Soil Report for Trelan (Central Excavation Unit Site 41), The Lizard, Cornwall

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The Lizard Peninsula is unique to the British Isles in terms of both vegetation and geology: plants occur which are related to Mediterranean and Lusitanean flora (Staines, 1978) and the range of rocks and superficial deposits is large and complex.

Geology (Figure 1)

The possibly pre-Cambrian rocks of the Lizard Peninsula are the oldest in south-west England and their depositional history may have been as follows (Staines, 1978):-

1. Deposition of muds, sandstones, volcanic tuffs and basltic lavas, now present as the mica schists and granulites of the old Lizard Head series and the Landewednack and Traboe Hornblende schists.

2. Local intrusion of acid sills.

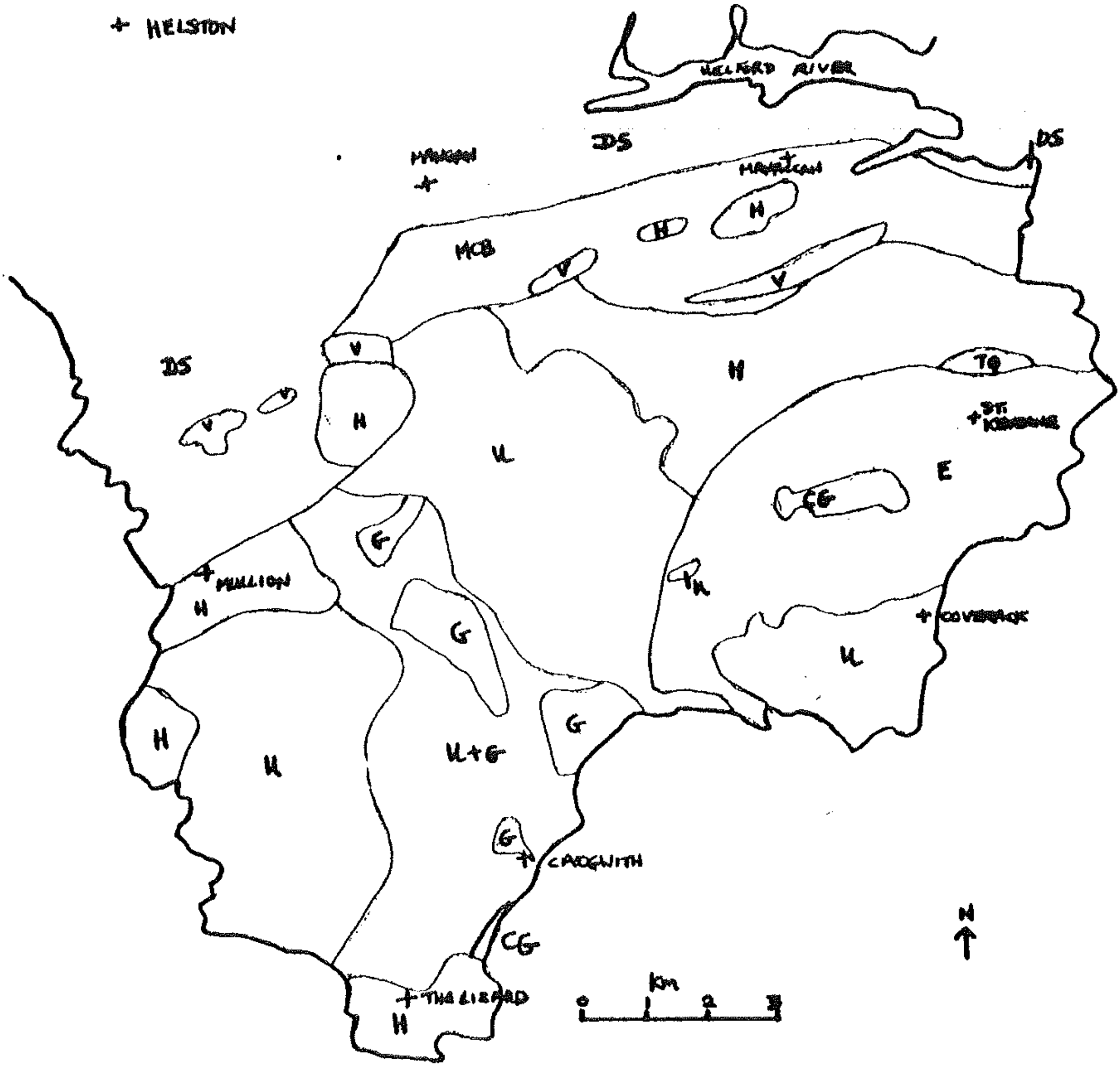
3. Orogenic movement of pre-Cambrian to Cambrian age with regional metamorphism of peridotite, now altered to serpentine. The primary peridotite assemblage occurs as a coarse-grained olivine-Pyroxene spinel assemblage (bastite serpentine) while later alterations have produced tremolite-serpentine anc ther recrystallised varieties, most of which are usually completely serpentinised.

