Ben Avon Tors and Associated Landforms – Revisited

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I couldn't quite believe it at first: had I written the article "Terra Incognita" which appeared in the 2013 CC Journal (Vol. 22 No 110), and used the pseudonym Hugh Spencer? I too had first climbed Ben Avon as a boy, walking from Corgarff (August 1960) – and it was my second Munro, and my first had been Lochnagar with the Aberdeen Grammar School hillwalking club on 30 May 1960. In 1965 I progressed to Aberdeen University to study Geography, and my degree dissertation was centred on the very area so well described by Hugh Spencer – the "periglacial landscapes" of the Eastern Cairngorms.

On re-reading "Terra Incognita" I thought that it raised various questions, particularly in relation to the tors – how and when were they formed, how did they survive the ravages of the Ice Age(s) the erosional effects of which are so obvious in the immediately adjacent glens and corries, and are they still evolving in the present day?

I resisted the temptation to revisit the many articles and texts cited in my Geography dissertation. However, I did remember that a former tutor, David Sugden (latterly Professor of Geography at Edinburgh University) had written an article entitled 'The Cairngorm Tors and their significance', published in The Scottish Mountaineering Club Journal in 1983 (Vol. XXXII No.174) obviously aimed at the climbing and hillwalking fraternity. His fairly succinct explanation of the alternate theories remains valid today and is referenced in more recent publications.

The two original basic theories may be summarised:

1. Pre-glacial origin due to weathering under a warmer humid climate where chemically enhanced groundwater permeated down joints and decomposed the parent rock.

2. 'Periglacial' origin in polar regions <u>not</u> ice-bound, with downslope movement of material aided by saturation resulting from seasonal thawing of frozen ground – known as 'gelifluction' or 'solifluction'. Exposed bedrock, more resistant to freeze-thaw processes, particularly on hill and ridge crests, takes on a tor-like form.

The former theory tends to be more favoured, acknowledging the jointing pattern still discernible in the tors, including the 'sheeting' (exfoliation or pseudo-bedding) of the granite parallel to the tor surfaces. However the tors have obviously been subjected to intense and prolonged frost or freeze-thaw action, still evidenced today in the peripheral 'etching' or rounding.

Undoubtedly this occurred particularly in the later and immediate postglacial phases when the upper slopes and plateau surfaces were exposed above the valley and corrie glaciers. Exhumation and exposure of the more resistant outcrops has been aided by solifluction of the more degraded material downslope.

The unique landscapes we see today on Ben Avon and throughout the Northern Cairngorms have developed on granite originally intruded into the area 400 million years ago, and subsequently exposed and eroded. The granite tends to be a coarse-grained amalgam of feldspar, mica and quartz which was subjected to intense pressure and fracturing, resulting in an extensive jointing pattern still apparent today. Much of the closer jointing has been exploited as a result of a succession of very differing climates, possibly including deep chemical weathering under more sub-tropical conditions in the pre-glacial period. The decomposed granite has largely been removed by erosion to produce the extensive plateau areas typifying the Cairngorms at present. Areas with wider jointing patterns tend to have been more resistant, and ultimately have remained as the tors and associated rocky outcrops, subsequently further modified. Certain more massive structures encased in well-decomposed material remain buried, and are yet to be exhumed. They can be seen part-exposed in some corrie headwalls and incipient corries e.g. Sgor Riabhach to the south of Big Brae and south east of West Meur Gorm Craig.

However, it is the Ice Age remodelling that first began 2.5 million years ago that is primarily responsible for today's landscape. Successive glacial and inter-glacial periods have tended to obliterate many 'interim' glacial features, with the landforms discernible today being attributable primarily to the last major glacial period beginning 35,000 years ago. This is considered to have achieved a maximum ice cover over all the Cairngorms and much of upland Scotland in excess of half a kilometre thick around 22,000 years ago. The elevated flatter plateaux will have attracted a very slow moving so-called 'cold base' ice sheet effectively frozen to the bedrock and with minimal erosive effect on pre-existing landforms. This contrasts markedly with the far greater erosive power exerted by the faster moving ice channelled along the pre-glacial drainage network. Here meltwater at the base allowed more abrasive material to be incorporated into the underside of the ice sheet, eroding the more typical glacial troughs, which are today's glens and straths.

