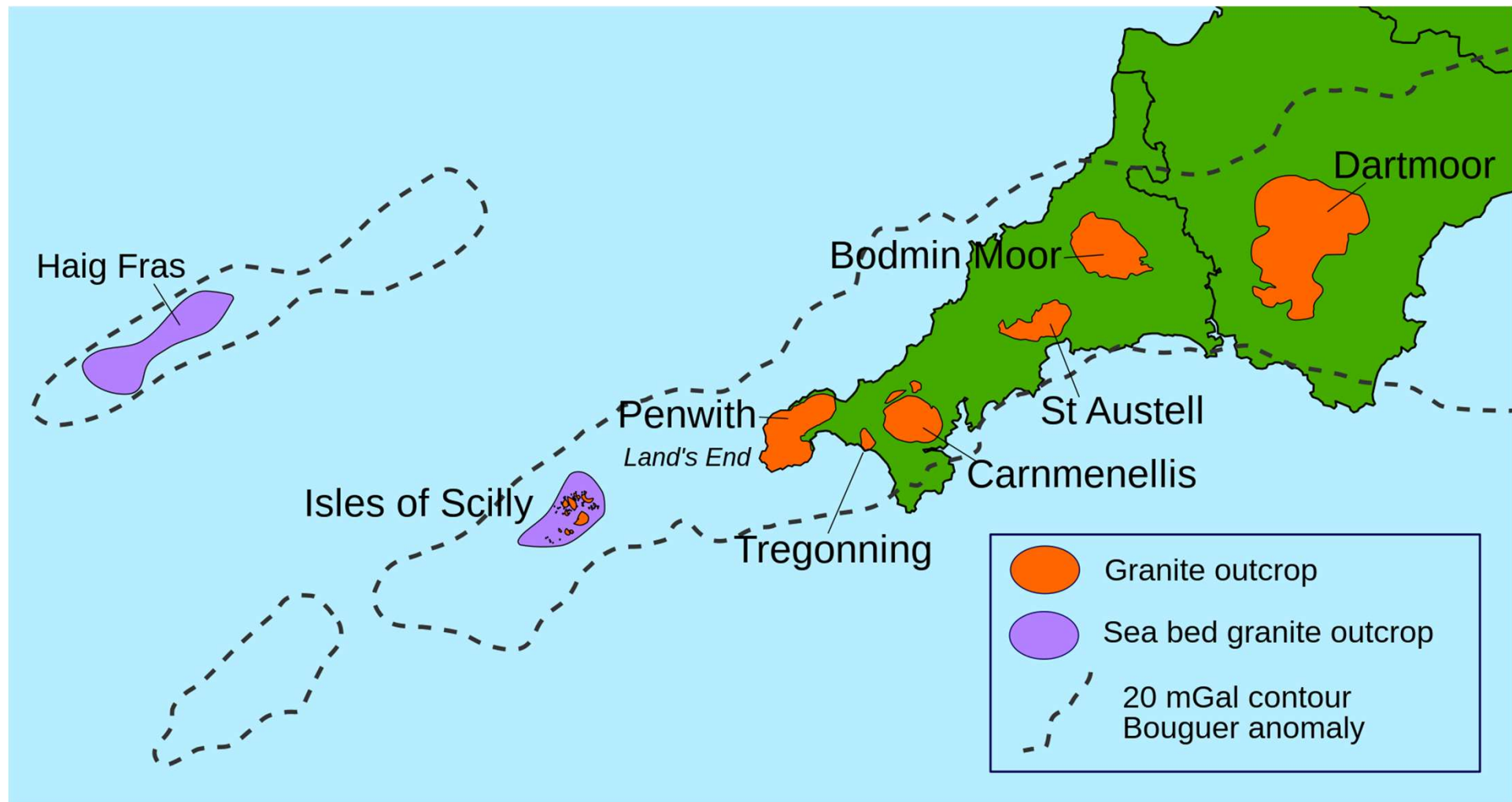


Scilly Isles and Lundy in the last Ice Age

Random observations at speed during holidays in 2022 with some later research

ISLES OF SCILLY

- During the last Ice Age, 21,000 years ago, a large glacier flowed southwards down the Irish Sea Basin reaching as far as the northern extremities of Bryher, Tresco and St Martin's.
- South of this ice limit, cold tundra conditions resulted in the accumulation of orange-brown grit deposits known locally as "Ram" and previously quarried for making concrete blocks, lintels, road aggregate etc . This ram is still visible in the cliffs around the island.
- As the climate warmed and the ice melted, it would initially have been possible to walk from Scilly to Cornwall and possibly further afield, but eventually sea levels rose, forming a large single island, and ultimately the archipelago we see today.







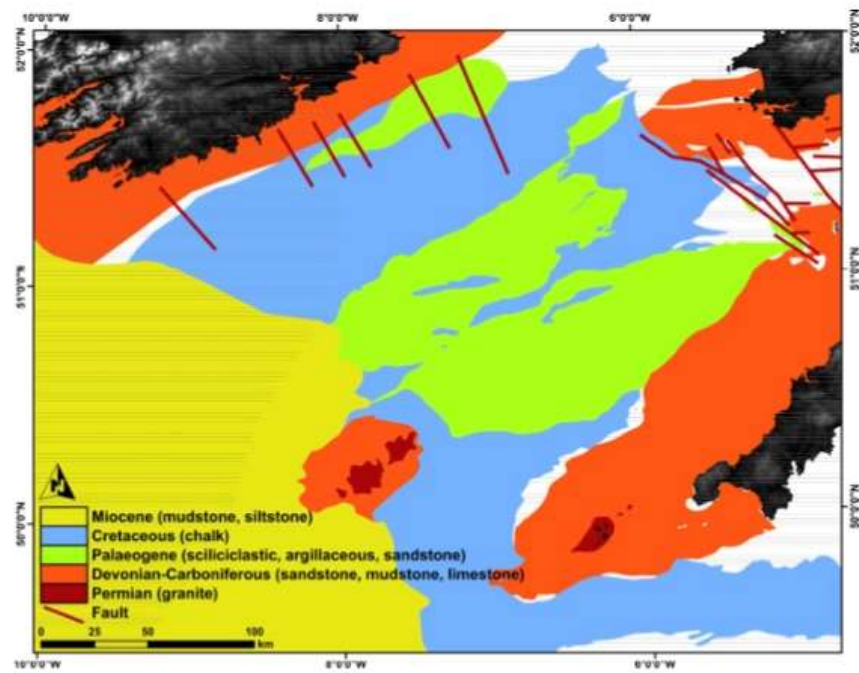


Figure 1.6 - Map showing the primary sub-Quaternary geology of the Celtic Sea shelf (BGS, 2013, 1979).