4. Intrusion of the St.Keverne gabbro with gabbro dykes.

5. Orogenic movement of probable Devonian age associated with intrusion of basaltic and doleritic dykes. Also acid intrusion of microgranite forming basic dykes within the gabbro and gneissic sills and sheets within the serpentine.

6. Permo-Carboniferous faulting and folding of the Lizard metamorphic complex, against the Devonian sediments to the north, resulted in the formation of sheared shales and sandstones of the Meneage crust breccia, which includes blocks of Ordovician and Silurian quartzite and limestone.

Figure 1 **Sketch Map of the Lizard District**



KEY:
DS - Devonian slates
MCB - Meneage Crust Breccias
V - Dolerite and lavas
H - Hornblende schist (includes mica schists)
U - Serpentine (peridotite)
U+G - Mixed serpentine and granite-gneiss
E - Gabbro
G - Granite-gneiss
TQ - Treleague Quartzite (hornblendic quartzite)
CG - Crousa gravels (Pliocene? clays and gravels)

The spread of the Mio-Pliocene sea produced extensive erosion surfaces, the main one in west Cornwall being at 131 m. A number of scattered marine deposits occur at various levels in Cornwall, one being the Crousa gravels, near St Keverne. These consist of water-worn vein quartz pebbles in a loamy matrix. Widespread rounded pebbles suggest that similar deposits covered much of the gently sloping Lizard Platform (Staines, 1978).

Loess deposits occur extensively over the Lizard penisula and strongly influence the pattern and character of soil distribution. The presence of similar loess on the Isles of Scilly and the fact that the deepest loess deposits on the Lizard occur close to the south coast suggests a possible channel floor origin (Staines, 1978). Granitic alluvial deposits brought down by the streams draining the Cornish granites could have provided the source material.

