BRITISH GEOLOGICAL SURVEY

1:50 000 Series

ENGLAND AND WALES
SHEET 351 & 358

PENZANCE

Solid and Drift Geology

Original geological survey on the one-inch scale by Sir Henry T. De La Beche. Published on Old Series Sheet 33 in 1839.
Original geological survey on the six-inch scale by E. E. L. Dixon, D. A. MacAlister, C. Reid and B. S. N. Wilkinson in 1898-1903. Published 1907.
Resurveyed on the six-inch scale by A. J. J. Goode, R.T Taylor and A. C. Wilson in 1970-76.
G. Bisson, District Geologist.
Published 1984. G. M. Brown, D.Sc., F.R.S., Director, British Geological Survey.
3000/84

ORDNANCE SURVEY OF GREAT BRITAIN

Based on the First Series 1:50 000 sheet 203 dated 1974.

The representation on this map of a road, track or path, is no evidence of the existence of a right of way.

Made and published by the Ordnance Survey, Southampton, for the British Geological Survey, Natural Environment Research Council.

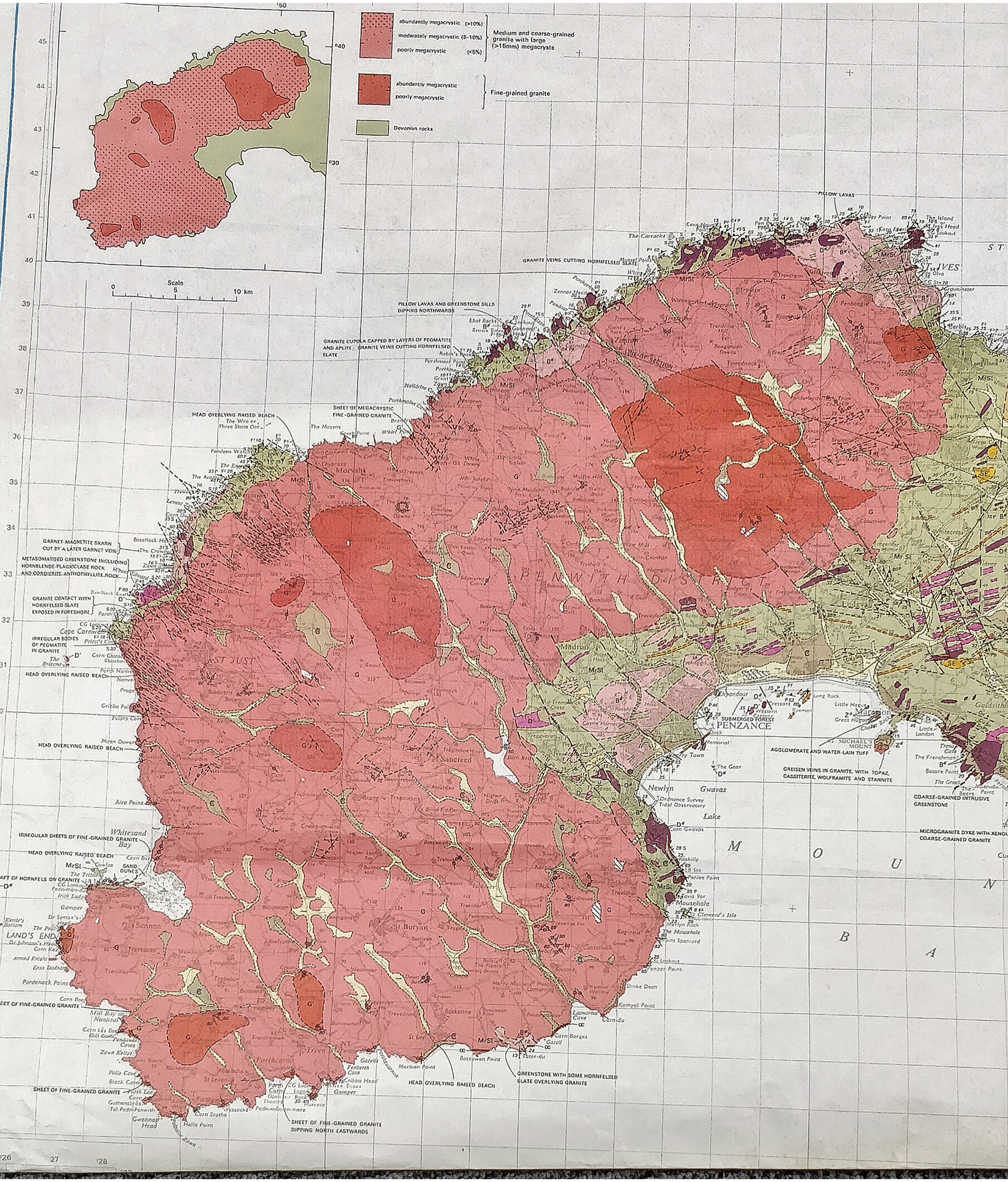
METALLIFEROUS MINERALS

Copper and tin have been produced in large quantities, with lesser amounts of arsenic, bismuth, iron, lead, silver, tungsten, uranium and zinc. The lodes are closely associated with granite outcrops and with subsurface granite ridges. The lodes are hydrothermal fissure-fillings occupying fault fractures; multiple reopening has produced some complex lodes. Wallrock alteration is commoner in granite than in slaty rocks. Carbonas and floors were formed by extensive replacement of wallrock about numerous small veins: carbonas have been described at St Ives Consols [505 398], and tin floors at Grylls Bunny [365 335], Botallack. Some elvans have been mineralised, usually near an intersection with a lode, and have been worked as stockworks, eg, at Wherry Mine [468 293]. Near the apical regions of the granites, closely-spaced, sub-parallel, greisen-bordered veins are common and are sporadically mineralised: the St Michael's Mount granite is typical, with cassiterite, wolframite and stannite.