Periglacial material – known locally as Ram



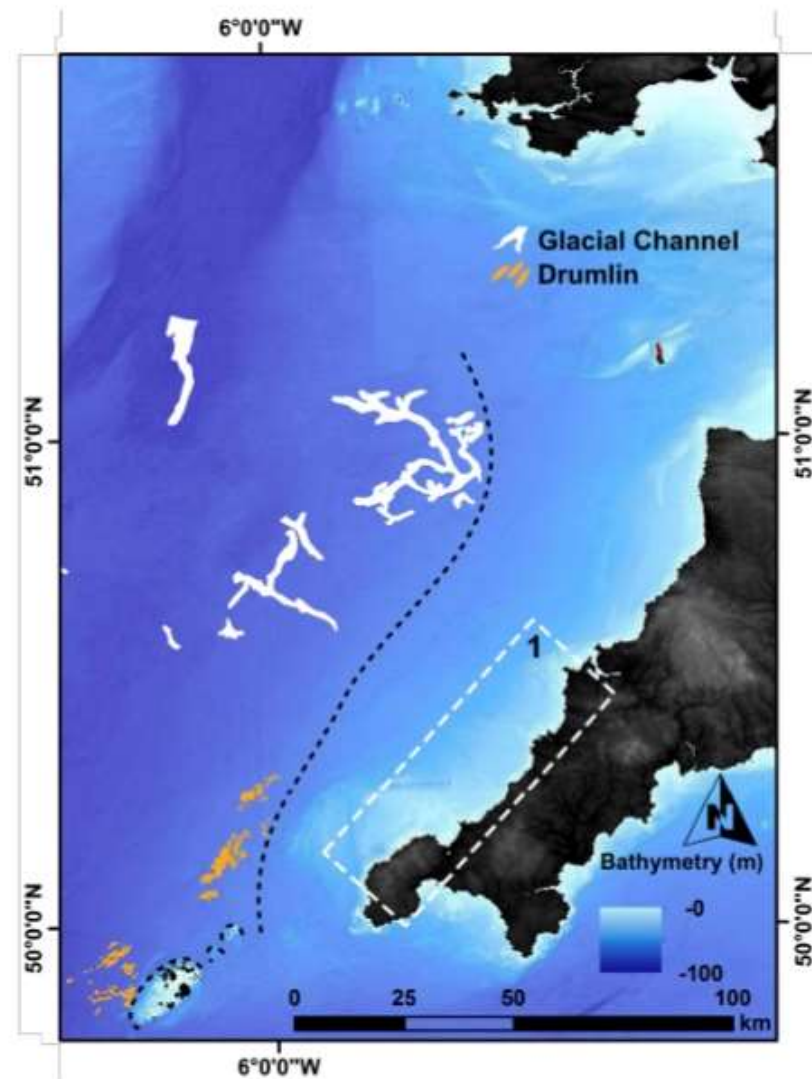
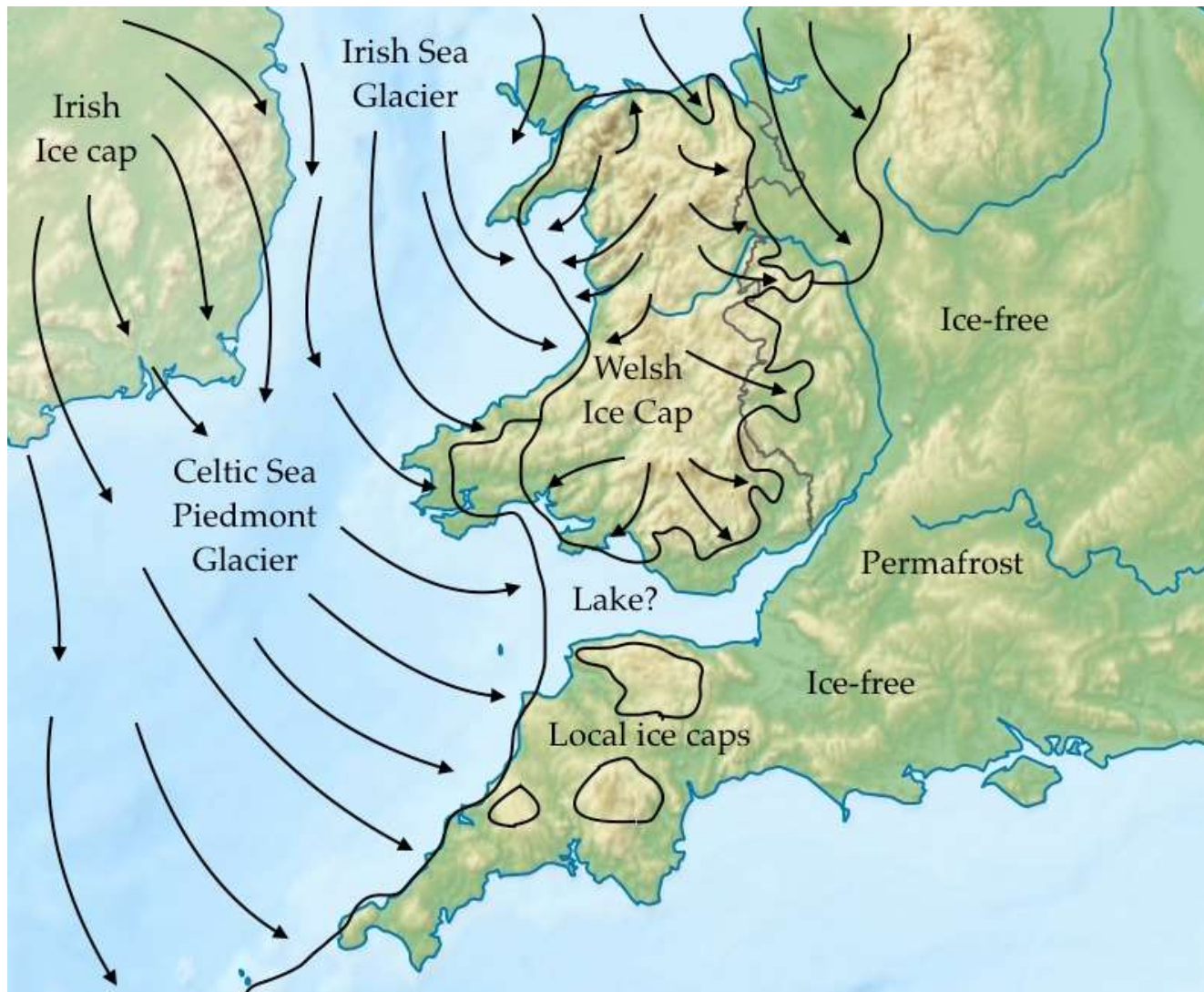
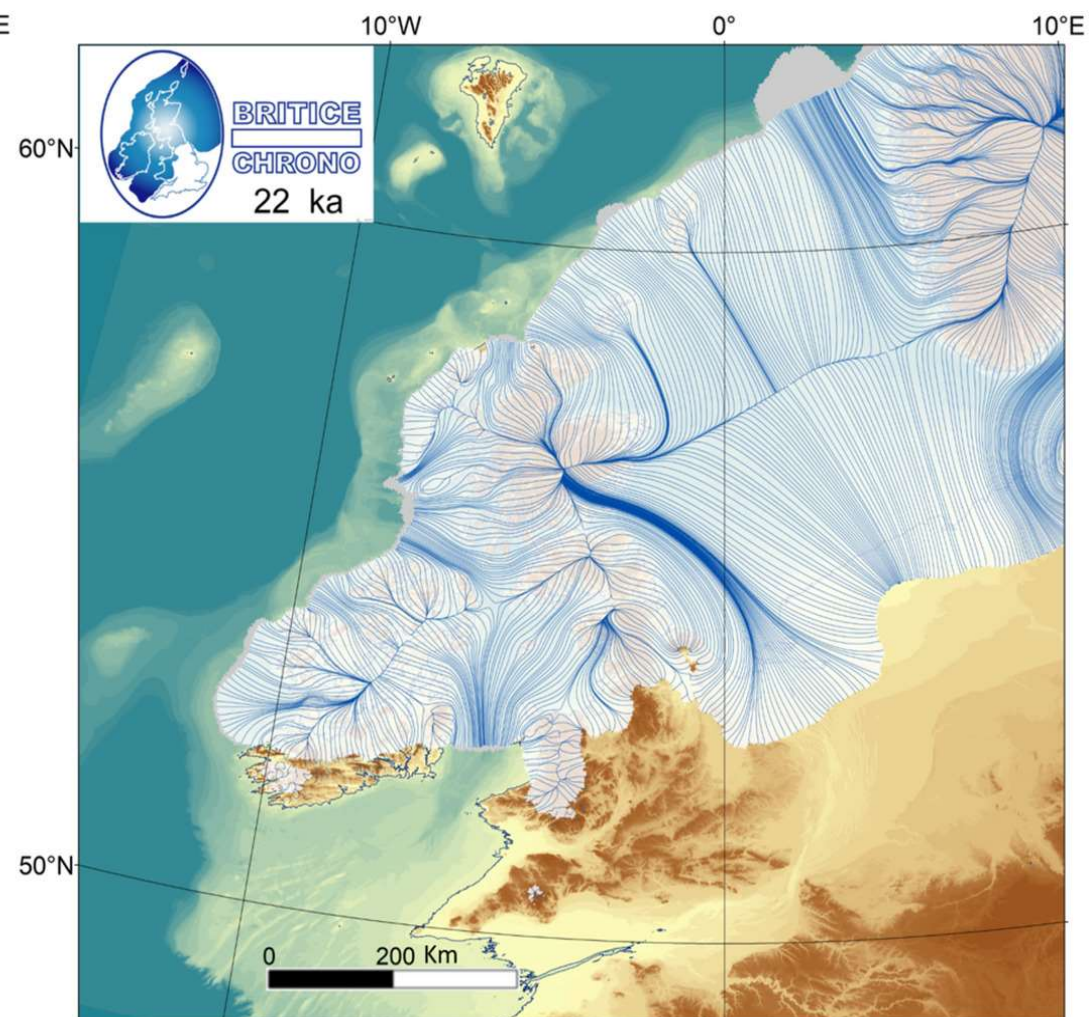
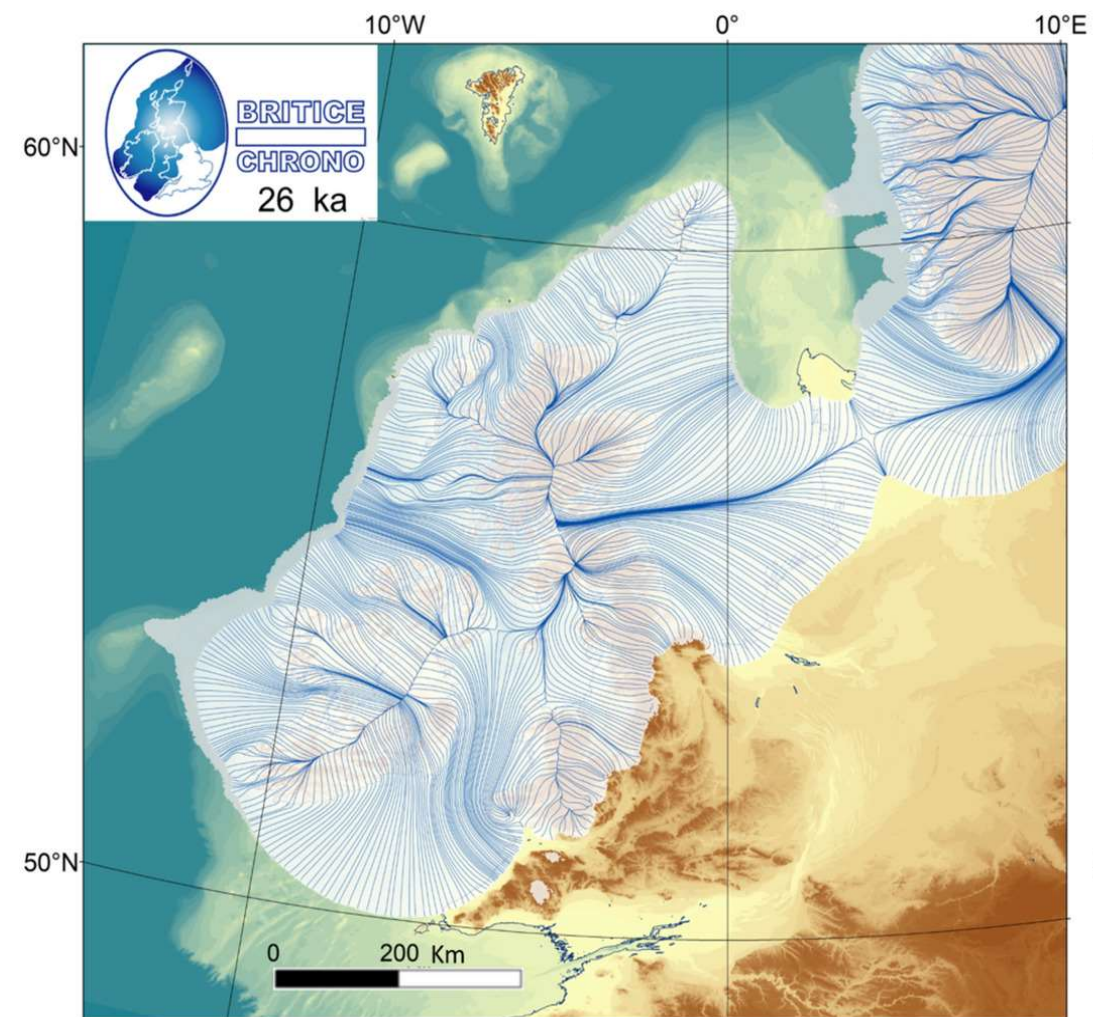


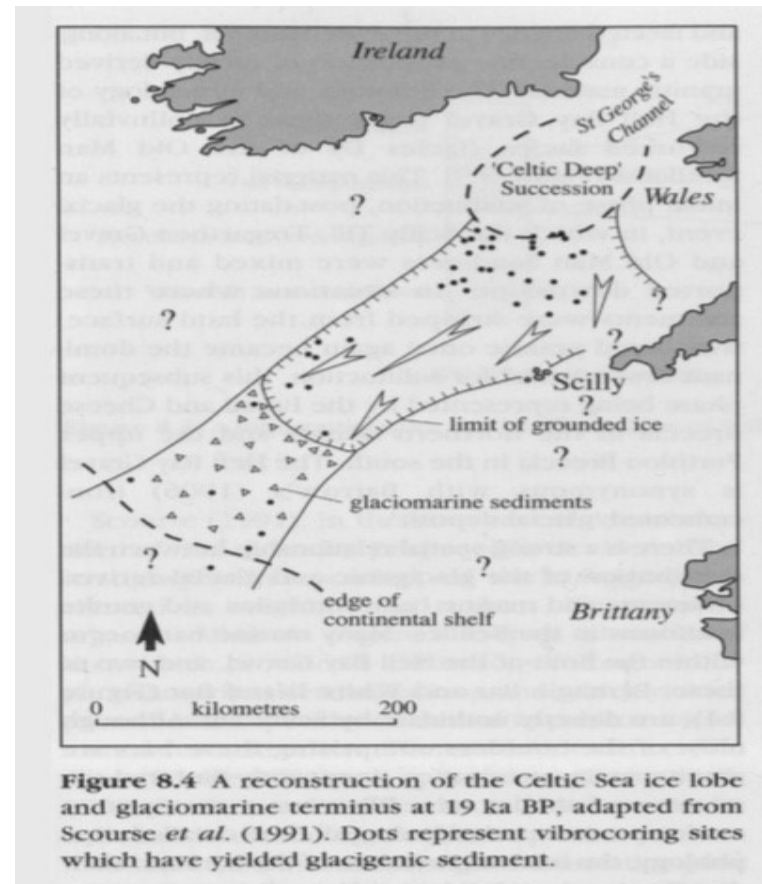
Figure 5.3 - Map showing the limit of glacial features on the eastern inner-shelf at the present-day 70 m isobath (dashed).