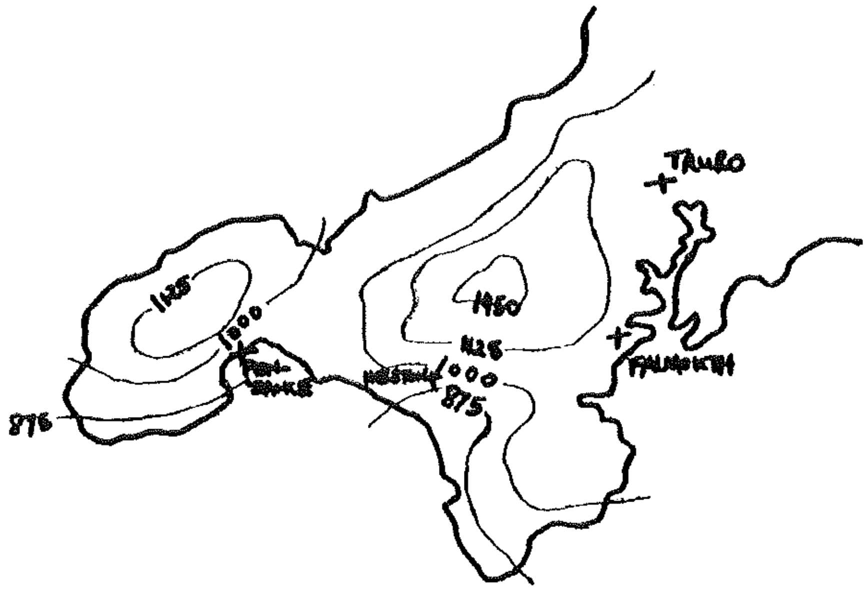
Soils and Vegetation

Soil type on the Lizard is determined by the combination of parent materials and position in the landscape (Staines, 1978).

Serpentine, in sites other than cliffs or steep valley sides, generally appears to weather to more or less impermeable clays and silty clay loams. Along the cliffs loamy brown earths and brown rankers dominate, usually associated with extensive rock outcrops, and heath vegetation occurs dominated by sheeps fescue (Festuca ovina) and ling (Calluna vulgaris) i.e "Rock heath", or Cornish heath (Erica vagans) and gorse (Ulex europaeous) i.e "Mixed Heath" (Staines, 1978). Shallow clayey stagnogleys occur just inland of the cliff edge.

Inland in depressional sites gley soils dominate with silty clay or silty clay loam textures; the heath-type found here ("Tall Heath") is dominated by Cornish heath and black bog rush (Schoenus nigricans), reflecting the generally base rich (magnesium saturated) soils. On the interfluves most soils are formed from loess (40 cms. to 1 m. thick) overlying weathered serpentine. Stagnogleyic argillic brown earths and typical stagnogleys dominate and have very acid surface and sub-surface horizons. A feature of these soils is the presence (under heathland) of iron oxide nodules or more rarely a thin iron pan just below a thin humose surface horizon (Staines, 1978). The vegetation reflects the soil acidity and is dominated by bristle-leaved bent (Agrostis setaceae), ling, belt heather (Erica cinerea), cross-leaved heath (Erica tetralix), purple moor grass (Molinia caerulea) and western furze (Ulex gallii). Cornish heath, a reliable indicator of high pH, is absent; however much of the heathland is now reclaimed and forms indifferent to good pasture.

Figure 2. Annual Mean Rainfall (mm) 1916-50



Over much of the serpentine outcrop the rock is mixed with gneissic and granitic material giving loamy brown earths and ground-water gley soils rather than silty or clayey soils (Staines, 1978). The gabbro outcrop is partially dissected and in rolling country deep loamy brown earths dominate. In the many broad depressions and flat interfluves on the southern outcrop loamy and clayey ground-water and surface-water gley soils predominate. The hornblende and mica schists weather deeply to form loamy brown earths over most of the dissected country; gley soils are limited to a few valley bottom sites. The Crousa gravels support paleo-argillic brown earths and paleo-argillic stagnogleys and usually have a thin covering of loess.

Climate

The Lizard experiences a very mild, moist climate: winters are warm and rainfall (Figure 2) is moderate rising from below 760 mm on the eastern coast to over 1016 mm in the Helford Valley. Exposure is the main limiting factor in land use.

Site 41

During the summer of 1981 excavations were carried out by the DoE Central Excavation Unit, under the direction of Mr G Smith, of the remains of a mound which was thought to be a Bronze Age barrow, on Goonhilly Down, Cornwall. The areas was originally heathland but has now been reclaimed and ploughed and was under a cereal crop at the time the excavation took place.

A buried soil (Section A) below the mound (in which turves could be seen) was examined and particle size and loss on ignition determinations were carried out on samples (1 to 6) from the profile, which is shown in rough sketch in Figure 3. A soil column (Section B) collected by N Balaam for pollen analysis (Balaam, 1983) was also examined and is shown in Figure 4 and Plates 1 to 3.