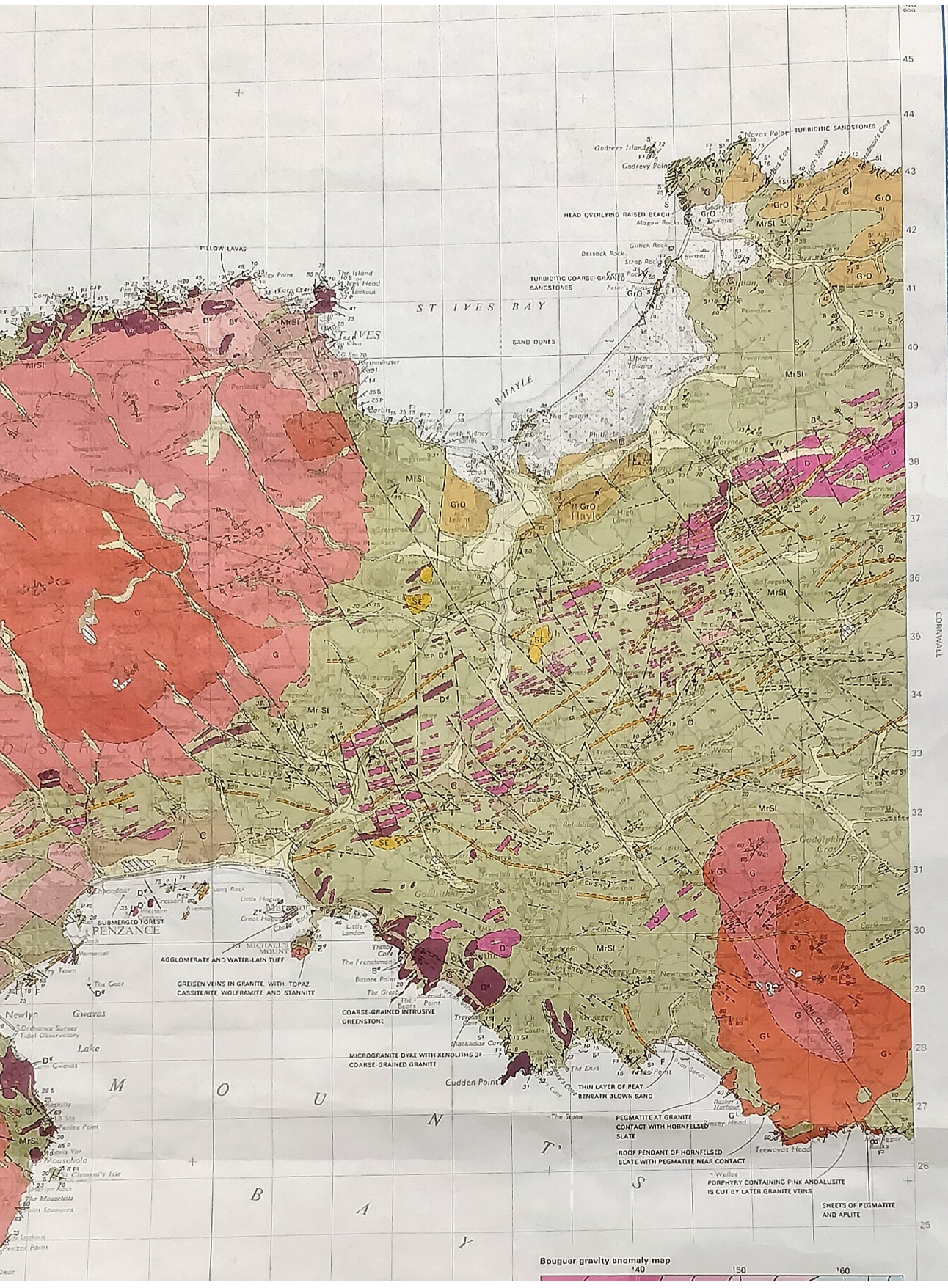
Of the many workings, only Geevor Mine [375 345] is now active, producing ore from narrow, complex lodes that have been worked mainly within the granite. The workings are approximately 600 m deep, and exploration seawards and in depth has been permitted by the dewatering of Levant Mine [369 345]. The latter produced mainly copper from narrow lodes in the country rock; it is possible that tin occurs below.

Alluvial deposits have been widely worked for stream tin in the past, mostly on a small scale.

R.T.Taylor, A.J.J.Goode



abundantly megacrystic (>10%)
moderately megacrystic (5-10%)
poorly megacrystic (<5%)
Medium and coarse-grained granite with large (>15mm) megacrysts
abundantly megacrystic
poorly megacrystic
Fine-grained granite
Devonian rocks
Scale
0 5 10 km
PILLOW LAVAS
GRANITE VEINS CUTTING HORNFELSED SLATE
PILLOW LAVAS AND GREENSTONE SILLS DIPPING NORTHWARDS
GRANITE CUPOLA CAPPED BY LAYERS OF PEGMATITE AND APLITE : GRANITE VEINS CUTTING HORNFELSED SLATE