Thereafter a slow amelioration of the climate saw a reduction of ice cover and retreat to a valley and mountain corrie stage. A deterioration around 13,500 years ago, referred to as the Loch Lomond re-advance, saw a temporary re-establishment of upper valley and corrie glaciers, but the ice finally disappeared around 11,500 years ago.

The adjacent plateau areas then exposed were subjected to prolonged periods of intense cold. This resulted in frost-shattering and granular disintegration with general downslope movement of material due to the constantly recurring freeze-thaw action. A more limited cold period between 1550 and 1850 AD, generally referred to as the 'Little Ice Age', saw the re-establishment of certain corrie glaciers or permanent snow beds. Extensive perpetual snows also remained on the plateaux for many years and are described as such in various publications from that period.

After 11,500 years ago, the remaining ice occupying the valleys and corries had started to disintegrate in-situ as well as retreating 'up-valley' releasing vast quantities of meltwater containing sands and gravels deposited as mounds and terraces. A vast array of these features occupies the entire valley floor immediately south of the confluence of the River Avon with the burns emanating from Slochd Mor. The suite of terraces are at varying levels with particularly steep sides reflecting their final 'ice-contact' with the phased disappearance of the decaying ice. The flat-topped terraces and mounds are also pitted with hollows or 'kettle holes' indicating where stranded ice blocks finally melted.

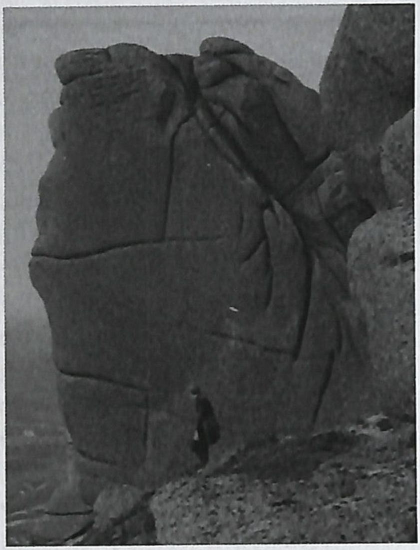

Figure 1
The west flank of Sron na h-Iolaire

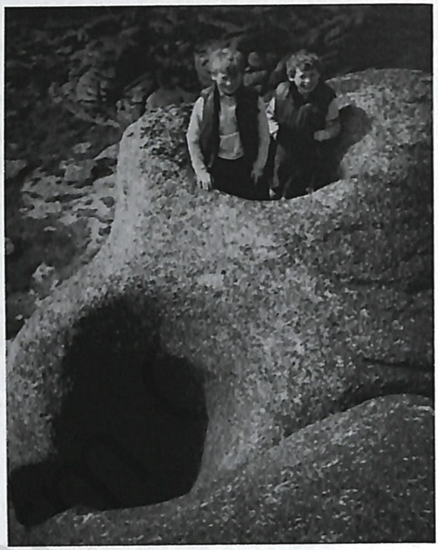

Figure 2
Pot holes on Clach Bhan

Overlooking this depositional landscape, on the steep cliff-lined slopes of Sron na h-Iolaire flanking the major glacial trough of Slochd Mor, tor-like rock protuberances extend from the top of the cliffs above about 750m, (Fig.1). In addition, discernible tor-like outcrops occur on various slopes generally above 700m, particularly those on the north spurs of East and West Meur Gorm Craig and Clach Fiaraidh so well described by Hugh Spencer. Massive tors at Clach Bhan, on the west shoulder of Meall Gaineimh and on East Meur Gorm Craig are either on the plateau or plateau edge at over 850m. The most impressive and highest example is Clach Bun Rudhtair, (The Needle Tors) at 900m protruding over 15m above the steep north east spur of Stob Bac an Fhurain. It is reasonable to infer that the lower limit for the tors and outcrops, which mostly coincides with the lower limit for the frost-shattered block-fields and un-vegetated granular material, equates to the surface level of the valley glaciers in the later phases of the last glacial period.

