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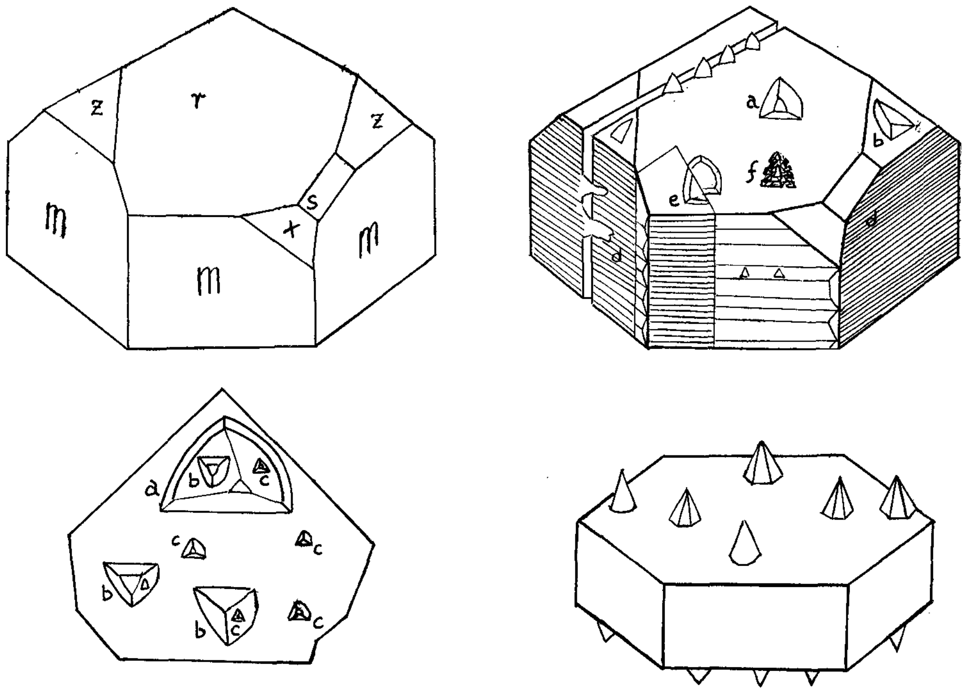
Surface structures of Pamir quartz

THE author has been concerned with the production of quartz from the Pamirs for some years, and has examined several thousand crystals (Vadilo, 1947). The only forms developed are $r\{10\bar{1}1\}$, $z\{01\bar{1}1\}$, $m\{10\bar{1}0\}$, $s\{11\bar{2}1\}$, and $x\{51\bar{6}1\}$ (fig. 1). The bounding facets of steps or horizontal striations on the *m* faces, often regarded as definite acute rhombohedra r_a and z_a, are rather to be considered vicinal facets, making no definite angle with *m*, but lying anywhere between *m* and *r* or *z*; the triangular growth pyramids typical of *z* and *r* faces are never observed on such vicinals.

Growth pyramids on *r* (fig. 2, a) and on *z* (fig. 2, b) have triangular outlines, the base being a triangle with curved sides, with the least curved side parallel to the edge [*rm*] or [*zm*]; for pyramids on *r* the base is a equilateral triangle, for those on *z* an isosceles one. Growth pyramids are often situated along cracks and grow over them (fig. 2, e). Some such pyramids are formed as the result of the attachment of small (<1 mm) crystals to the large one; the small crystal converts to a growth pyramid. Pyramids overlapping a twin boundary present a combination of the typical forms seen on *r* and *z* faces (fig. 2, e). Elevated growth forms also occur consisting of numerous minute, closely-packed growth pyramids (fig. 2, f). Minute growth pyramids may also be observed on the sloping sides of larger pyramids, and on *r* or *z* faces bounding striations on *m* faces.

Growth pyramids on *m* take the form of striations parallel to the edge [*mr*] or [*mz*],



FIGS. 1 to 4: FIG. 1 (top left). Crystal habit of Pamir quartz. FIG. 2 (top right). Growth pyramids on the several faces. FIG. 3 (bottom left). Etch pits on *r*($10\bar{1}1$). FIG. 4 (bottom right). Regeneration growth on a broken surface normal to the *c*-axis.

the tops and sloping sides of which are formed by facets vicinal to *m*, *r*, and *z*, and seldom by true *m*, *r*, or *z* faces. The striations below [*mz*] edges are, as a rule, narrower than those below [*mr*] edges (fig. 2, d), and the presence of both wide and narrow striations on an *m* face indicates twinning (fig. 2). The difference in width between the striations is due to growth of layers on *z* faces being more rapid than on *r* faces. Triangular growth pyramids may be found on *r* or *z* faces forming the slopes of striations. Cracks may be covered by dome-shaped vicinal hillocks, as shown in fig. 2, d.

Etch figures may sometimes be observed on *r* faces. In one example, there were three types of surface structure: large (1 cm) triangular growth pyramids (fig. 3, a); triangular etch-pits, about 3·5 mm (fig. 3, b), which were present both on the face itself and on pre-existing growth pyramids; and tiny (1 mm) triangular growth pyramids, clearly the last structure formed, present on the face itself, on the large growth pyramids, and inside etch pits (fig. 3, c).

Regenerated splinters are not uncommon in the Pamir quartz. If the broken surface happened to be roughly normal to the *c*-axis, a number of isolated growth cones first form, which are then covered by vicinal *r* or *z* faces or both, and finally the surface is covered with a drusy aggregate of parallel pyramids (fig. 4).

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Analyses of altered struvite from Skipton, Victoria

SPECIMENS of Skipton Cave guano minerals, held in the mineral collection of the Government Chemical Laboratories, Perth, Western Australia, showed on examination subaqueous and subaerial replacement of struvite by newberyite. The phosphate minerals occurring in this cave have been only partially studied since their discovery by McIvor (1887, 1902). The description by Cohen and Ribbe (1966) of a subaqueous alteration of struvite to newberyite at Mono Lake, California, prompted further investigation.

The Skipton Cave, described by Ollier (1963), occurs on the north slope of Mt. Widderin, 25 miles south-west of Ballarat. The bats responsible for the guano were last seen live in 1866 and their species is in doubt; however, Simpson and Smith (1964) reported the discovery of a mineralized mandible of *Miniopteris schreibersi*. Collection material was supplemented by further specimens collected in 1966 from the Skipton Cave by the author.

Specimen S2216, newberyite after struvite, is of a similar form to that described by Ribbe (1969) and the crystals have been partially altered to a white opaque compact newberyite powder. The alteration is definitely subaerial in origin as the sample was kept in a closed box for over thirty years.

Specimen MDC 2888A, newberyite collected in January 1966 is of two types: MDC 2888A(a) large crystals of tabular and pyramidal forms, which are common in the cave; and MDC 2888A(b) replacing struvite of a similar form to S2216, but coarsely crystalline, white, zoned, and with remnants of clear struvite, which could have originated in either subaqueous or, less likely, subaerial conditions.

Specimen MDC 2887B, fresh clear struvite crystals of the same form as S2216 was also collected and kept in damp guano until examined. The samples were handpicked,