The Section A profile description is as follows:-

Figure 3 (Section A)

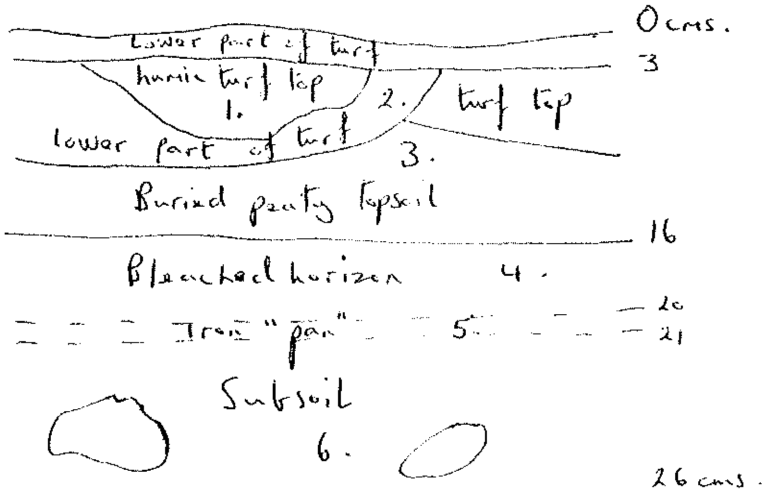
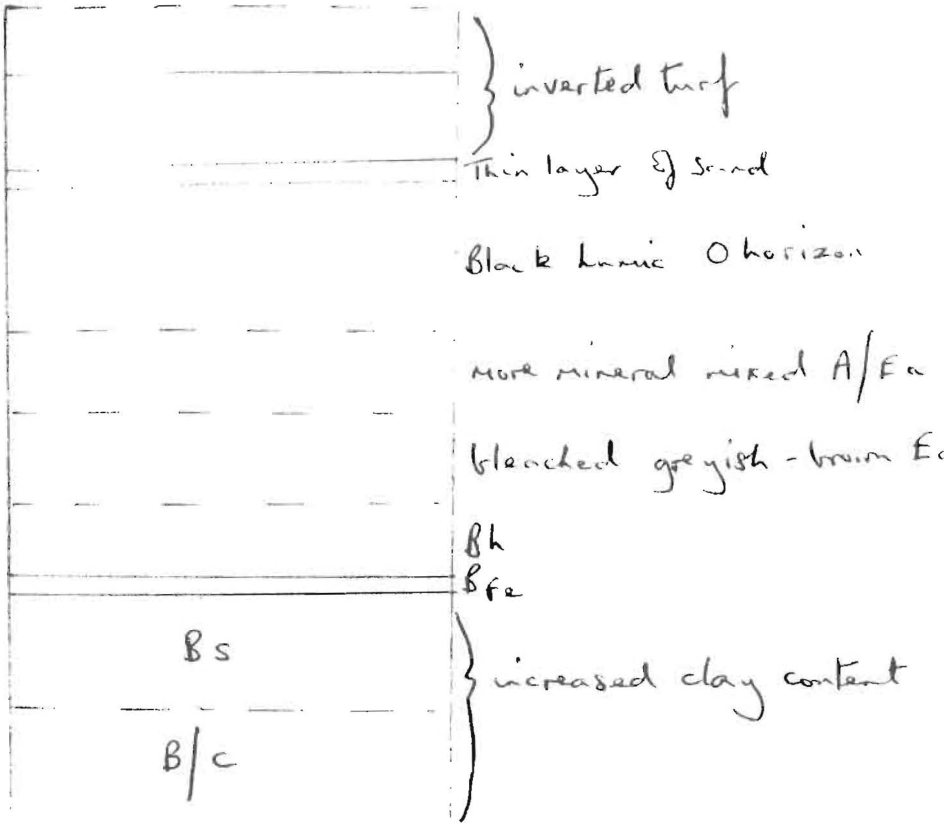


Figure 4 (Section B)



1. The upper part of a turf was black (10 YR 2.5/1), humic and stone-free, with sandy silt loam texture and weak subangular blocky structure. Roots were common, medium to fine fibrous, and mottles were absent.