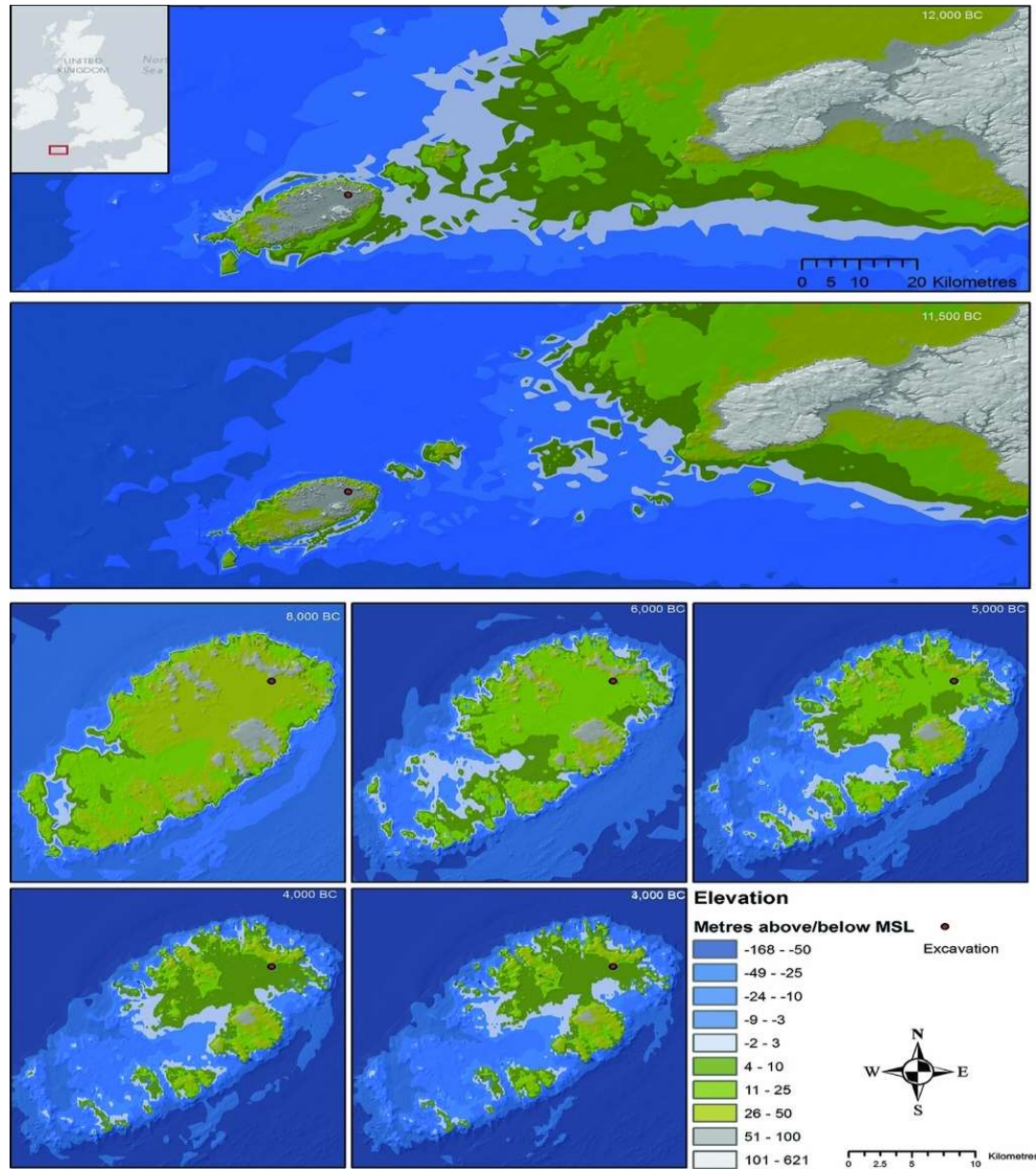


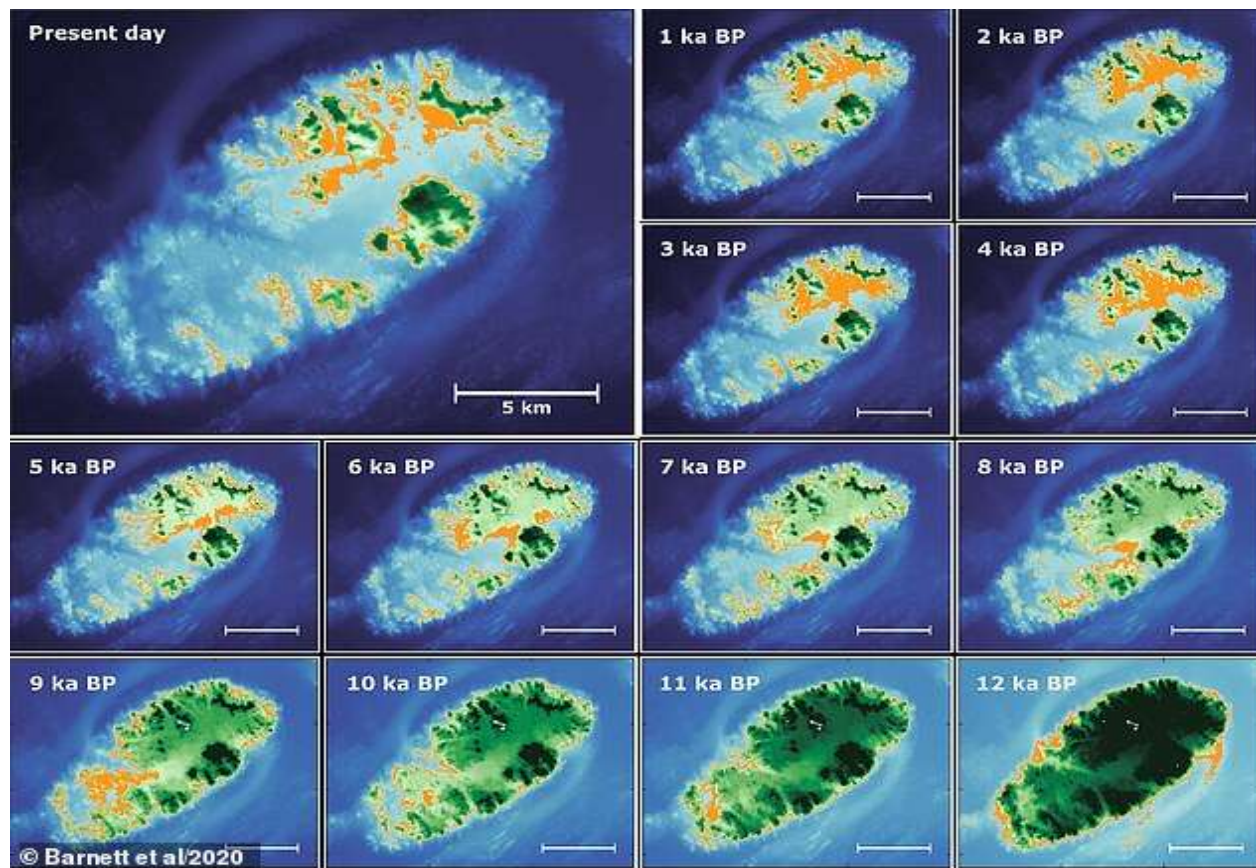
Devensian Glacial
Maximum – according
to Dr Brian Johns



