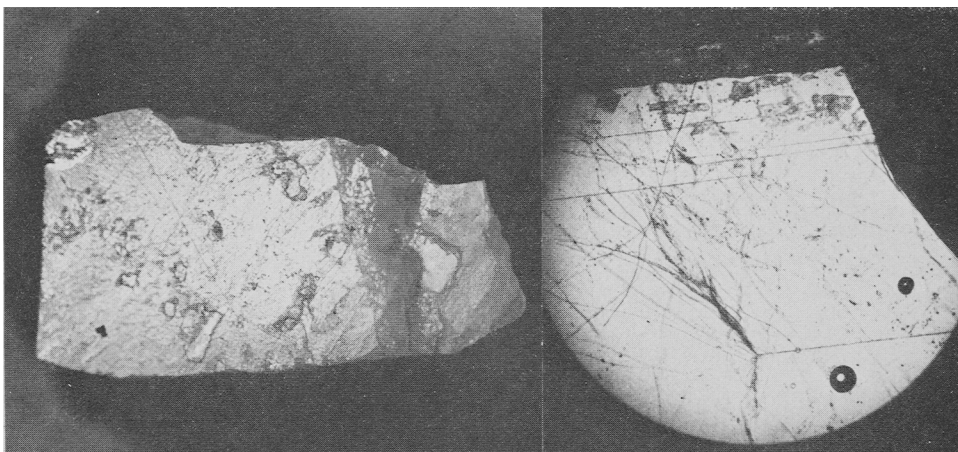


Natural cleavage in quartz from northern Nigeria

NATURAL cleavage in quartz, though rare, has been reported by a number of authors (see bibliography in Frondel, 1962, and Deer, Howie, and Zussman, 1965). A new occurrence is reported.

A little hill of vein quartz outcrops some 300 yards to the west of mile-post 100 on the Zaria–Jos road in northern Nigeria. The vein quartz is intrusive into granite gneiss, and near the core contains patches of rose and smoky quartz; it is massive, with a cracked, granular texture.

A piece of the vein quartz with patches of rose quartz in it split on hammering along flat and reflecting planes, which closer examination showed were distinct cleavage surfaces (fig. 1). Rupture took place along three parallel cleavage surfaces, one more



FIGS. 1 and 2: Fig. 1 (left). Natural cleavage in quartz from northern Nigeria. Fig. 2 (right). Photomicrograph of a section normal to the cleavage, showing the irregular spacing of the cleavage planes, their non-persistent nature, and the relation of one of the planes to angular fractures. Note the two generations of fractures, one apparently contemporaneous with and the other later than the development of cleavages, and the cracks and tiny cavities. Magnification $\times 27$.

extensive than the other two. A further specimen with good cleavage surfaces was found after a long search. The cleavage surfaces, though flat and reflecting, are interrupted by etch-like patterns, and are irregularly spaced; a thin section cut perpendicular to the cleavage direction (fig. 2) reveals seven successive cleavage plates with thicknesses ranging from 0.07 to 1.70 mm. Some of the cleavage planes, as observed in thin section, seem to have developed in relation to fractures in the quartz.

The cleavage is rhombohedral, but no attempt was made to distinguish between the *r* and *z* rhombohedra. Thin sections show many unoriented needles of an unidentified mineral (not rutile), a large number of cracks, fractures, and tiny holes that probably contained fluid inclusions. Partial chemical analyses were made of the rose quartz, which was crushed to pass 200 mesh and cleaned with a magnetic separator and heavy liquids; alkalis were determined with a flame photometer. The results were: SiO₂ 99.45, Na₂O 0.26, K₂O 0.09 %. A spectrogram indicated traces of Al, Ti, Fe, Mn, and Ca.

The irregularities in the spacing and persistence of the cleavage surfaces (see fig. 2) suggest that they are not primary growth features, but secondary features of the quartz, possibly resulting from stress of the quartz body, as indicated by its cracked and granular texture. The relation of some cleavage surfaces to cracks is also suggestive of a stress-related origin for the cleavages.

Anderson (1945) showed that *r*, *z*, and *d* were preferred rupture planes in the vein quartz fillings of the Antietam quartzites; he described the rhombohedral deformation planes as being 'characterized by sharp fracture containing neither opaque nor fluid inclusions' (pp. 413-14). He also noted irregularities of continuity in the 'sharp fractures' (p. 411). Halden (1955) also noted breakage parallel to rhombohedral faces of some massive quartz from California.

The occurrence and characteristics of the Nigerian cleaved quartz are similar to those of some other reported occurrences.

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Rodingite from Naranji Sar, Dargai ultramafic complex, Malakand, West Pakistan

THE rodingite described here (which has been sold locally as 'jade') occurs at Naranji Sar (71° 46' E., 34° 28' N.), a hill south of the village of Mena, about 20 miles west of