SHEET OF MEGACRYSTIC FINE-GRAINED GRANITE
HEAD OVERLYING RAISED BEACH
GARNET-MAGNETITE SKARN CUT BY A LATER GARNET VEIN
METASOMATISED GREENSTONE INCLUDING HORNBLENDE-PLAGIOCLASE ROCK AND CORDIERITE-ANTHOPHYLLITE ROCK
GRANITE CONTACT WITH HORNFELSED SLATE EXPOSED IN FORESHORE
IRREGULAR BODIES OF PEGMATITE IN GRANITE
HEAD OVERLYING RAISED BEACH
HEAD OVERLYING RAISED BEACH
IRREGULAR SHEETS OF FINE-GRAINED GRANITE
HEAD OVERLYING RAISED BEACH
SHEET OF FINE-GRAINED GRANITE
SHEET OF FINE-GRAINED GRANITE
SHEET OF FINE-GRAINED GRANITE DIPPING NORTH EASTWARDS
HEAD OVERLYING RAISED BEACH
GREENSTONE WITH SOME HORNFELSED SLATE OVERLYING GRANITE
SUBMERGED FOREST
AGGLOMERATE AND WATER-LAIN TUFF
GREISEN VEINS IN GRANITE, WITH TOPAZ, CASSITERITE, WOLFRAMITE AND STANNITE
COARSE-GRAINED INTRUSIVE GREENSTONE
MICROGRANITE DYKE WITH XENOL COARSE-GRAINED GRANITE
ST IVES
PENWITH DISTRICT
PENZANCE
LAND'S END
ST JUST
Morvah
Zennor
Madron
Sancreed
St Buryan
Sennen
Newlyn
Mousehole
Whitesand Bay
Cape Cornwall
Gwennap Head
Gwavas Lake
MOUNT'S BAY
MICHAEL'S MOUNT
Marazion