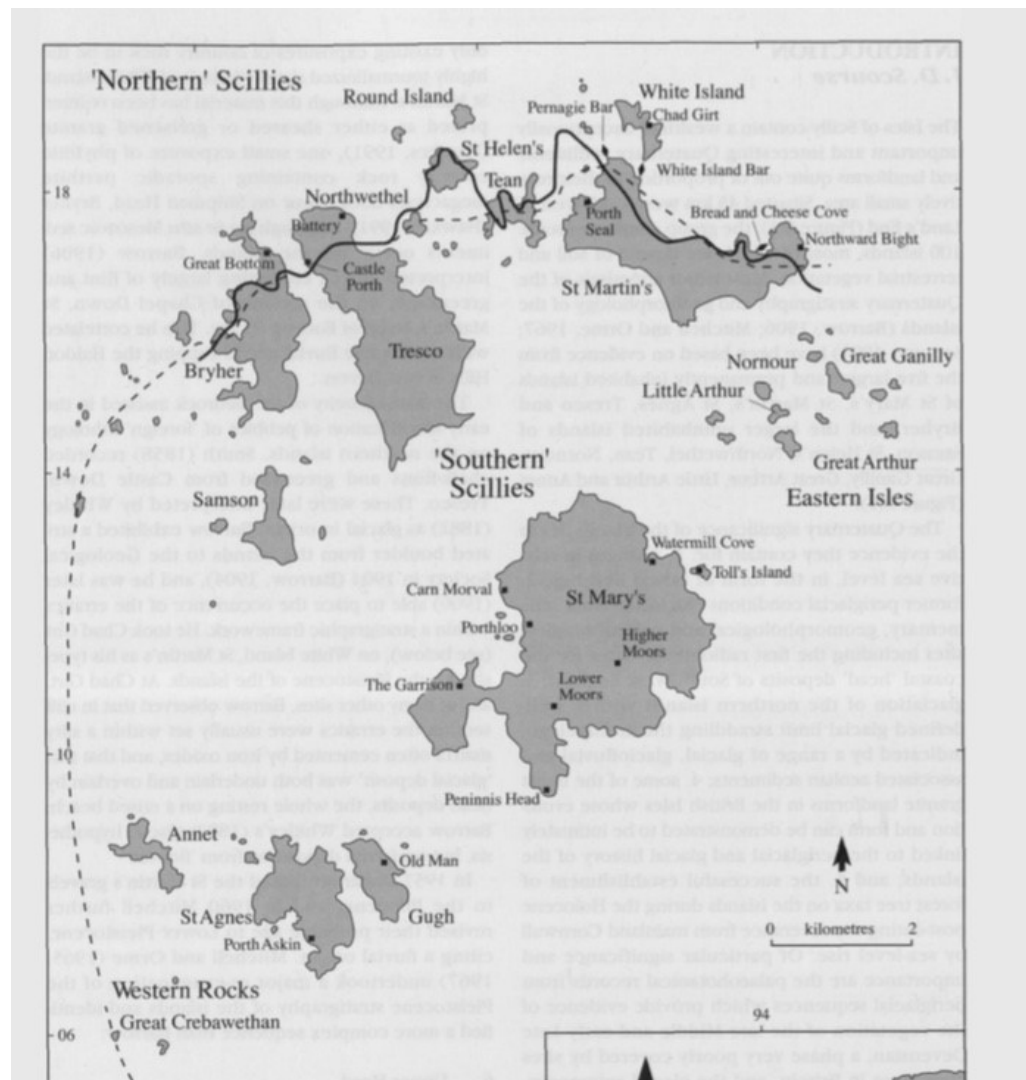
Devensian Glaciation in Scilly

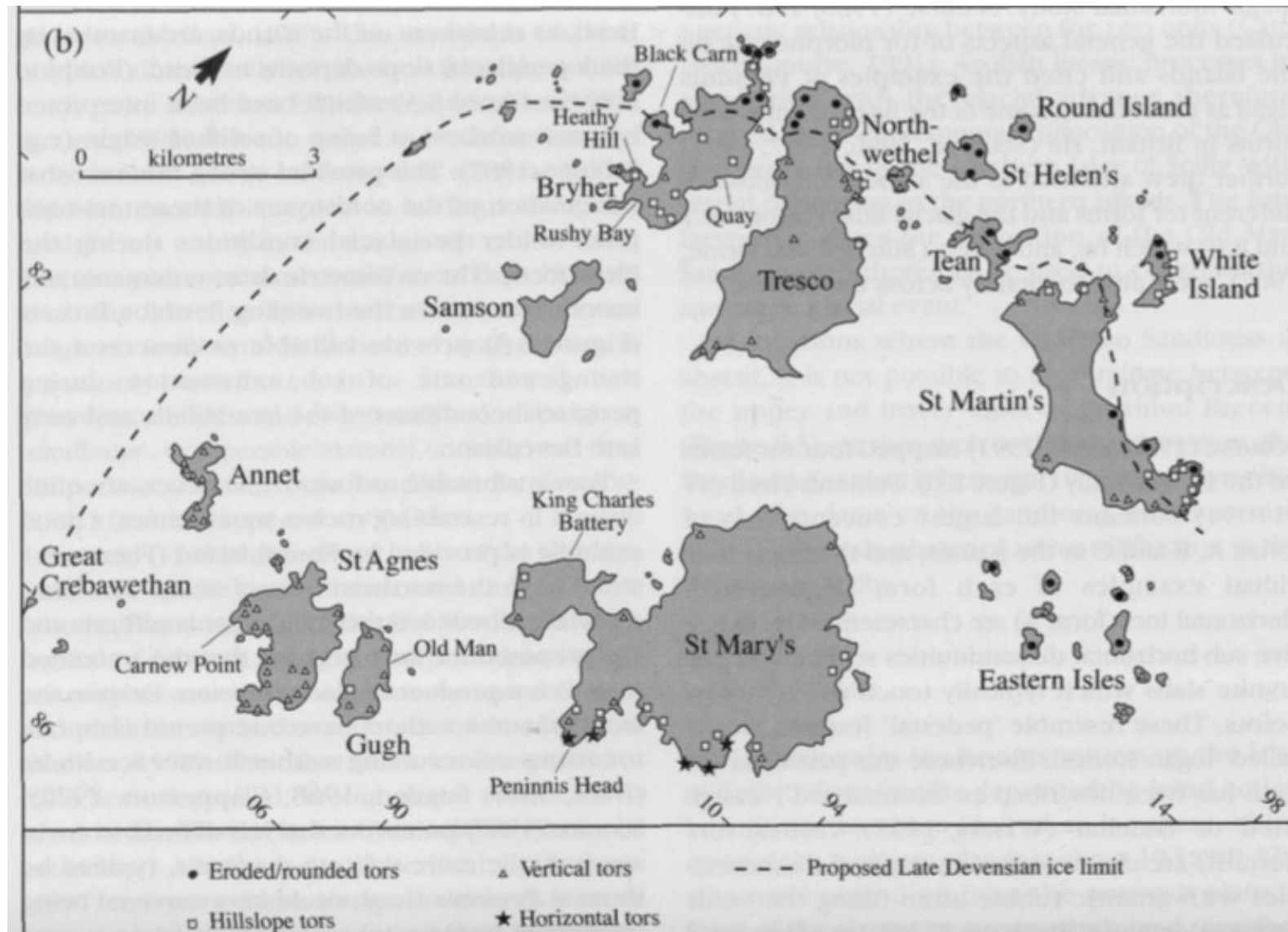












Peninniss Head



This site contains some of the most spectacular granite landforms in the British Isles. These include the finest development on the Isles of Scilly of the 'castellated' or 'mammilated' tor forms which are characteristically found only outside the glacial limit which straddles the islands.



St Agnes



The lower slopes of tors at Peninnis Head, as elsewhere on the islands, are mantled by thick periglacial slope deposits or 'head' (Porthloo Breccia) which have been interpreted by most researchers as being of solifluvial origin (e.g. Scourse, 1987). This provides strong evidence that exhumation of the corestones of these tors took place under periglacial conditions during the Pleistocene. The radiometric dates on organic sediments from within the mantling Porthloo Breccia provide valuable evidence on the timing and rate of tor exhumation during periglacial conditions of the late Middle and early Late Devensian.

St Agnes



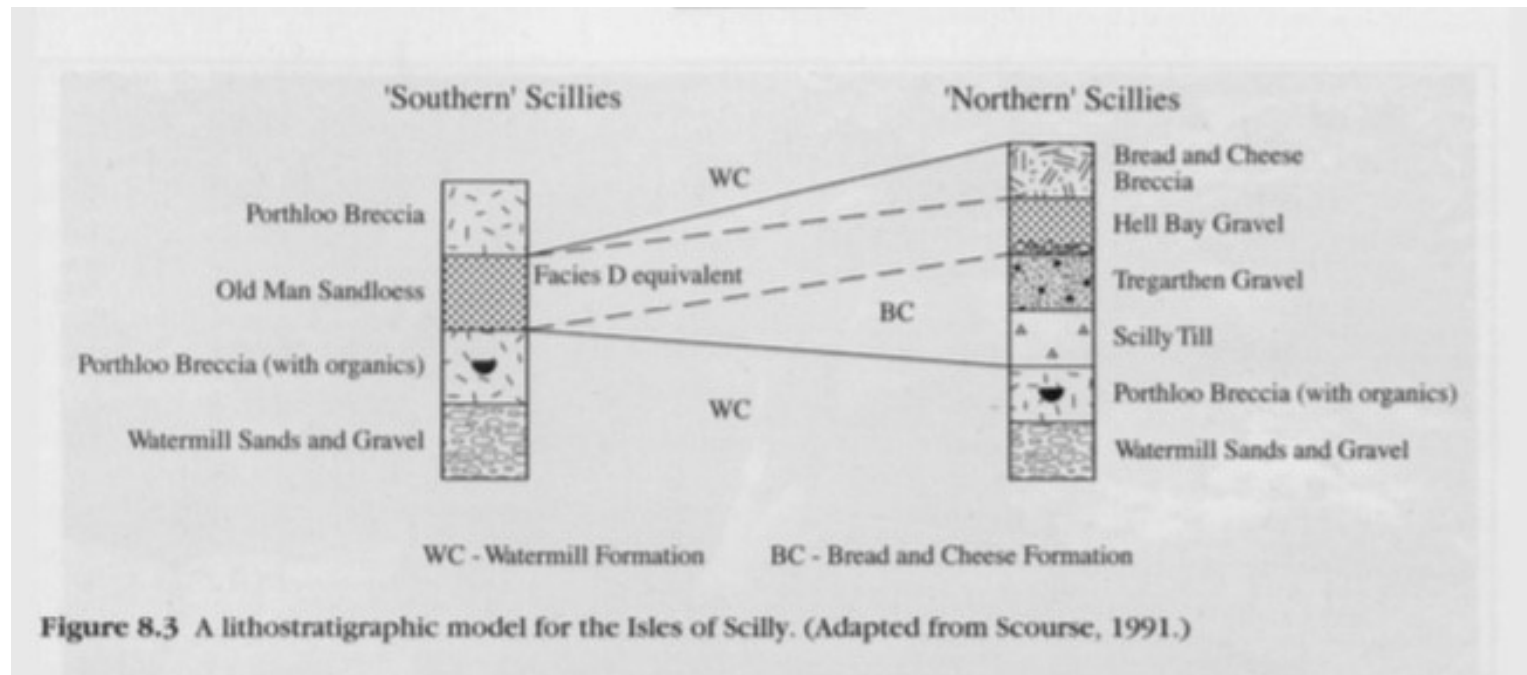
Piece of flint balanced by another Geologist?!
North End Brhrer



Windmill Cove St Marys – Peat deposit From Ice age pond



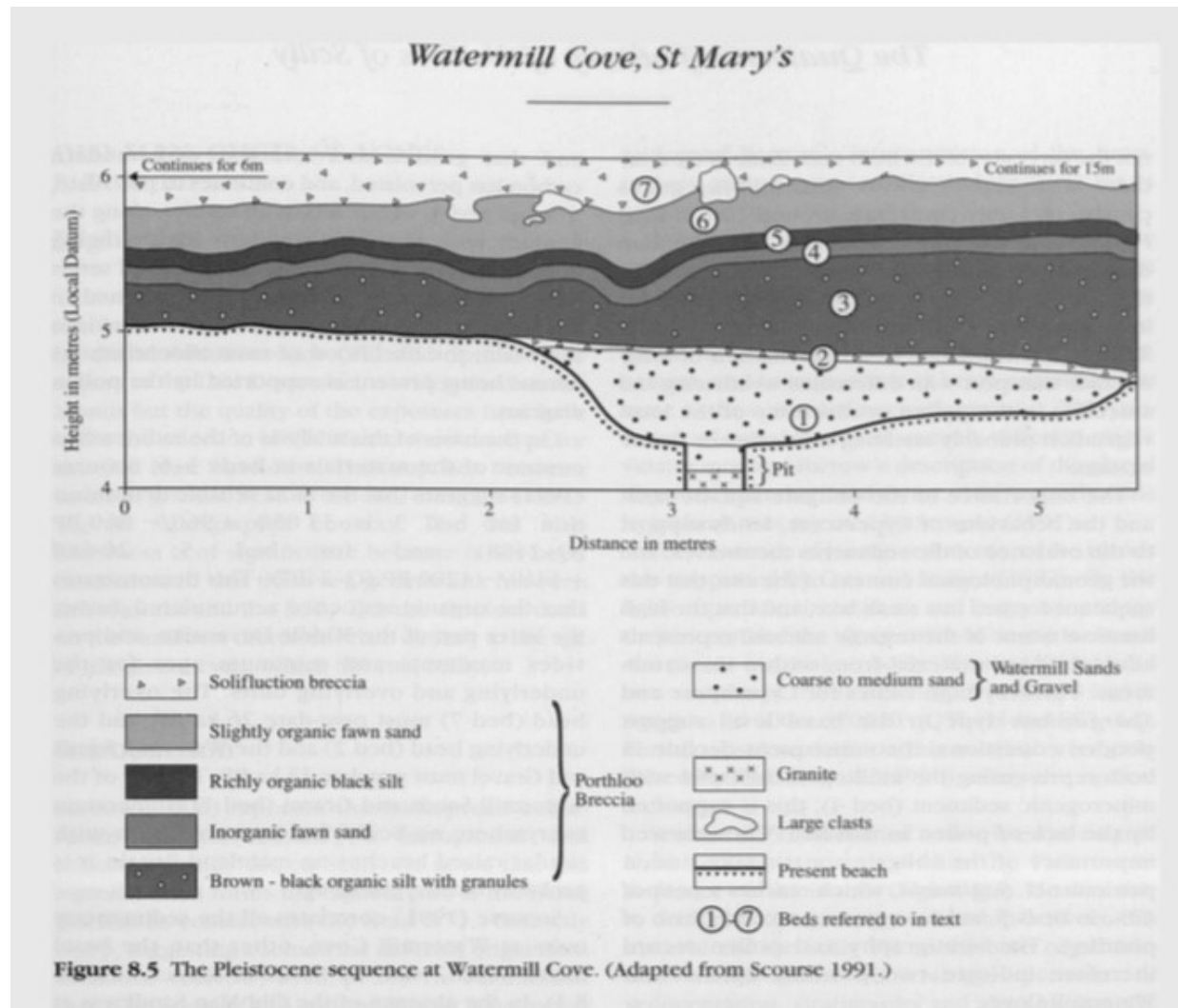
Dates obtained from Watermill help correlate glacial deposits in rest of Scilly



Windmill Cove



Watermill Cove



Presence of spagnum moss spores suggest organic layer formed in pond.