2. The bottom of the turf consisted of dark greyish brown (10 YR 4/2) firm sandy silt loam, stone-free and with subangular blocky structure. Roots were few, fine fibrous and mottles were absent.

3. The buried topsoil was black (2.5 YR 2.5/0) firm humic sandy silt loam with subangular blocky structure. Roots were few, fine fibrous and mottles were absent.

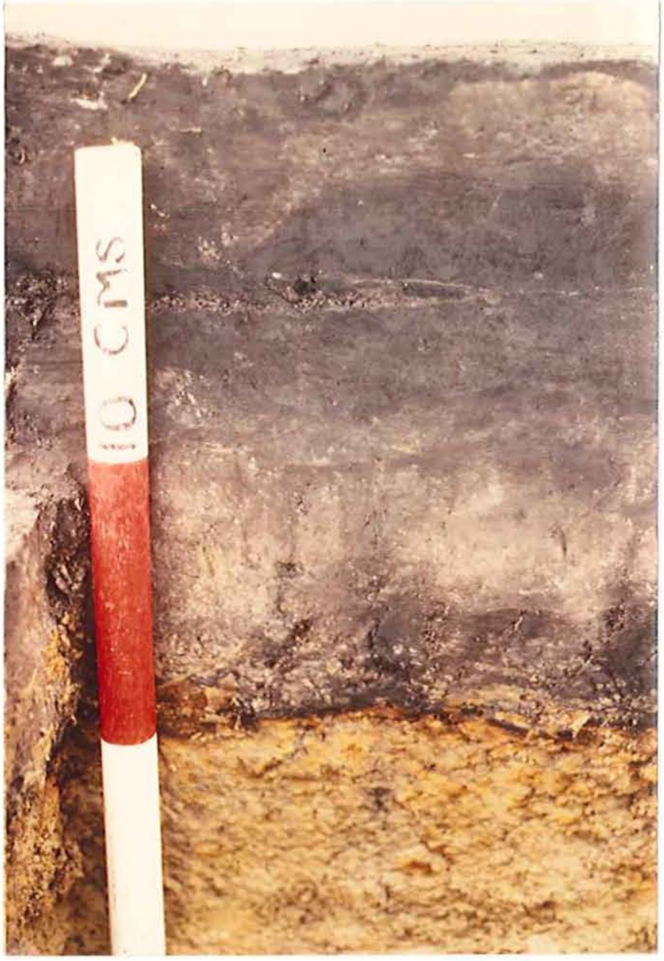
4. The b Eag horizon was dark brown (7.5 YR 3/2) sandy silt loam with weak subangular blocky structure. Roots were rare, there were a few small stones and common fine rusty mottles with indistinct boundaries.

5. There appeared to be an accumulation of iron oxides at this level but the layer was not indurated. The dark brown (7.5 YR 3/2) sandy silt loam was stone-free and has subangular blocky structure. Roots were rare; common distinct reddish yellow (7.5 YR 6/8) mottles were present.

Plate 1.

Plate 2.

Plate 3.



C.E.U. LIZARD #1. IGNITED PROFILE.