SHEET 351 & 35

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EXPLANATION OF GEOLO SYMBOLS AND COLOU

DRIFT

QUATERNARY

- Landslip
- Blown Sand
- Marine Beach (sand and gravel)
- Marine and Estuarine Alluvium
- Lower Raised Beach
- Upper Raised Beach
- Alluvium
- Alluvial Fan
- Terrace, undifferentiated
- Head

SOLID

PLIOCENE
- SE — St Erth Beds

DEVONIAN
- MrSl — Mylor Slates
- S — Sandstone in Mylor Slates
- GrO — Gramscatho Beds
- sl — Slates in Gramscatho Beds

CRETACEOUS

IGNEOUS ROCKS

- N — Phonolite of Wolf Rock

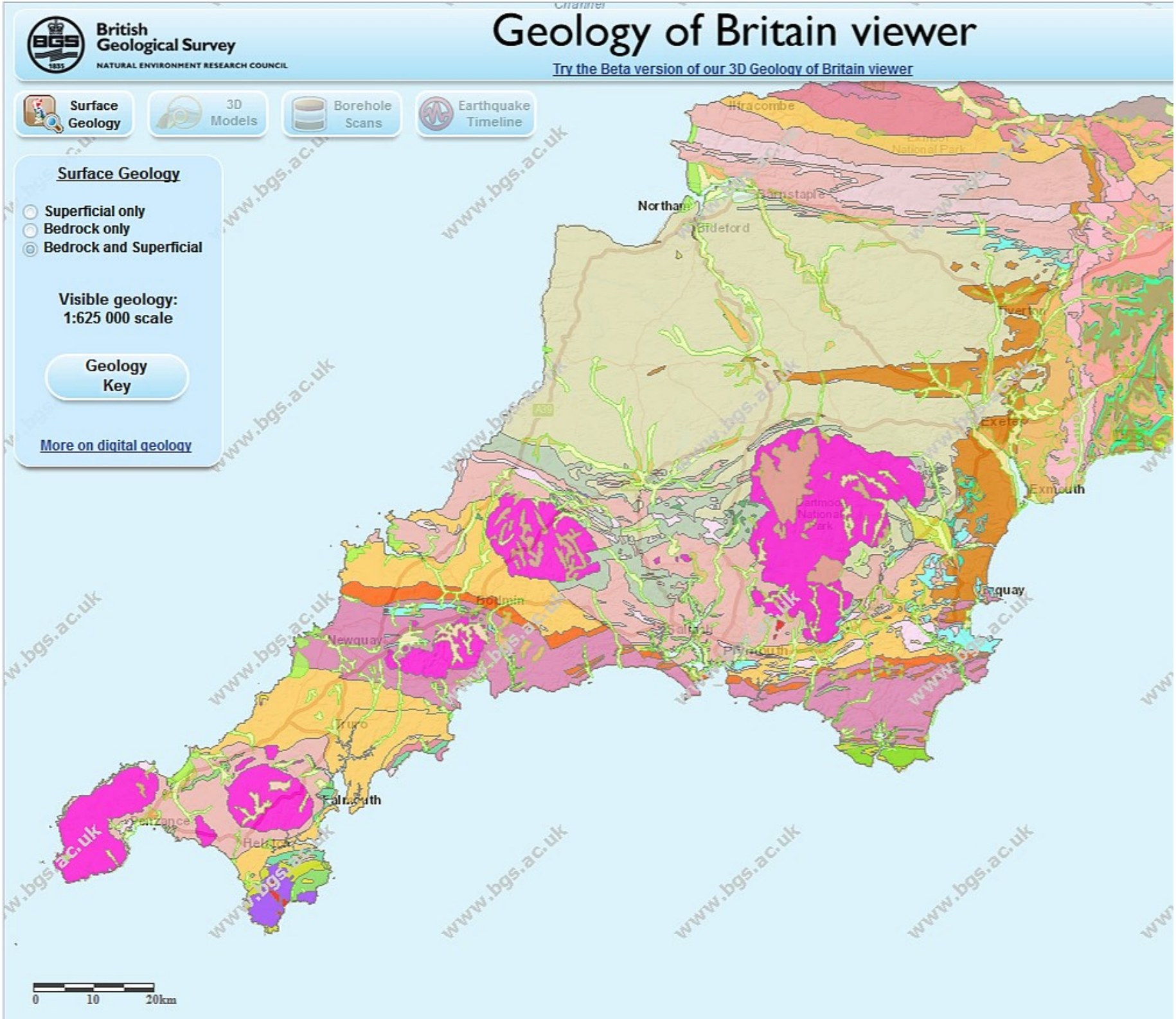
PERMIAN
- F — Quartz-porphyry, felsite and microg