Watermill Cove contains the best exposures on Scilly of raised beach sediments deposited in an interglacial temperate stage, before a glacier advanced as far as the northern islands around 19 ka BP. The site also contains excellent exposures of organic sediments deposited under cold tundra-like conditions between 33 ka and 26 ka BP. Pollen analysis of these sediments reveals an open grassland type vegetation with no trees.

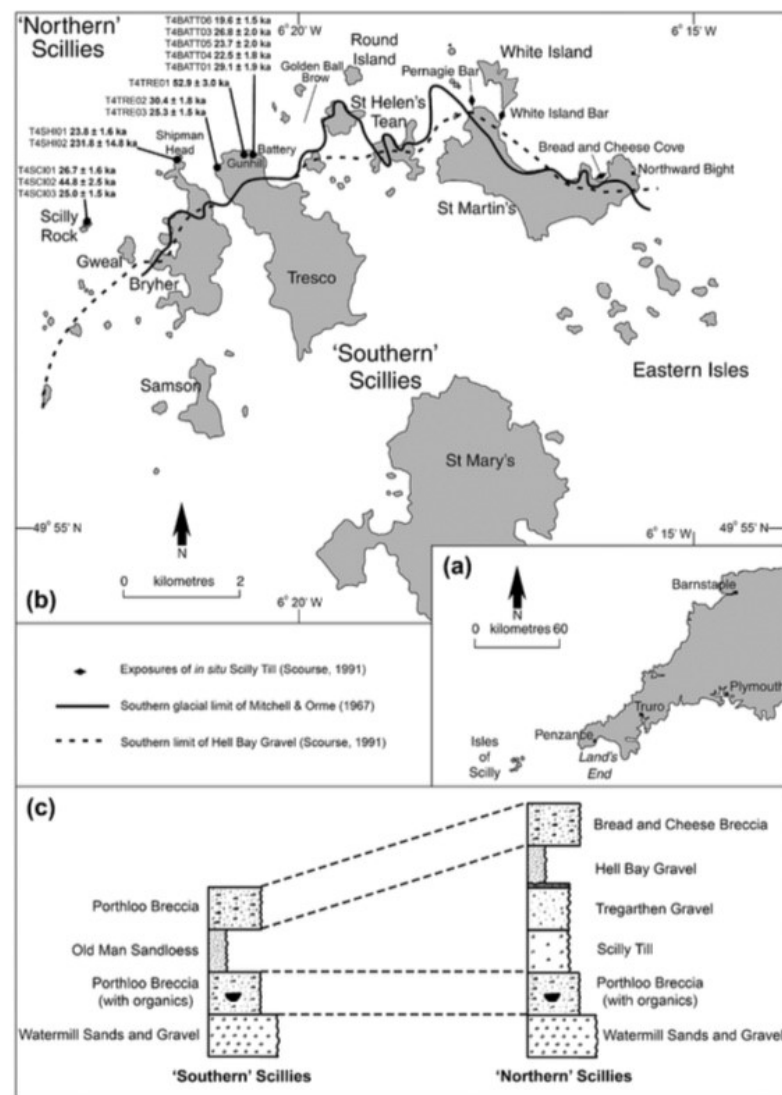


Figure 2. Location of the Isles of Scilly in south-west Britain (a). The northern Isles of Scilly with the sites and associated dates discussed in the text where the inferred maximum ice limit is also shown (b). The lithostratigraphic models for the southern and northern Isles of Scilly (c; Scourse, 1991; Scourse and Furze, 2001; Scourse *et al.*, 2009a). The Scilly Till and Tregarthen Gravel represent primary *in situ* glacial units. The Hell Bay Gravel represents a soliflucted admixture of Old Man Sandloess, Tregarthen Gravel and Scilly Till. The Bread and Cheese Breccia and upper Porthloo Breccia represent a final phase of solifluction.

Looking over to Tresco – northern end-
absence of Tors.





Raised beach exposure in Porth Killier, St Agnes. Here the beach materials are overlain by up to 2m of windblown deposits and colluvium.

Bread and Cheese Cove St Martins



This is the type location for Scilly Till and the only place where there is organic material that is dateable underneath Glacial till. However this is much younger than that at Watermill cove at around 7-9000 BP rather than 30000 BP. Its thought this is due to contamination by younger C14 from more modern peat above.

Till – Bread and Cheese Cove St Martins



- The Scilly Till is extremely poorly sorted and crudely stratified with a number of sub-horizontal iron-stained sand partings up to 1 mm thick. The contained clasts are very freshly striated and faceted, and consist of a wide variety of lithologies, including Cretaceous flint, Variscan greywackes and quartzites, red sandstones and schistose metamorphic rocks, in addition to local granitic material (Hawkes, 1991).

Scilly Till – diamicton with faceted and striated erratics including flint and Devonian Sandstone





North End
Bryher
erratics in till?

Looking over to White Island from St Martins.
Tombola and ridge represent Moraine?



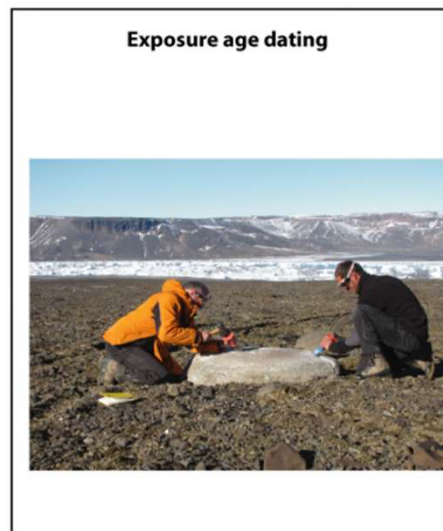
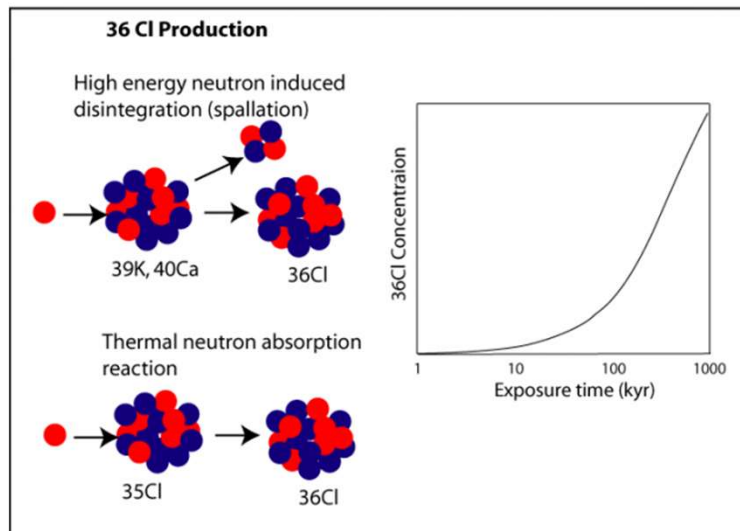
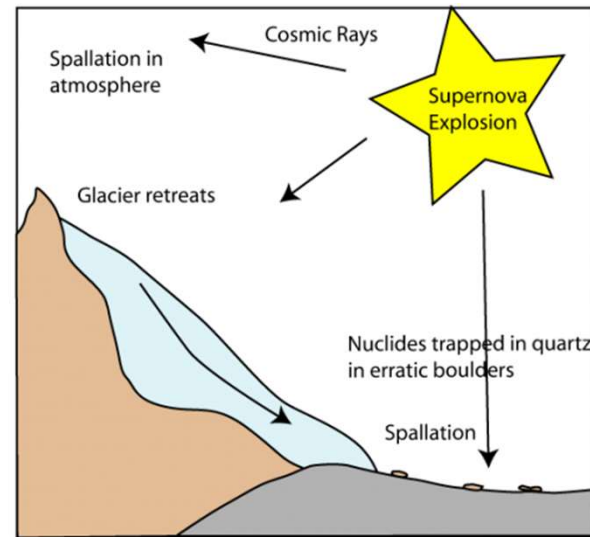
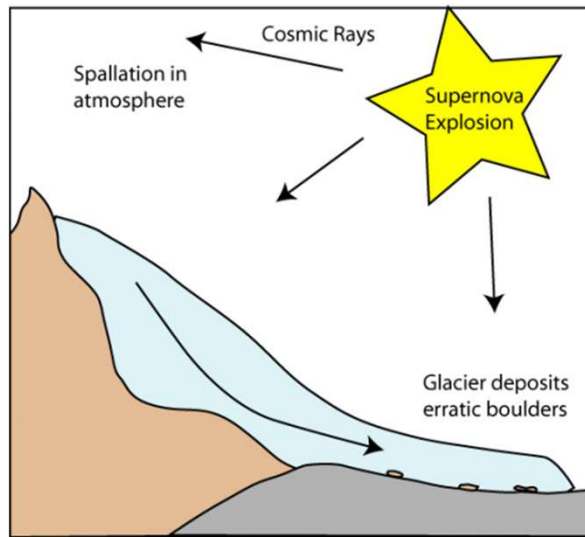
White Island North West St Martins – Whale back hills?



Clay-rich sediments lie under the boulder bar between White Island and St Martin's. The clay contains coarse particles of erratics, including sandstone, and was used by locals for making bread ovens. These clay sediments also contain microscopic needle-like particles of silica found in marine sponges, indicating that they were brought to Scilly from the Irish Sea Basin in the last glacier.

Beryllium 10 exposure dating - Terrestrial Cosmogenic Dating

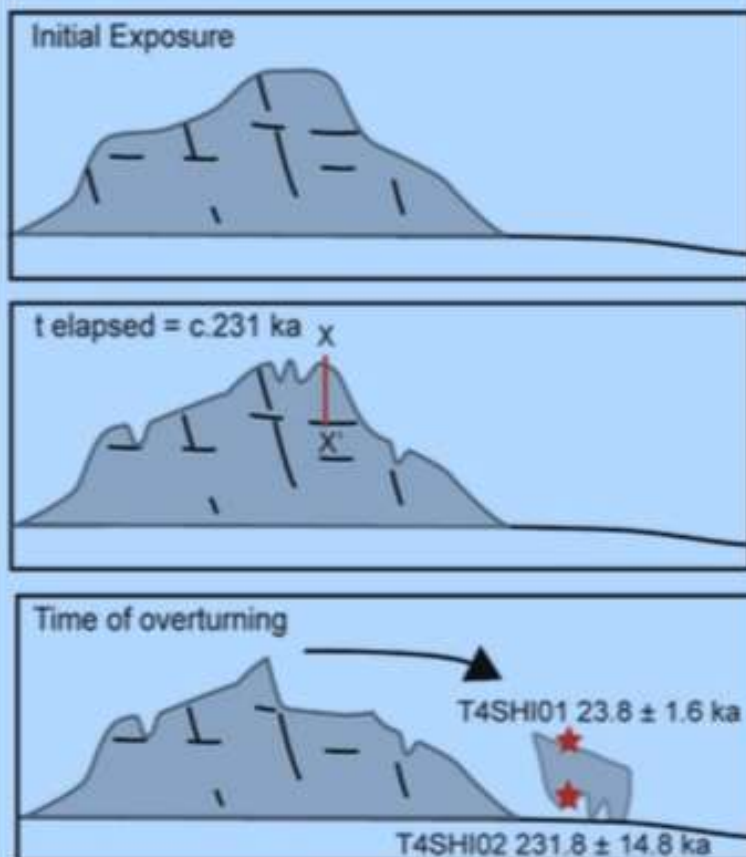
- Neutrons (along with much smaller amounts of muons) interact with minerals in rock surface producing *in situ* terrestrial cosmogenic nuclides, such as Be^{10} in quartz. The longer the exposure of the rock surface the greater the quantity of *in situ* terrestrial cosmogenic nuclides in that rock surface.



