Raised beach and mined fluvial deposits near Marazion, Cornwall

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The western end of the Marazion by-pass, now under construction, passes through two shallow cuttings east of its new roundabout junction with the A30 at Newtown (Fig. 1); these cuttings have revealed a Quaternary succession which had not been recorded previously -- although Reid and Flett (1907, p. 68) noted a scatter of pebbles and loamy gravel with flint and chert in the vicinity - and a series of old mining tunnels.

From the westerly cutting (SW 5070 3188 to 5091 3189) the following succession is typical. The basal 1.3m was augered below the road bed.

Topsoil	Brown pebbly loam	0.30m
Head	Dark brown, pebbly, silty, loam	0.50m
Raised beach	Buff to ochre-coloured silty to clayey sand, with abundant well rounded pebbles	2.60m
	Ochre to brown-coloured sand with occasional pebbles	1.45m
Alluvium?	Light grey sandy clay	>0.60m

Periglacial frost action has carried wedges of head material about a metre down into the underlying beach deposits but one large wedge (5086 3189) penetrates for 2.5m. All the wedges appear to be steeply inclined to the west or south-west.

In the upper part of the beach sediments most of the pebbles are well rounded and about 20 to 40mm in size. They consist predominantly of white quartz but include cream-coloured flint, quartz-veined and tourmalinised slate, fine-grained granite, elvan and one pebble of pale buff quartzite. Pebbles of greenstone and unaltered slate are rare. The presence of flint, which also is found on the modern beach, is indicative of an off-shore derivation and confirms that the deposit originated as a beach. The matrix is mainly a coarse- to medium-grained sand (0.25-lmm) of sub-angular to well rounded quartz, together with lithic fragments and some tourmaline grains.

The underlying sand is closely similar to this matrix, though somewhat darker in colour owing to coatings of ferruginous oxides. Some poorly developed interstratification with the overlying pebbly horizon is locally apparent.

The basal sandy clay is clearly of different origin. Its 40% sand content is almost exclusively angular and consists largely of lithic fragments and white quartz. The grey colour appears to be the result of gleying. From these characteristics it is believed to be an alluvial deposit.

In the eastern cutting (5100 3189 to 5121 3188) the raised beach is much thinner but the underlying fluvial sediments are better exposed. The northern face shows the following section:

Topsoil	Brown pebbly loam	c. 0.30m
Head	Dark brown pebbly, silty, loam	0.45m
Raised beach	Buff-coloured sand with occasional bands of fine pebbles	1.50m
Fluvial gravel	Brown pebbly, coarse to fine gravel and brown coarse sand	0.50m

The beach sand is seen to thin eastwards and westwards and at the ends of the cutting head rests directly upon fluvial gravel.

Deeper excavations on the southern side of the cutting proved more of the fluvial deposit in sections showing:

Topsoil	Brown pebbly loam	c. 0.30m
Head	Brown, pebbly, silty, loam	1.00- 1.20m
Raised beach	Buff sand	0.50m
Fluvial gravel	Gravel with fine pebbles to large boulders and coarse sands. Commonly stained red or brown. Poorly sorted	3.75m