CARBONIFEROUS
- Aplite
- G — Biotite-granite, medium and coarse-
- G — Biotite-granite, fine-grained
- G — Lithium-mica granite
- Lamprophyre

DEVONIAN & / CARBONIFEROUS
- D — Metabasic rocks, undifferentiated
- Metagabbro and metadolerite
- B — Metabasic volcanic rocks, pillow la
- Metabasic volcanic rocks, agglome

DEVONIAN
- Contact metamorphic aureole sur

- Horizontal strata
- 50 — Inclined strata, dip in degrees, dir
- 20 — Inclined strata, dip in degrees, no
- 42 — Inclined strata, dip in degrees, inv
- Vertical strata
- 13 — Foliation inclined, dip in degrees
  'S' denotes foliation parallel to b
- Foliation vertical
- 35 — Cleavage inclined, dip in degrees
  'P' denotes crenulation cleavage
  'P2' denotes crenulation cleavag
  'S1' denotes cleavage related to
  'S2' denotes cleavage related to
  'S3' denotes cleavage related to
- Cleavage, vertical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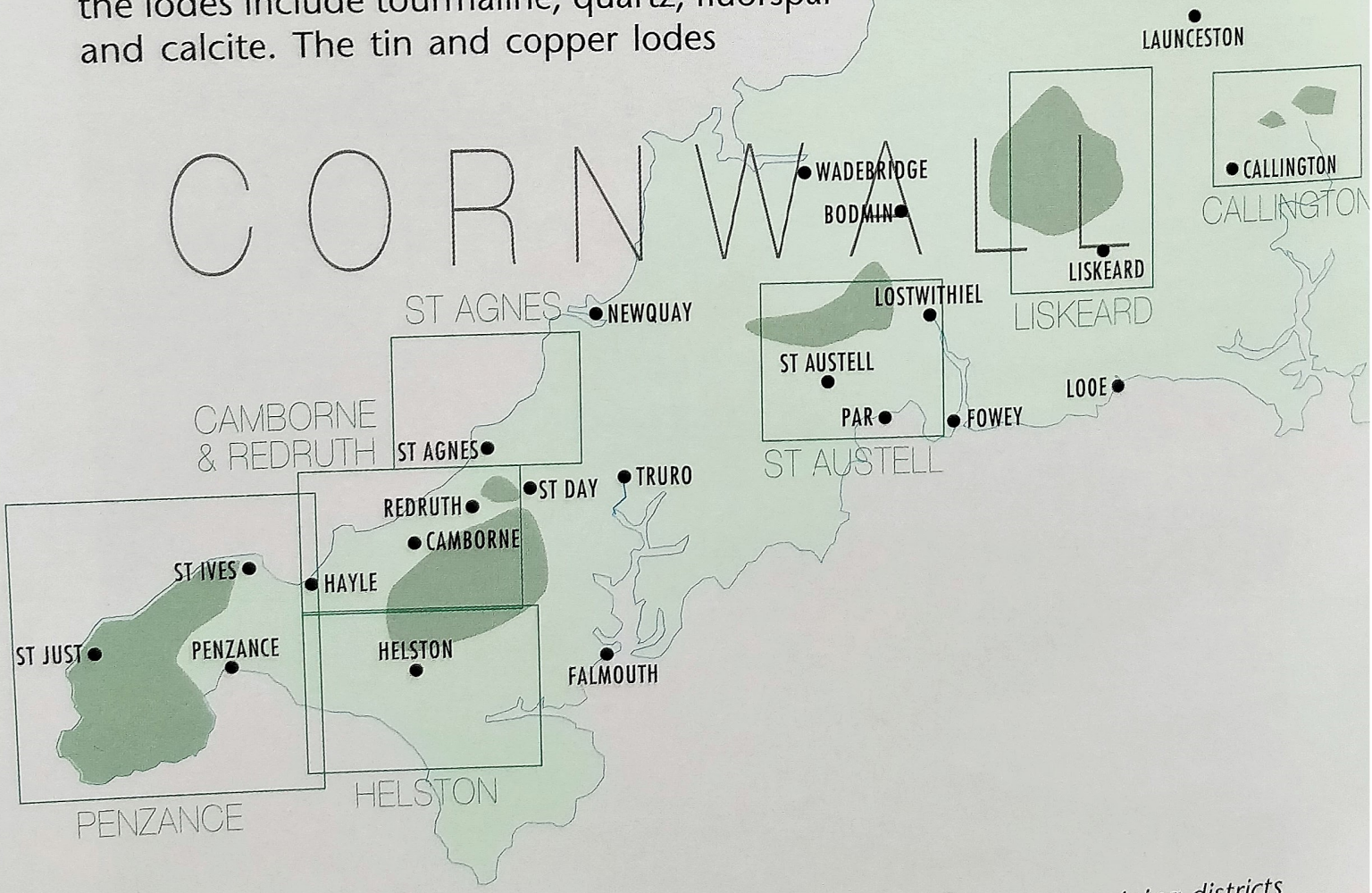
Superficial only
Bedrock only
Bedrock and Superficial
Visible geology:
1:625 000 scale
Geology Key
More on digital geology
Ilfracombe
Barnstaple
Bideford
Exeter
Exmouth
Newquay
Truro
Falmouth
Penzance
Helston
Plymouth
0
10
20km

GEOLOGY

Cornwall's mineral wealth lies in its geology. The spine of the peninsula is formed by granite uplands from Dartmoor (Devon) westwards through Bodmin Moor, Hensbarrow, Carnmenellis, and West Penwith, with the Isles of Scilly beyond. Lesser outcrops of granite associated with mining include Carn Brea, Carn Marth, Castle-an-Dinas, Hingston Down, Kit Hill, St Agnes and Tregonning. These were intruded as molten bosses beneath older rocks about 280 million years ago, and have been revealed by subsequent erosion. Around each granite margin is the metamorphic aureole, a ring of baked rocks known locally as killas. It is here that the richest mining districts of Cornwall are found.