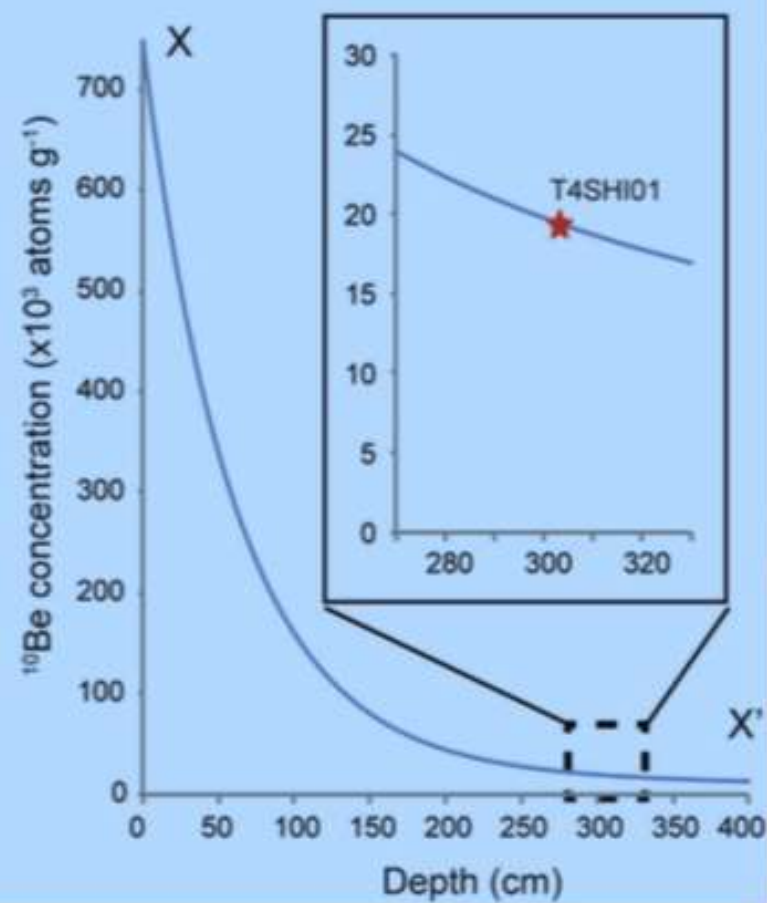
Cosmogenic nuclide dating or TCN (Terrestrial Cosmogenic Dating)

Reactions occur in minerals in the rocks upon bombardment by cosmic rays called spallation (capture of neutrons by atoms forming new elements). Quartz in the granites can be analyzed for Beryllium content which is formed in the quartz lattice by spallation reaction on the oxygen. The amount of Beryllium can be used to estimate date of exposure of rock face.

(a)



(b)



Possible Ice toppled boulder north end Bryher



- Also used in exposure dating is OSL – Optically Stimulated Luminescence a process in which a pre-irradiated (exposed to ionizing radiation) material when subjected to an appropriate optical stimulation, emits a light signal proportional to the absorbed dose.
- OSL is used on glacial landforms that contain quartz or sediments in glacial streams. The OSL signal is reset by exposure to sunlight.

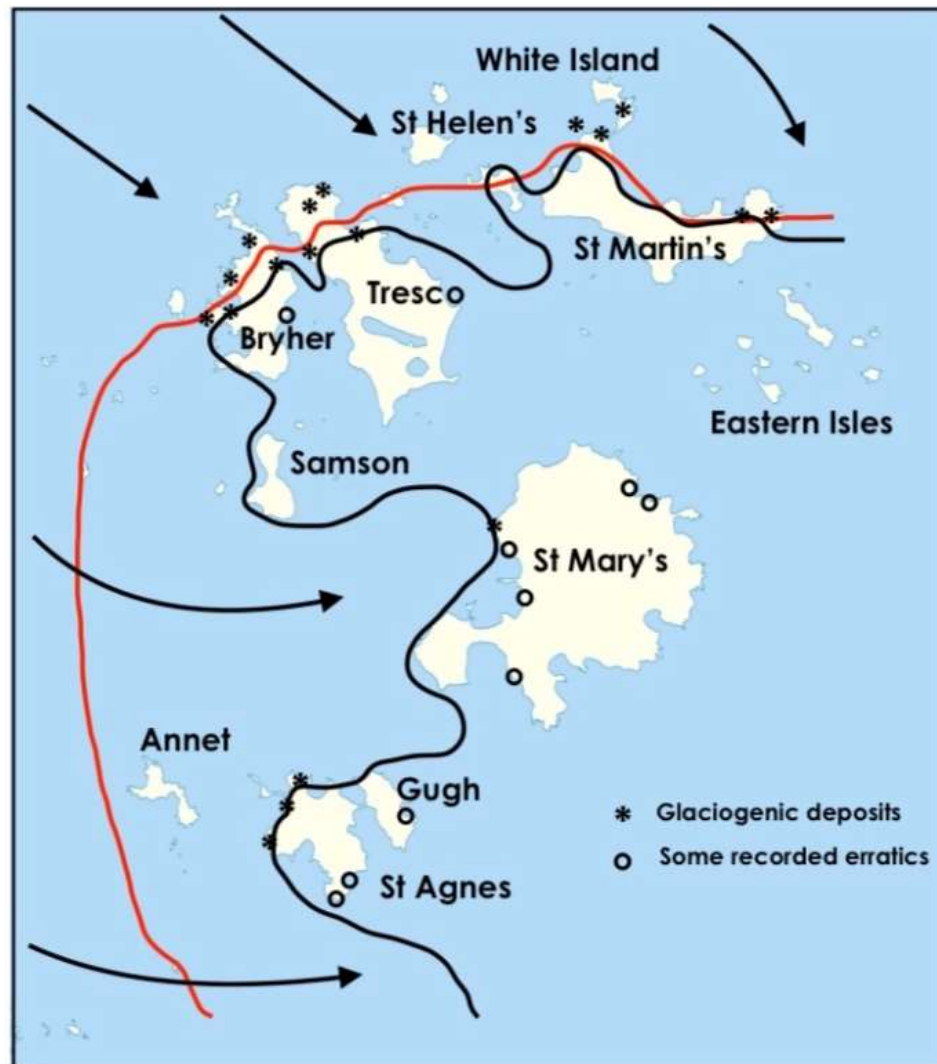


Figure 11. Modified glacial limits for the Devensian glaciation of the Isles of Scilly, based largely upon evidence presented in this paper. The red line represents the limit of the Hell Bay Gravels, taken by Scourse (1991) and others to represent the maximum extent of Devensian ice. The black line shows a revised Devensian limit, incorporating ice incursion from the west into the southern islands.



Sandy facies near
Battery Point
Tresco –
Tregathen
Gravels? Ice
proximal outwash
deposits– with
erratics at base.



East Side Northern Tresco near Pipers Hole Cave showing bee burrows. These burrows are one source of contamination when trying to date more organic rich sediments by Carbon 14 isotope methods.



Pipers Hole Cave. Over 50 m long with internal lake – most roofed by Raised Beach – natural or extended by tin mining?



LUNDY





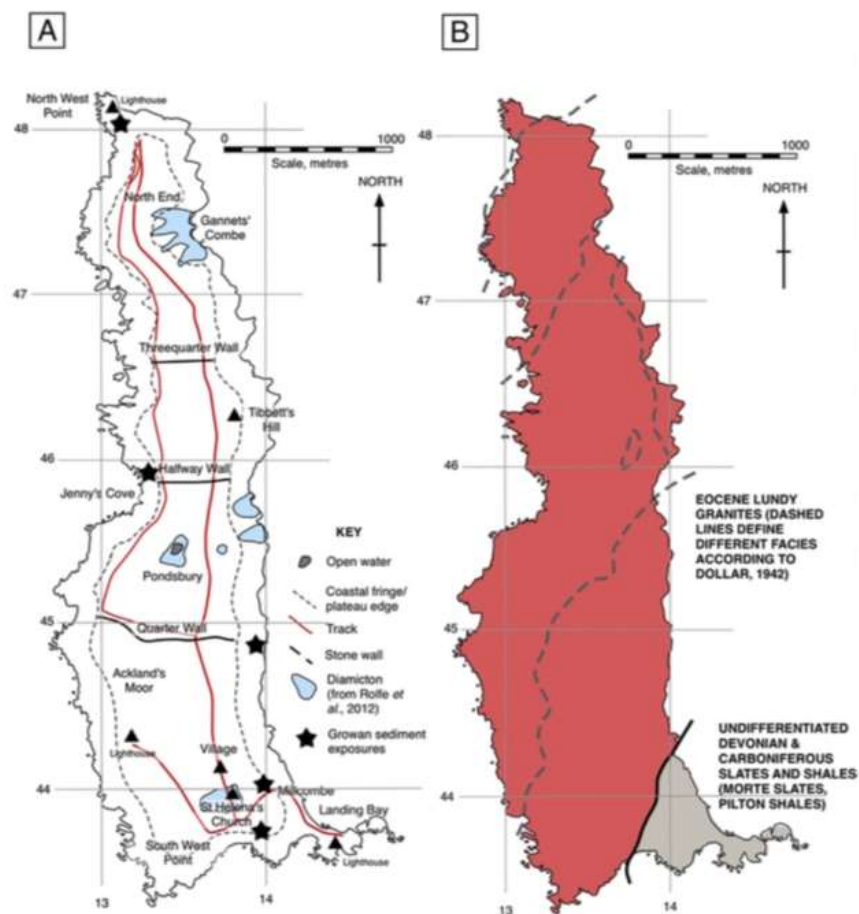


Fig. 2. Maps of Lundy Island, showing key features. A: Geography of Lundy Island: the island comprises a relatively flat plateau surface fringed with coastal cliffs. The island is divided into four zones by three prominent stone walls. Locations of diamictons identified by Rolfe et al. (2012) are noted. B: Bedrock geology and structure, compiled from sources noted in the text. The majority of Lundy Island comprises one or more facies of Tertiary Lundy Granite, intruded through Devonian and Carboniferous slates and shales. Contact metamorphism is well developed in the south-east corner of the island. There is widespread subsequent intrusion of dykes into pre-existing fractures within both the granite and shales/slates comprising chemically distinctive veins of mainly dolerite, trachyte and rhyolite (Compiled from Dollar, 1942; Edmonds et al., 1979; Thorpe et al., 1990; Tindle and Thorpe, 1992; Smith and Roberts, 1997).