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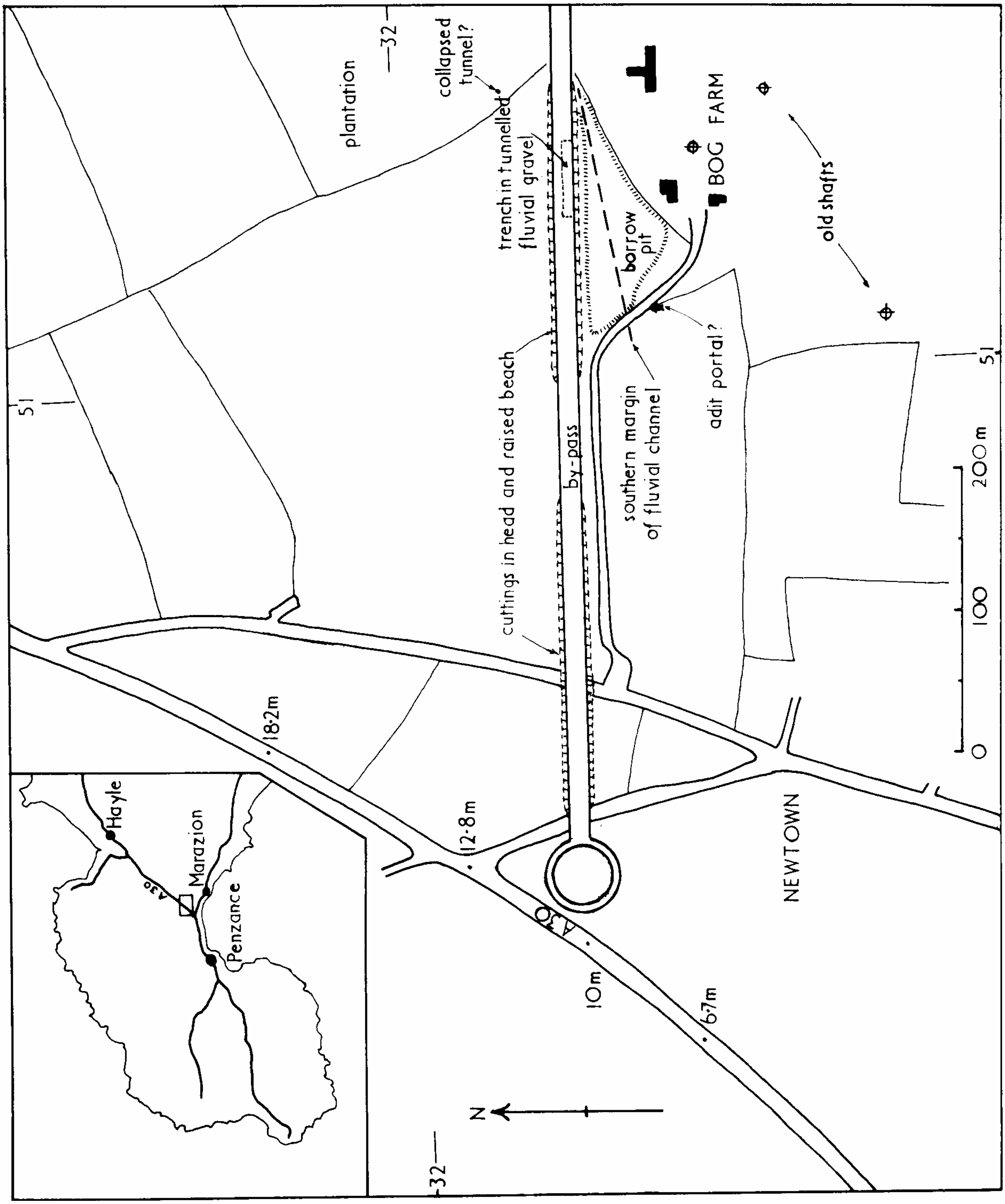

Figure 1. Map of the Newtown area, showing the location of the Marazion by-pass, with associated Quaternary and mining features.

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Although variable in size, pebbles in the gravel are commonly (60 to 100mm across with larger boulders towards the base where one, of elvan, measured 0.6 x 0.5 x 0.2m. All sizes of clast range from angular to sub-rounded (rarely well rounded) and consist of quartz, slate, elvan and greenstone. The last three components are much more abundant than in the raised beach sediments and flint is conspicuously absent. Traces of stratification are emphasized by lenticular bodies, some 2 to 3m long and 0.3m thick, of coarse sand with scattered pebbles. Both gravel and coarse sand are partially cemented by interstitial fine sand and silt and by iron and manganese oxides.

Flat slate clasts near the base of the deposit show an imbrication fabric indicative of east to west depositional flow and current movement in this direction is suggested by poorly formed ripple marks in one of the finer sand lenticles.

The form of the fluvial deposit is better defined in the borrow pit south of the road cutting. At the northwestern corner (5103 3186) 2.0 to 2.5m of gravel underlie 1.0 to 1.5m of head and topsoil but to the south-east (5105 3185) slate lies beneath 1.Sm of slaty head with pebbles. Slate is exposed in the floor of the pit (5110 3185) at a similar depth and under angular slaty head along its southern side (5110 3182 to 5120 3187). The gravels seem to be incised into the slate bedrock to a depth of about 3.5m with the southern margin of this channel aligned E.N.E.-W.S.W. It is probable that the gravels extend as far as a collapse (5021 3191) in the forestry plantation to the north of the road. From these observations the gravels are interpreted as fluvial sediments filling a channel marking the former course of the stream which now enters the sea at Marazion.

Accurate levelling of the deposits has not been attempted but the indicated top of the beach sediments at c. 10m O.D. and base at c. 6m O.D. suggest correlation with the raised beach commonly exposed at about this height around the Cornish coast (Everard and others 1966; James 1976). This beach has been ascribed to high sea levels during the Ipswichian interglacial (Keen and others 1981; Bowen 1973), or, possibly, to an earlier interglacial period (Stephens 1970). The river gravels are obviously older and their age is a matter for speculation; an age early in the Ipswichian interglacial, however, would accord with the local and regional evidence. It is not possible to determine whether the channel represents the original course of the Marazion stream or whether it was a diversion imposed by blockages caused by earlier Wolstonian periglacial detritus. During its use, which on the model above must have been of short duration, the stream flow was evidently very vigorous, allowing the transportation of large boulders. This also supports the view that deposition took place early in an interglacial when the stream was draining meltwater.