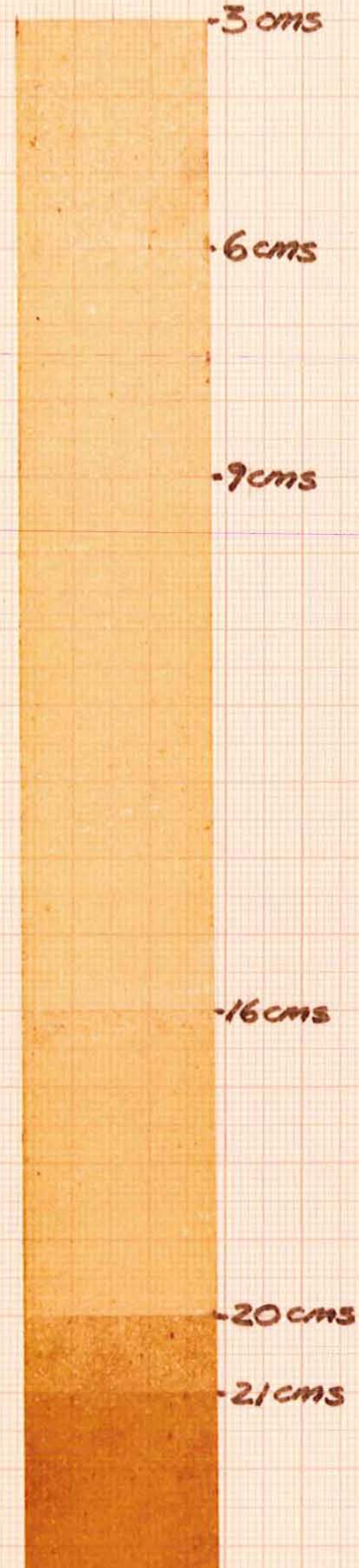
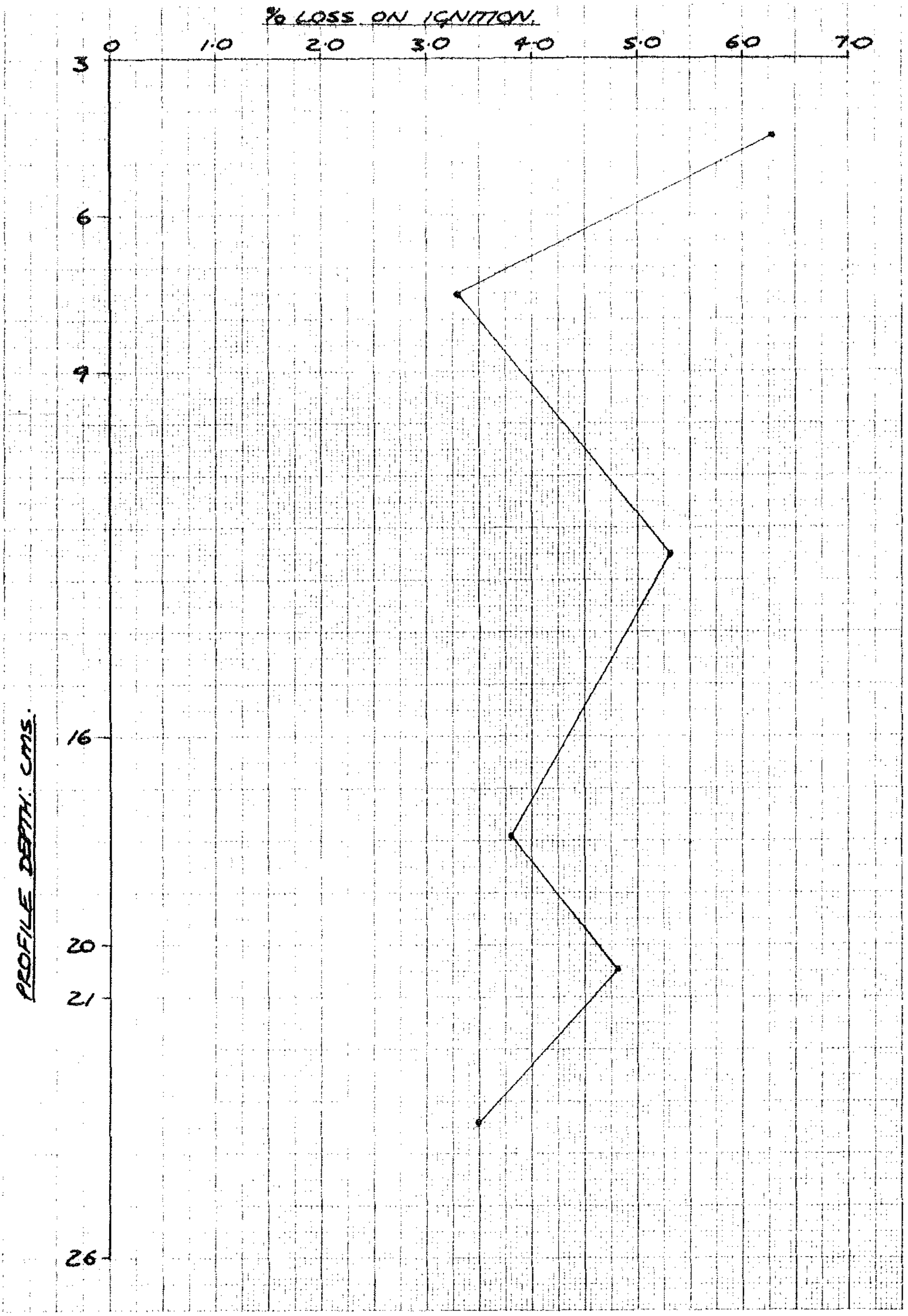