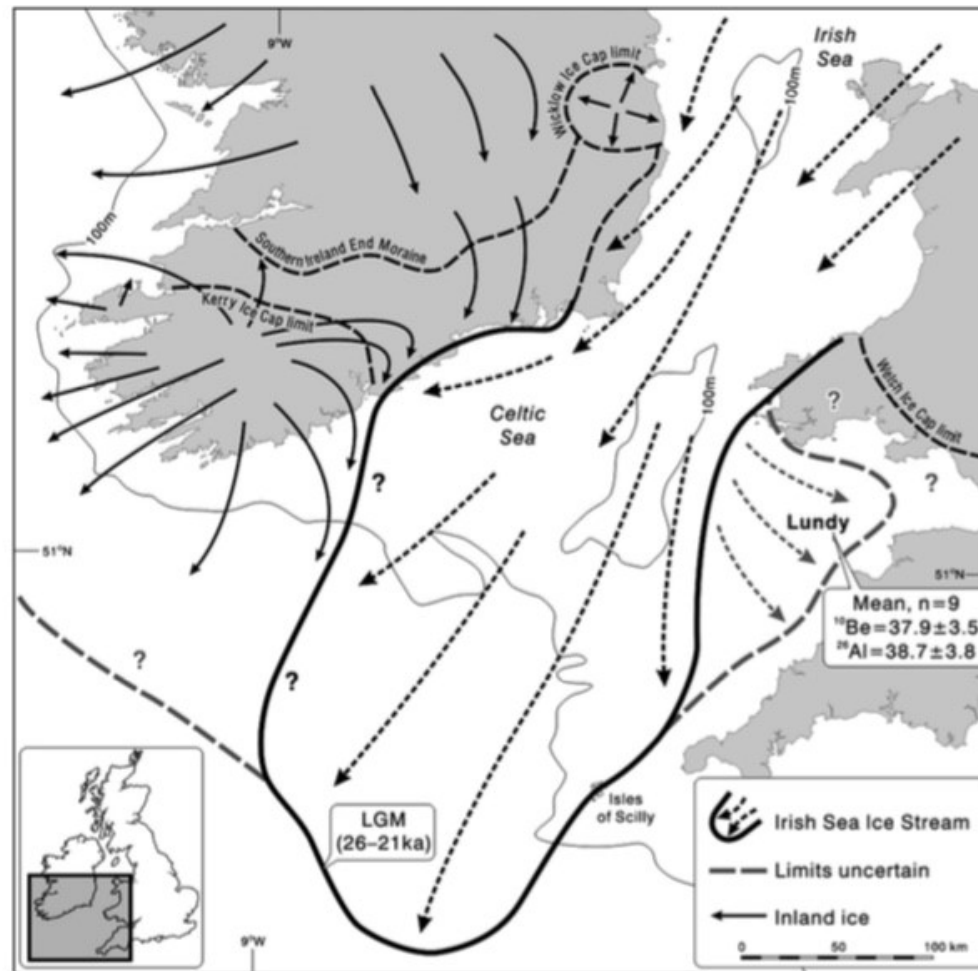
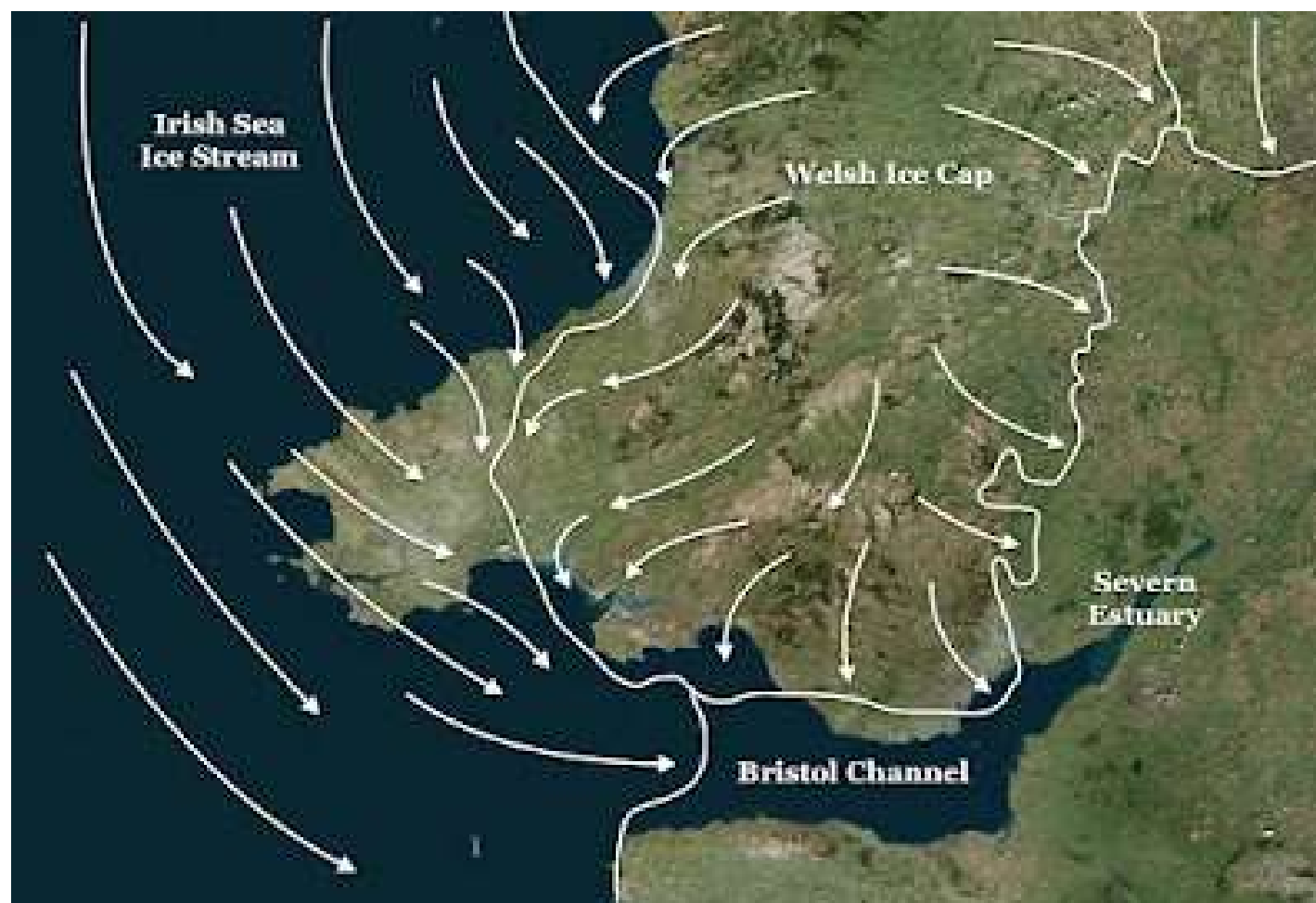
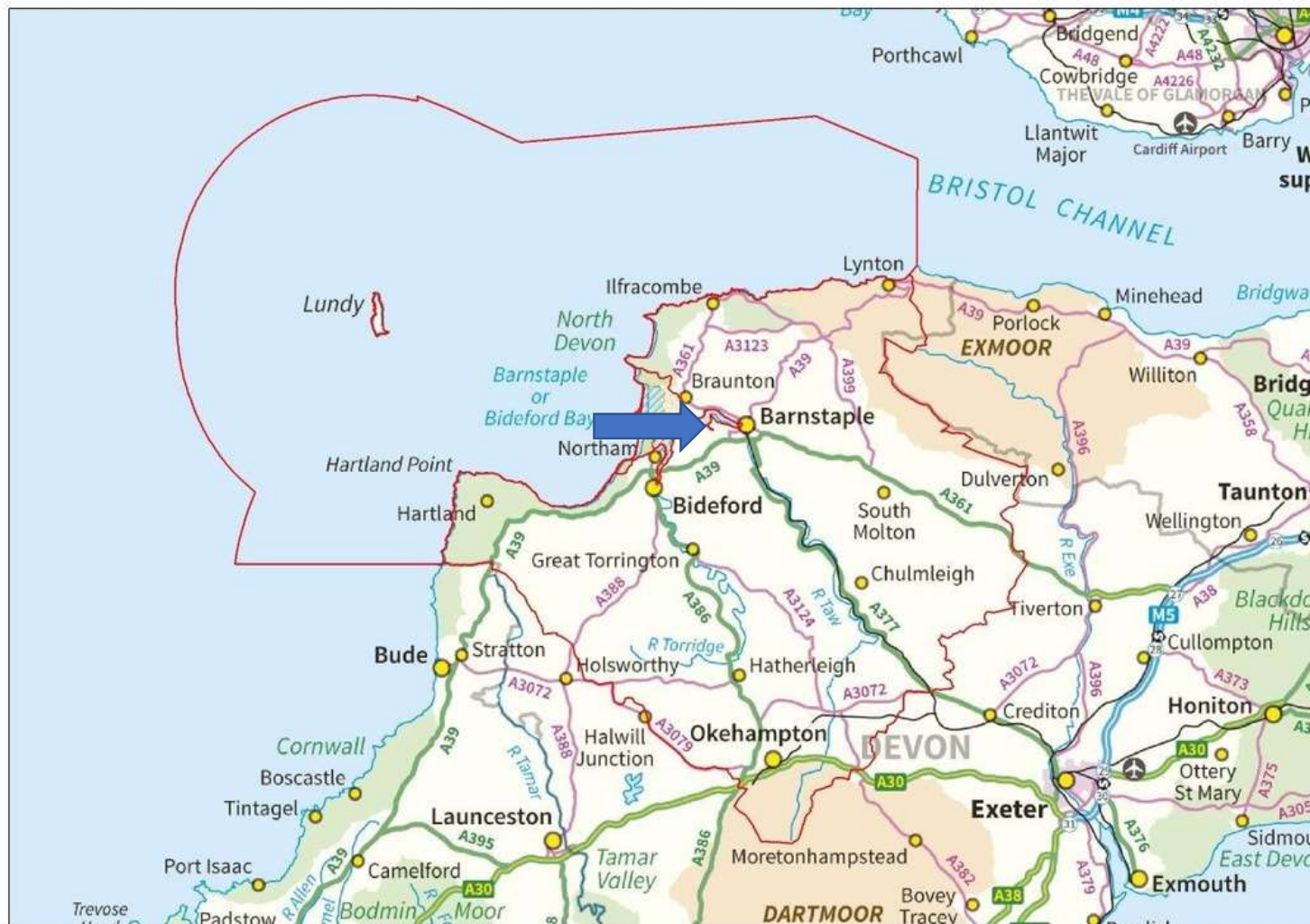


Figure 4: Ice margin configurations at the LGM and also during an earlier phase when Lundy was ice covered. The LGM position and ice directional indicators are based on a figure in Ó Cofaigh and Evans (2007, their Fig. 2). Reproduced from Rolfe *et al.* (2012) with permission from Elsevier





Map North Devon

Arrow shows position of Fremington Till – confirmed Glacial in origin but date ie Anglian or Devensian debatable.