During a late cooling stage of the molten granite, fissures opened up into which passed mineralising fluids combined with circulating water which cooled to form mineral lodes. Normally the vertical order of deposition of minerals upwards is tin, copper, zinc lead and iron. Unwanted 'gangue' minerals in the lodes include tourmaline, quartz, fluorspar and calcite. The tin and copper lodes



Cornwall showing the location of the mining districts

TIN

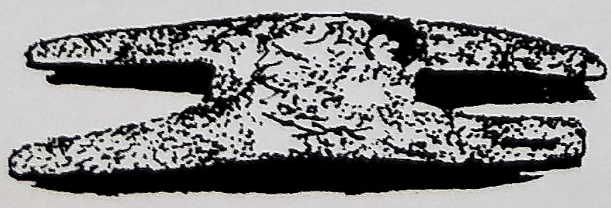
The occurrence of tin is much rarer than other metals such as copper or iron, and although only a small amount was added to copper to make bronze, its scarcity must have made Cornwall an important source in prehistoric Britain and Europe. There is no proof that Bronze Age peoples worked tin here, but it is perhaps no coincidence that their abundant villages and stone circles are close to where tin is later known to have been exploited on the moors of Bodmin Moor, Dartmoor and West Penwith.

The earliest tin workings were not mines but streamworks. Past erosion of lodes had removed tin stones (cassiterite), sorted and deposited them in valley gravels where they could be