During excavation of the easterly cutting several old shallow mining tunnels in the gravel deposits were encountered and this section was dug out to below tunnel floor level to ensure foundation stability. The tunnels were all small, varying from 0.45 to 0.65m in width and 0.65 to 1.35m in height, and commonly round or oval in section; the largest tunnel had the arched shape of a normal mining level. In most cases a fully grown man could have negotiated them only by crawling, a young lad perhaps by stooping. Their direction varied and probably was sinuous, though generally north-south. It was presumed that the tunnels interconnect but no junctions were seen. Access and ventilation seem to have been provided by narrow vertical shafts, two of which were exposed during excavation, and by a presumed adit which emerged immediately west of Bog Farm and is now recognisable as a narrow overgrown trench (5104 3182).

Individual tunnels were at slightly different elevations but all lay between 4.0 and *5.5m* below surface, apparently following sandier layers in the fluvial channel deposits and usually within 0.5m of the base of the channel. Preservation was remarkably good with only rare wall or roof collapses; this may be due to their small size, low superincumbent load and cementation by iron oxides and very fine sediment. Some workings were partially filled by angular head debris, apparently spread from downslope collapses. Most of the tunnels were essentially dry, even after a prolonged period of heavy rainfall.

It appears that the old miners recognised the fluvial character of these sediments and were exploring for cassiterite in their basal layers. A composite grab sample taken from a selection of tunnelled sand layers contained about 28% of fine gravel (>2mm) and 8% of silt and clay (<0.06mm).At least 60% of the sample comprised lithic fragments, mostly slate with a little greenstone and granite, the remaining 40% being quartz, mica and iron oxides with increasing amounts of tourmaline in the finer grain sizes. Separation in bromoform (SG=2.84) yielded a small crop of heavy minerals, mostly tourmaline, iron oxides and lithic fragments; no cassiterite was recognised.

These exploration tunnels undoubtedly are very old but there is no immediate evidence of their age. A short length of wood, presumed to be part of a pit prop and the only evidence of artificial ground support, was found in one working. This material may be suitable for carbon-14 dating. Workings of a similar nature are recorded from Trannack near Helston (Henwood 1873, p.200), from the River Fal drainage (Henwood 1873, p.204-5) and in the alluvium of streams draining into St Austell Bay (Rashleigh 1822). These date from the period 1792 to 1843 and it seems likely that the Marazion exploration tunnels may be of similar antiquity. Indeed, Henwood (1843, p.34) records that "... a bed of stream tin ore, of very inferior produce, some 20 or 30 feet above the sea level near Newtown, on the Marazion green, has for

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many years afforded employment to a few persons...". Although there is no mention of tunnel working, the location suggests that Henwood is referring to the same excavations.

It is also a reasonable assumption that the tunnels are linked to the history of mining at the nearby Bog Mine, shafts of which lie east and south of Bog Farm (5113 3180). In 1792 this mine was restarted to work copper from lodes beneath the marsh and from 1831 to 1846, as Wheal Darlington, it developed to a depth of 120 fathoms and also produced some tin (Jenkin, 1965, p. 22). It is probable that the copper lodes were discovered during alluvial exploration and, therefore, that the earliest tunnelling may pre-date the 1792 underground operations.

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References

Bowen, D.Q. 1973. The Pleistocene succession of the Irish Sea *Proc. Geol. Assoc., 84,* 249-272.

Dines, H.G. 1956. The metalliferous mining district of south-west England. *Mem. Geol. Surv. Gt. Brit.* 2 vols. H.M.S.O. London.

Everard, C.E., Lawrence, R.H., Witherick, M.E., Wright, L.W. 1966. Raised beaches and marine geomorphology. *In* Hosking, K.F.G., and Shrimpton, G.J. (eds). Present views of some aspects of the geology of Cornwall and Devon. *Roy. Geol. Soc. Cornwall.* Commem. Vol. for 1964, 283-310.

Henwood, W.J. 1843. On the metalliferous deposits of Cornwall and Devon. *Trans. Roy. Geol. Soc. Cornwall, 5,* 1-386.

Henwood, W.J. 1873. On the detrital tin ore of Cornwall. *J. Roy. Inst. Cornwall, 4,* 191-254.

James H.C.L. 1976. Problems of dating raised beaches in Cornwall. *Trans. Roy. Geol. Soc. Cornwall, 20,* 260-274.

Jenkin, A.K.H. 1965. *Mines and miners of Cornwall.* Part 11, Marazion, St Hilary and Breage. Town and Country Press: Bracknell.

Keen, D.H., Harmon, R.S. and Andrews, J.T. 1981. U series and amino acid dates from Jersey. *Nature, 289,* 162-164.

Rashleigh, P. 1822. Account of alluvial deposits at Sandrycock. *Trans. Roy. Geol. Soc. Cornwall,* Z 281-284.

Reid, C. and Flett, J.S. 1907. The Geology of the Land's End district, *Mem. Geol. Surv. Gt. Brit.* H.M.S.O. London.

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