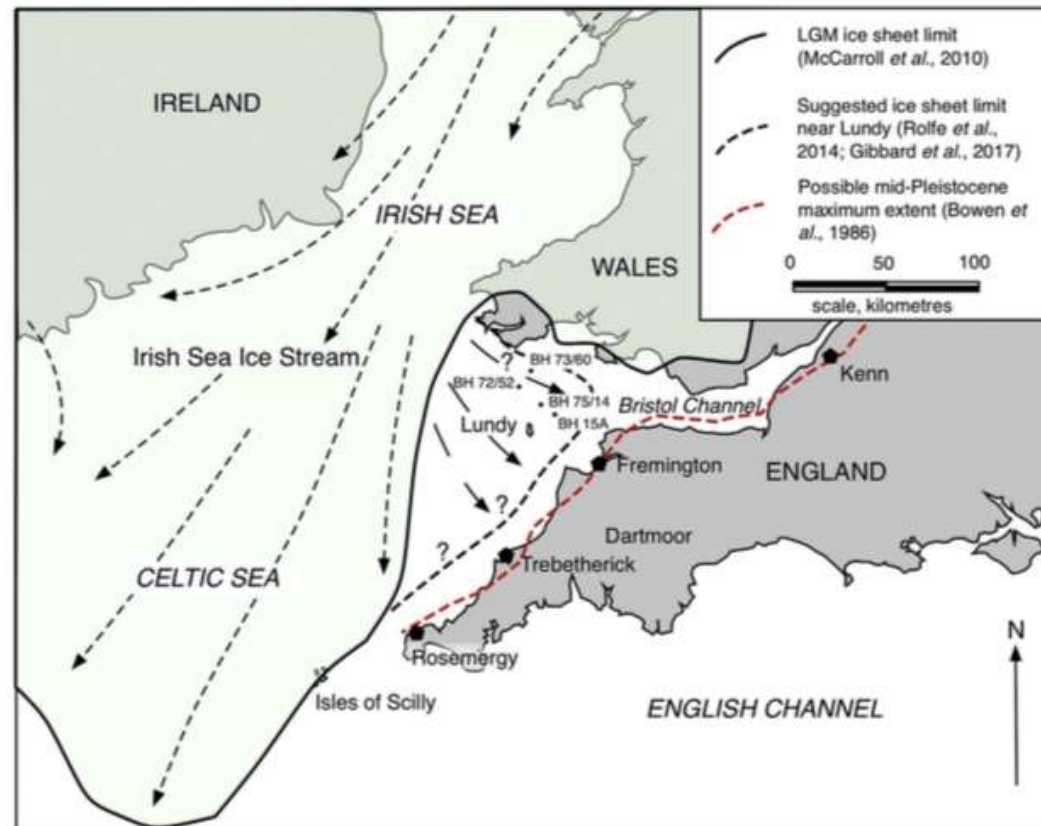
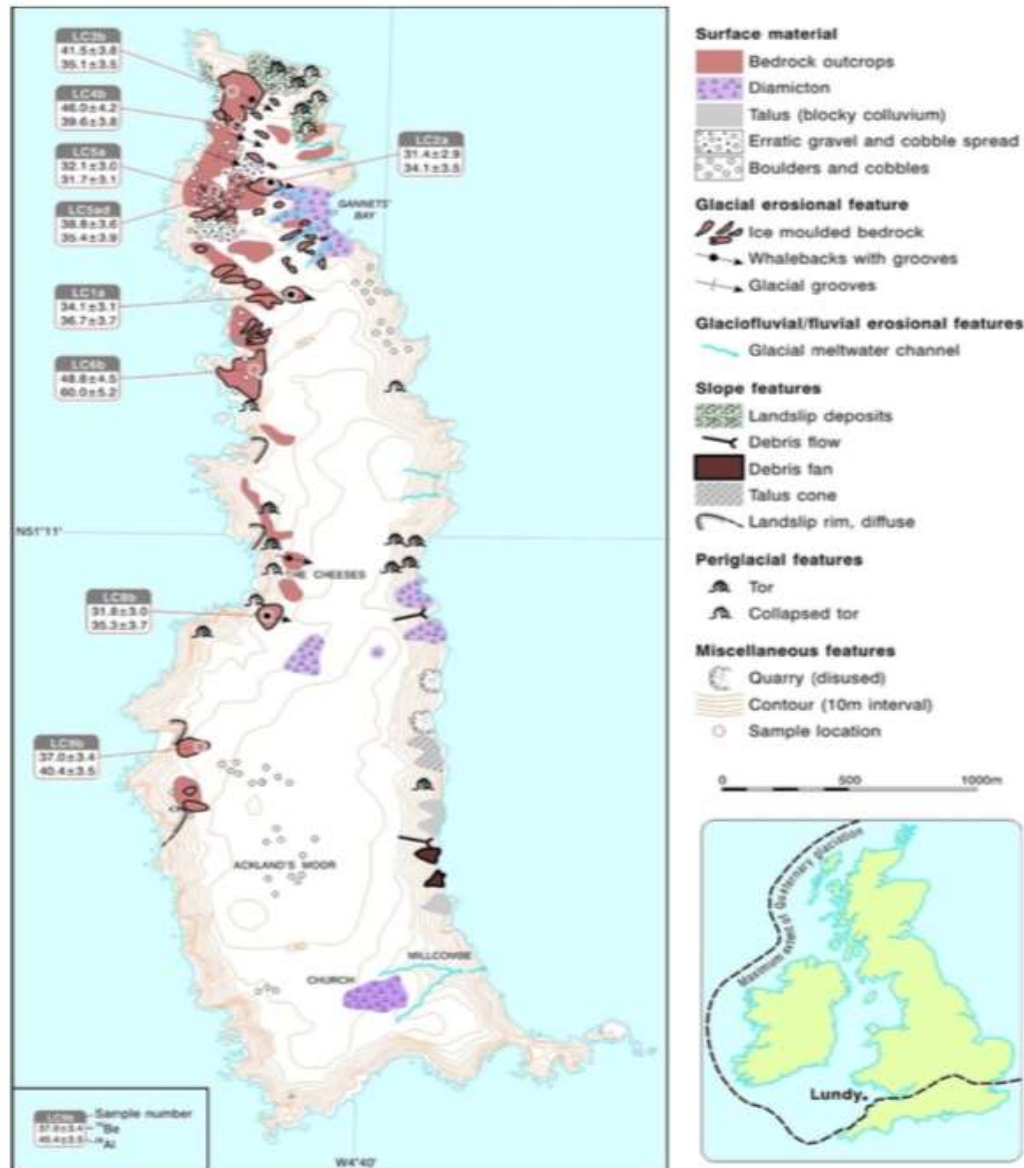


Fig. 1. Location and context of Lundy Island, with respect to suggested Last Glacial Maximum and maximum Pleistocene ice sheet limits (Bowen *et al.*, 1986; McCarroll *et al.*, 2010; Gibbard and Clark, 2011). The additional extent of glaciation thought to have inundated Lundy Island immediately prior to the LGM suggested by Rolfe *et al.* (2014) is also illustrated. Locations of sites previously suggested to preserve evidence of Pleistocene glaciation that may be related to Lundy Island are also noted, as are borehole locations thought to contain glacial sediments.



From Chris Rolfe Southampton University – Journal of Lundy Field Society











The Earthquake

Traditions says it opened up in 18th century and was caused by the Lisbon Earthquake – actually deep weathering causing landslides along joints





Erratic or road stone from
Morte Slates exposed
southern part of island?







Glacial striations or joints?

Plate 2: W.N.W.-
E.S.E. lineations of
granite bedrock
surfaces and grooved
whaleback bedrock
(Photo © Chris Rolfe)

Plate 3: Glacially
transported boulder on
Ackland's Moor in the
southern part of Lundy
(Photo © Philip Hughes)



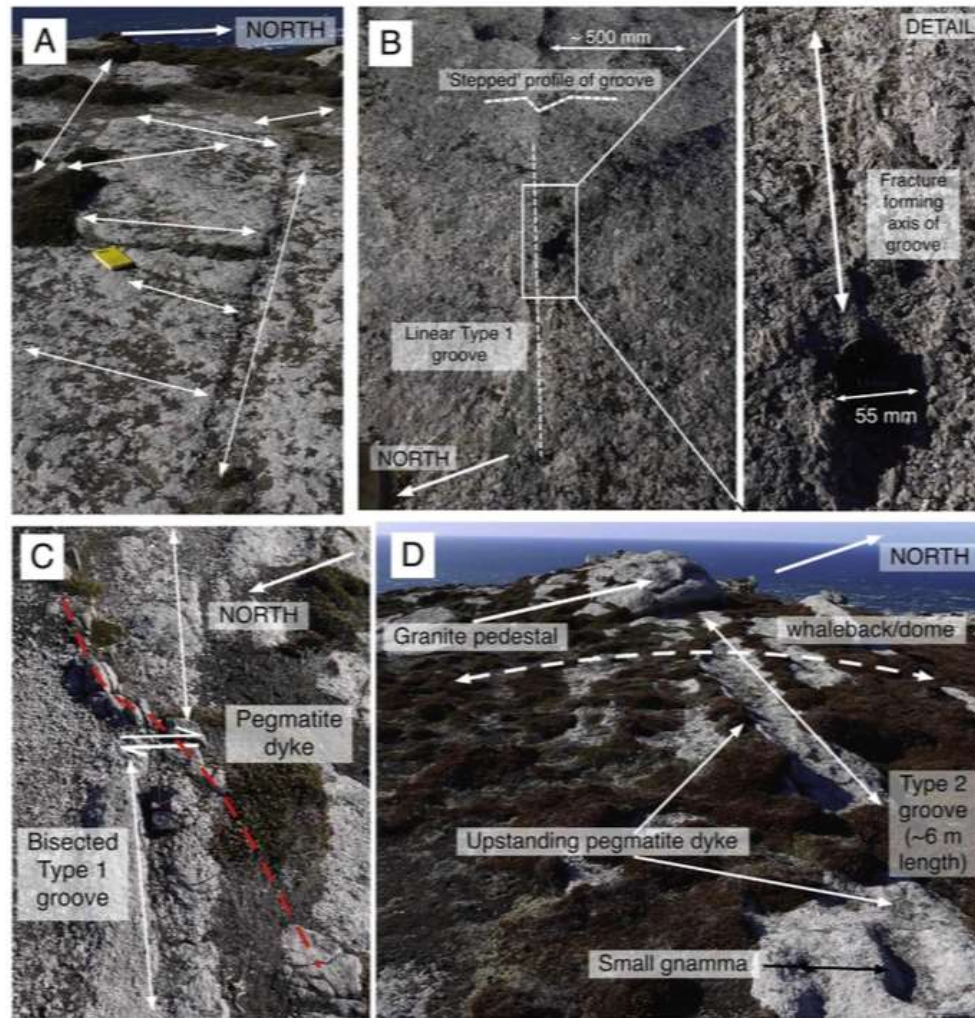


Fig. 6. Selected 'groove' features on Lundy Island. A: B: Network of Type 1 'grooves' that cross-cut and bisect one another in a variety of orientations at SS 1313/4764, and are clearly joints within the bedrock rather than glacial erosional features. B: Type 1 linear groove at SS 1328/4744 on otherwise weathered granite. The inset shows a sharp, linear fracture within the granite that demonstrates this feature is a weathering product rather than representing linear abrasion. C: Type 1 linear groove bisected and dislocated by a small pegmatite dyke at SS 1322/493, in the vicinity of sample location LC3b of Rolfe et al. (2014). F: Type 2 linear groove, associated with a bedrock dome and granite pedestal at SS 1322/4793, in the vicinity of sample point LC3b of Rolfe et al. (2014). The overall large-scale structure at this site is a dyke oriented WNW-ESE, with the linear depression conditioned by the location of an upstanding pegmatite dyke. The dyke begins beneath the 'lee' of the granite pedestal, which is interpreted as a corestone developing into a perched boulder. Note that the rock surface within the groove is rougher than the surrounding flatter bedrock surfaces.

- We therefore conclude that the exposure-age dates reported by Rolfe et al. (2012) reflect the dynamic equilibrium between cosmogenic nuclide production and granite surface lowering rather than the time since exposure and that their assumption of zero erosion rates is invalid.
- Re-examination of the geomorphology of Lundy Island identifies a suite of related landforms that reflect a combination of sub- aerial processes of pneumatolysis, granite weathering and slope movement operating under cool-maritime temperate and periglacial conditions, with more recent impact of wildfires and human agency. Critically, this study finds no evidence for past glaciation, contrary to previous work.
- From Landscape evolution of Lundy Island: challenging the proposed MIS 3 glaciation of SW Britain
Simon J. Carra,*, John F. Hiemstrab, Geraint Owen Geologists Association

- <https://www.youtube.com/watch?v=48ikKLGUhNs>

- From 1:35 min

Lundyite — Lundys unique intrusive rock