Other massive tors exhibiting wide-spaced jointing patterns are more randomly located on the flatter plateau areas, and include the main Ben Avon summit (Leabaidh an Daimh Bhuidhe) and Clach

Choutsaich both at over 1100m and Clach an t-Saighdeir at over 950m. It is appropriate to consider the origin of the block-fields and expanses of gravels in part in relation to the degradation and 'etching' of the tors both in the immediate post-glacial period and possibly also in the present day. Many of the tors exhibit an undercutting around the base, as well as extensive rounding and enlargement of the joint network. This includes erosion of the so-called 'pseudo-bedding' parallel to the tor surfaces, together with weathering pits (pot-holes) in the upper surfaces. Having visited Clach Bhan in mid-winter and photographed the extensive rime-ice encrustation across the whole tor surface, it is fair to conclude that even present day water penetration into the rock joints with subsequent expansion upon freezing, will result in the creation of further granular detritus. Winter winds, regularly in excess of 100kph and gusting considerably above that figure, and temperatures as low as -15°C are recorded at the Cairngorm summit weather station only 15 km to the west. The combination of these factors provides ideal conditions for present day intense frost weathering with consequential granular disintegration and creation of surface detritus, albeit on a minor scale. Both the present day and relict frost-weathered debris has been further modified and moved downslope. This process referred to as solifluction, creates hummocks and patterned ground on flatter surfaces with stone stripes, lobes and small terraces on slopes.

Often this granular debris has combined with coarser blocks to form lobes up to 3m deep, the larger blocks acting as 'retainers' on the downslope side. The larger lobes are considered to be inactive 'relict' features, with the finer granular material which is still active often upraised as a crust on elongated ice-crystals or needles known as 'pipkrakes'. On these sloping ground terraces, when the ice melts, this can lead to a collapse and net migration of detritus downslope. These features are particularly noticeable on the NE slopes of Meall Gaineimh where the stalkers path winds upwards toward Clach Bhan through a whole zone of turf-banked terraces. They are often sloping on the upper surface, usually only up to 30cm high, 1m deep and 3m wide. Here the terrace retainer is usually low wind-clipped turf stripes comprising heather *(Calluna)*, bearberry *(Arctostaphylos)* crowberry *(Empetrum)* and dwarf mountain azalea *(Loiseleuria)*. On more exposed slopes these terraces are often at an oblique angle, possibly reflecting the intensity and direction of the prevailing wind. The wind itself can act as a significant erosional element, damaging the turf 'retainer', producing a pattern of vegetation with bare gravel 'treads' or steps, and leading to further downslope movement of material. It is also responsible for creating extensive so-called 'deflation' surfaces, large un-vegetated expanses on the flatter high plateaux.

Hugh Spencer mentions the apparent downslope movement of a huge block on the northern spur of East Meur Gorm Craig. Its 'inverted' weathering pits confirm the disintegration and collapse of even the largest tors over time. There are many other smaller blocks in the vicinity some referred to as 'ploughing' blocks or boulders, often found in association with bare furrows or debris slides. The blocks appear to be supported by a 'bow wave' of granular material at the downslope side with a deeper groove immediately upslope of the blocks.

The weathering pits or potholes are fascinating in themselves. Some are shallow dish-like forms up to 30cm in diameter, but others particularly those on Clach Bhan and Clach Bun Rudthair are over 1m in diameter and 1.5m deep. On Clach Bhan one particularly large pothole exhibits a partially eroded side wall, leaving only a narrow rim of granite. It is recorded that as late as the 1860s local pregnant ladies were transported up the Meall Gaineimh path by pack pony to sit in the potholes in the belief that the pains of labour would thereby be lessened! The origin of these potholes is generally attributed to a combination of water, ice and rock particles or granules, with wind swirling the mixture. In winter a rim of ice forms around the side of the pothole and freeze-thaw will provide more granular material over time. Indeed, in the bottom of some dry potholes in summer it is possible to find fine granular material and rock crystals (Fig.2).

I would like to thank Hugh Spencer for providing such an interesting article and rekindling my personal interest in the area. Regrettably, my knees and I cannot envisage returning to Ben Avon but I have advised my younger brother that I would like my ashes scattered at Clach Bhan - you can imagine his response!