worked relatively easily by washing away the lighter material. As methods improved over the centuries, increasingly poorer deposits could be worked, so many valley floors have been turned over time and time again, often destroying any earlier evidence.

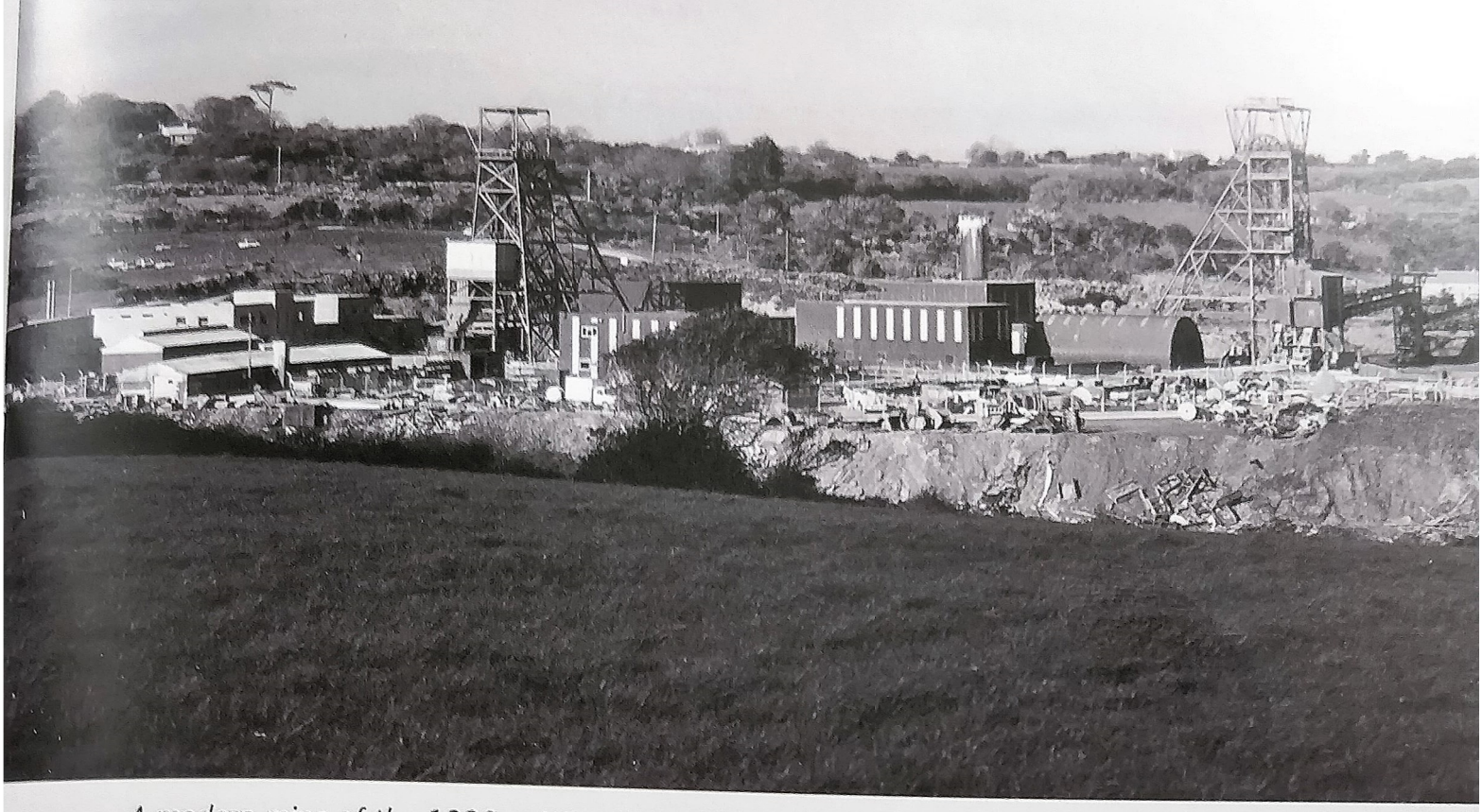
It is known that tin was traded with the Mediterranean world in Iron Age times. In the first century BC, Diodorus Siculus described how the people of Belerion (Land's End) prepared the tin, carefully working the ground containing 'earthy veins, the produce of which is ground down, smelted and purified.' This seems to be a clear reference to tin-streaming. The industry was well established, with the locals trading their tin with merchants on an island named Ictis, generally considered to be St Michael's Mount, although there are other contenders as far east as the Isle of Wight. A fine ingot from this period has been dredged from St Mawes harbour and is now in the Royal Cornwall Museum at Truro. The Romans took an interest in Cornish tin after their Spanish source failed in the third century AD, and an ingot from Carnanton is said to have been marked with a Roman stamp.

