] b) Buller Road, Newton Abbot [SX 865 709] c) Forde Road, Newton Abbot [SX 871 716]

breccia of Watcombe Clay' or Watcombe Breccia' type. Farther north, shallow excavations and boreholes on the supposed Permian breccia outcrop proved yellow fine-grained sands typical of near-surface weathering of Bovey Formation grey sands. The Permian at Decoy appears to be a small fault-bounded block, perhaps contained between different strands of the Torbay Fault (Figure 1).

Three recent site investigation boreholes have been sunk in the area of Bovey Formation sediments between the Decoy and Bovey basins. The borehole locations are shown on Figure 1 and the logs on Figure 2. Borehole A was sunk at Prospect Terrace, location, but the

boundaries on the map are depicted as uncertain. Devonian slates were proved beneath the alluvium of the River Teign by boreholes along the line of the A380 Kingsteignton by-pass some 750 m north-east of borehole C. The solid geology between borehole C and the bypass is obscured by alluvium, but it seems probable that the Upper Greensand and Aller Gravel are also present.

A shallow site investigation at Forde Park, Newton Abbot [SX 868 706] proved pink and grey mottled clays similar to those found in borehole C, and which are also tentatively assigned to the Lappathorn Member.

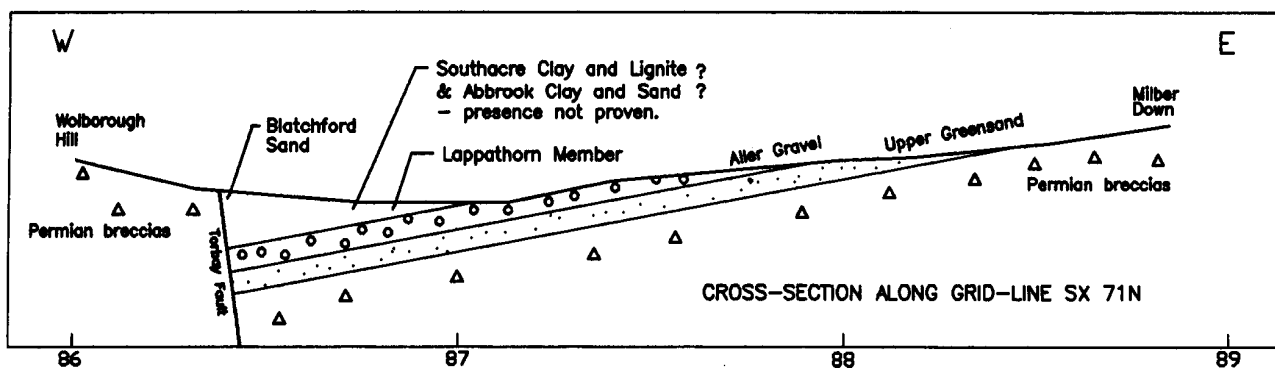


Figure 3. Cross sections across the connection between the Decoy and Bovey Basins.

DESK STUDY

The results from the site investigations outlined above suggest that the Upper Bovey Formation (Blatchford Sand Member) may be present along the western side of the connection between the basins, whilst the lowest member of the Middle Bovey Formation (the Lappathorn Member) is present on the eastern side. The inference is that the upper part of the Middle Bovey Formation, which includes the main ball clay sequences, underlies the central part of the area. Unfortunately no recorded boreholes have been sunk in this area. There are however some old records indicating that ball clays are present. Ussher (cited in Selwood *et al.*, 1984, p.140) recorded at least 11 m of clay at the railway station [SX 8678 7111]. The first edition Ordnance Survey 1/2500 plan of the area shows north-south trending water-filled pits just north-west of the railway station [SX 867 715]. The pits have smooth eastern margins and irregular western margins, suggesting that the pits were working down dip to the west. No other documentary evidence concerning these pits has yet been found by the author, so although on balance it is considered likely that these are clay pits, it is not certain. The same plan also shows an old shaft [SX 877 719] on the north bank of the River Teign, on what is now Newton Abbot race-course. The only likely explanation for a shaft in this location is for working ball clay, but it may have only been a trial. No documentary evidence concerning the shaft is known to the author, and there is no abandoned mine plan in Devon Record Office. Scott (1929) shows the main ball clay sequence running past Newton Abbot railway station, but provides no evidence for this. Scott's map shows the lower Stoneware Clay sequence to the east of the upper Ball Clay sequence, implying a westward dip, in accord with the borehole data presented here.

DISCUSSION

From the new information outlined above, a revised geological map of the area can be constructed (Figure 1). This indicates that the eastern half of the Decoy Basin is a southerly continuation of the eastern margin of the Bovey Basin. All along the eastern margin the data are consistent with gently westerly dipping strata (Upper Greensand, Aller Gravel and Bovey Formation) resting unconformably on Palaeozoic rocks (Figure 3). It remains possible that there is a fault or disturbance along the line of the Teign Estuary (c.f. Bristow and Hughes 1971; Bristow and Robson, 1994), but there is no requirement for such a feature to explain the outcrop pattern along the margin. At the southern end of the Decoy Basin the eastern margin is progressively cut off by the Torbay Fault which runs slightly oblique to it. The new data suggest that the Bovey Formation in the area between the Bovey and Decoy Basins consists of a westerly-dipping sequence from the Lappathorn Member up into the Blatchford Sand. A similar sequence is seen in the clay pits in the Bovey Basin to the north. However, in the south east corner of the Bovey Basin the strike of the main ball clay sequence swings around

from north-south to become parallel with the proposed Ringslade Thrust along the southern margin. For the main ball clay sequence to be repeated to the south requires more complex faulting than that yet defined.

West of the Torbay Fault in the Decoy Basin, the Bovey Formation and underlying Aller Gravel and Upper Greensand are folded about a west-south - west-east - north-east synclinal axis. Such folding is not seen east of the Torbay Fault. The deformation may be associated with movement on the Ringslade Thrust. The movement must post-date the Bovey Formation, which is folded, but the steeper dips in the Aller Gravel and Upper Greensand suggest some movement prior to deposition of the upper parts of the Bovey Formation. The folding must be associated with movement along the Torbay Fault. On the larger scale, the movement on the fault must have been dextral strike-slip, but locally movements would have been oblique. The presence of a fault sliver of Permian breccia in the Decoy Basin suggests that there was more than one phase of movement, exploiting different strands of the fault.

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