Figure 5.

C.E.U. LIZARD 41: ORGANIC MATTER; % LOSS OF WEIGHT ON IGNITION 375°C.



6. The subsoil was mixed reddish yellow (7.5 YR 6/8) and brown (10 YR 5/3) firm sandy silt loam, stone-free (apart from a few large boulders) and with subangular blocky structure. Roots were very rare and there were many distinct rusty mottles. Black humic material was associated with old root channels.

Morphologically the soil column collected for pollen analysis appeared to be better drained than that described previously, probably due to slight natural intra-site variation in the soil drainage regime. A thin layer of sand was noted overlying the top of the buried soil in section B which was not seen in Section A. This probably resulted from additions of mineral soil trampled into the soil surface during construction of the monument.

The site itself was flat and moderately drained; the soils appeared to be derived from a thin layer of loess overlying weathered serpentine. The modern soil has been much modified by peat cutting, so that most of peaty topsoil has been lost, and was even shallower than the buried soil.

Particle size analysis confirmed that there was a large proportion of silt in the buried soil and most of the sand was in the fine sand fraction, suggesting that loess had been a component of the parent material. At nearby Croft Pascoe (Goonhilly Downs) Staines (1978) described a stagnogleic brown earth in loess over serpentine, under heathland vegetation.

Results (for Section A) of particle size and loss on ignition determinations are given in Table 1. The ignited profile is shown in Plate 4 and the distribution of organic matter in the profile in Figure 5.

Table 1

Sample No.	Coarse Sand %	Medium Sand %	Fine Sand %	Silt %	Clay %	loss on ignition %
1	0.42	1.26	29.12	53.60	15.60	6.3
2	0.14	1.35	29.32	51.60	17.60	3.3
3	0.13	2.13	36.28	45.80	15.60	5.3
4	0.69	2.42	33.49	47.80	15.60	3.8
5	3.82	8.80	29.76	44.20	13.40	4.8
6	2.53	3.71	30.36	47.80	15.60	3.5

As would be expected, organic matter content was higher in the upper part of the turf (1) and buried topsoil (3) than in the more mineral horizons. The loss on ignition value for the iron "pan" (5) indicates that organic matter had been leached down the profile and accumulated at this level, suggesting that both Bh and Bfe components were present.

Comments

The soil buried beneath the mound appears to be a humus-iron podzol, which in places has been affected by gleying, developed under heathland conditions. This conforms to results of soil pollen analysis (Balaam, 1983) which indicated an open environment with little woodland, dominated by grassland heath.

References

1) Balaam, N (1983) Trelan, Sites 40 and 41. Unpublished report.

2) Staines, S (1978) British Society of Soil Science: Unpublished notes for the Post-conference tour to the Lizard Peninsula and West Cornwall.