In medieval times streamworks were still abundant, but there were shallow workings along some lodes. Dartmoor became the greatest tin producer in Europe in the Middle Ages, but the easily worked streams soon ran out and Cornwall regained its pre-eminence. Uses of tin at this time included cannons and bells of bronze (with copper), although articles of pewter (with lead) were still luxuries.

The tin industries of Cornwall and Devon were regulated by the ancient Stannaries, which held jurisdiction over large areas, similar to the lead mining districts of the Mendips and Peak District. The first known charter of 1201 confirmed the tinners' right of 'bounding' to search and dig for tin on unenclosed common land and to divert any stream for their use. There were Stannary Courts and a Parliament which met periodically to pass and amend the law. Heavy penalties were imposed on offenders by the courts and Lydford,



Tin ingot dredged up from St Mawes harbour.



A modern mine of the 1980s - Wheal Jane, showing Clemow's and No. 2 Shafts, now abandoned
M.J.M.

on the edge of Dartmoor, still has the ruins of a formidable gaol. Cornwall's was at Lostwithiel.

The system of coinage took place at the towns of Liskeard, Lostwithiel, Helston and Truro, with Penzance added in 1663. The first two were later replaced by Calstock, Hayle and St Austell. Each ingot was weighed to assess the duty to be paid to the Duke of Cornwall and a corner, or 'coign', was struck off to be assayed for quality. The tin block was stamped with the Duchy seal and only then could it be sold. Coinage ceased in 1838 and the courts in 1896, although the stannary charters have never been repealed.

Stream tin and shallow mining could not meet increasing demand, but the main obstacle to deep mining was the removal of water. Pumps worked by waterwheels had their limitations, so it was timely that the eighteenth century saw the application of steam power to pumping. The story of these developments in Cornwall was linked more closely with the rapid rise of copper mining. First came the beam engines of Newcomen and Watt, developed further by Cornish engineers like Richard Trevithick and Arthur Woolf. The Cornish beam engine reached perfection in the nineteenth century, initially for pumping, and then for winding and ore crushing.

Early tin mines of importance were Great Work and Wheal Vor, recorded as active in the fifteenth century. The greatest tin mine was Dolcoath at Camborne, successful first for copper, but when this started to fail in the 1840s the mine was able to turn to deep tin, something which occurred at many other mines. This celebrated mine became a major tin producer by the end of the nineteenth century, and reached a depth of 550 fathoms