6 Extraction techniques

At some point of time in prehistory, inhabitants of Lewis discovered the Cnoc Dubh quartz vein and realized its potential. The absence of loose material ('scree'), in front of the vein *before* construction of the sheep pen (James Crawford, *pers comm*), compared to the sizeable slopes of scree immediately north-east of the vein (Illus 2), suggests that some clearing of the site took place either prior to the exploitation of this resource, or as part of the ongoing reduction of the vein.

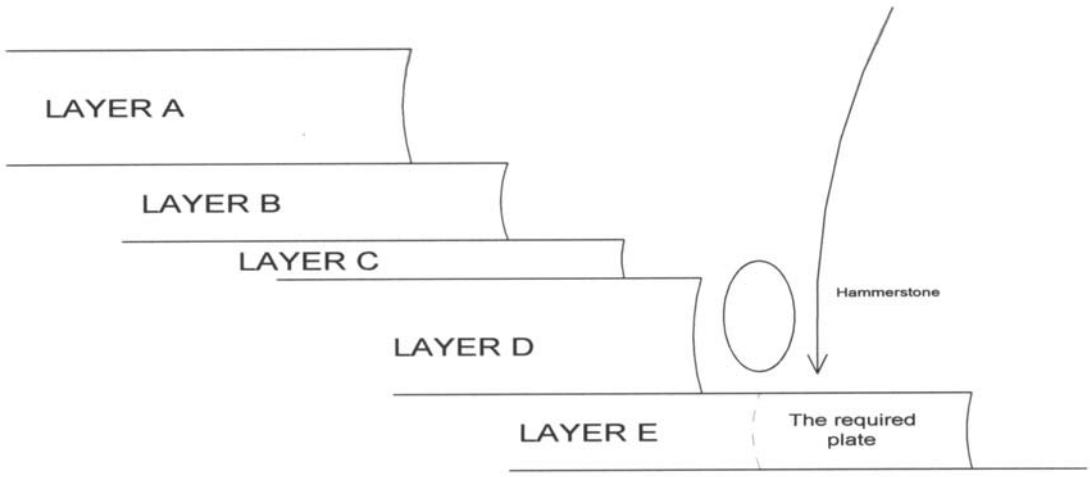
In the first case, scaffolding would have been required to reach the highest points of the seam, but wooden scaffolding has been documented from, for example, the flint mines of Grimes Graves (Saville 1981, viii; Russell 2000, 106) and would have been a possible option for the prehistoric quarriers of Cnoc Dubh. In the second case, removal of the scree would have been a staged process, following the gradual exhaustion of quartz at higher levels.

Based on probably millennia-old experience in quartz procurement and quarrying, the 'miners' of Cnoc Dubh were familiar with the tendency of quartz veins to form distinct vertical layers. Consequently, their first aim was to break through the outermost layer to acquire a working-edge from which blocks and larger plates of quartz could be detached. This was achieved by viciously pounding the outer layer in various places till it broke at one of the targeted points. Clusters of large circular impact scars, or incipient cones (Illus 8, 9, 10, 11 & 12), testify to cases in which the outer layer did not give way, probably because the quartz at that point was too dense. The generally large size of these scars, and thereby the Hertzian cones hidden beneath the surface, demonstrates the violent force applied to, first, open new layers and, later, detach blocks of quartz from the vein.

The moment a layer had been penetrated, production gained momentum and the quartz layer would be gradually 'peeled back' until those working the edges of that layer met resistance from, for example, the rock matrix, or areas of unworkable quartz (either too dense or too crumbly quartz). Then the next layer would be pounded until an opening developed, and this new layer was reduced, and its edges pushed as far towards the edges of the previous layer as possible. Due to the size and shape of hammerstones, it was not possible to completely 'peel back' Layer B to the edges of Layer A, and a step developed (Illus 14; also Illus 6, Illus 7).

This process continued, layer by layer, until the bottom of the vein had been reached, or until it had become impossible to detach more raw material due to the development of steps. In theory, a quartz vein may have been abandoned in prehistory *not* because all available quartz had been exhausted *but* because the technology did not allow further production (the use of hammerstones and the subsequent development of stepping). This technical problem could have been dealt with by removing parts of the rock matrix and attacking the vein from the sides, but this did not happen at Cnoc Dubh (nor at the Italian jasper source of Valle Lagorara; Negrino 1998, fig. 1.3). At the Lewisian site, the vein was abandoned when the entire lower half of the vein had been exploited and stepping had developed from the central part of the vein to its south-western terminal (Illus 6).

A number of auxilliary approaches may have been



Illus 14 General extraction procedure. The illustration shows the natural vertical layering of the vein, and how plates of quartz were detached; seen from above.

applied, which it has not been possible to prove or test, such as the use of wedges. Wedges could have been used in two ways, either to separate the peripheral quartz from the surrounding matrix, or to prise out blocks, or plates, of quartz from the various layers. The former use is unlikely, as the peripheral quartz has, in many places, fused with the adjacent gneiss, forming a relatively compact quartz-gneiss hybrid material. The latter use of wedges is quite possible, as the Cnoc Dubh quarriers could have made use of the various cracks between the vertical layers, or the secondary vertical and horizontal cracks running from the surface and into the vein. However, the main technique for releasing quartz from the vein would have been hammering the surface in the way described earlier, and demonstrated in Illus 8–14.

In his presentation of the quartz quarries at Gummark in northern Sweden, Broadbent suggests that fire-setting formed part of the approach of the local quarries (Broadbent 1973; Broadbent 1979). This claim is based on the discovery of soot and charcoal in connection with the outcrops. In his paper on the quartz quarry at Samp Mortar Reservoir, Connecticut, Powell 1965 rigorously refutes this: 'use of fire as a quarrying technique [of quartz] has a dubious reputation in the literature, and most authorities deny that it was ever used'. As fire-setting has not been reported from other quartz quarries, and as experiments (Ballin in prep. e) regarding the effect of fire on quartz suggest that direct fire makes this material disintegrate (thereby rendering it useless to a knapper), the author favours Powell's view. It is possible that the soot and charcoal reported by Broadbent simply derive from the quarriers' domestic fireplaces.