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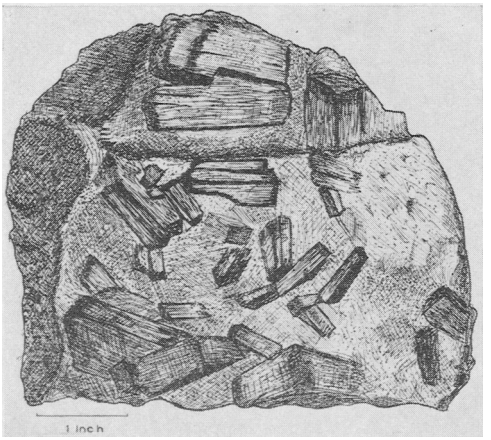
An occurrence of kyanite pseudomorphs after andalusite from Amb state, West Pakistan

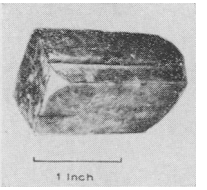
THE Amb State area makes part of the western limb of a regional syntaxial arc of the north-western Himalayas. It consists of pelitic and psammitic schists and quartzites, intruded by granitic gneiss, while the whole area is cut sporadically by doleritic minor bodies. The highest grade of metamorphism reached by the schists is marked by almandine garnet while andalusite and cordierite-bearing hornfelses are developed at the granite contact. Nothing has yet been published on this area although a preliminary account on the adjoining Mansehra area has been published (Shams, 1961).

Recently, during field investigation of the aureole rocks near Choian (grid 896394 1″ topographic sheet No. 43B/15, Survey of Pakistan), certain hornfelses were found in which the andalusite had suffered transformation into kyanite in such a manner that the original shape and twinning of the andalusite are remarkably well preserved. These rocks are heavy, tough and dark coloured and, in addition to pseudomorphs, consist of quartz, muscovite, biotite, garnet, and tourmaline etc. The pseudomorphs lie preferably within weak foliation planes of the rock and show rough parallelism of their longer dimensions, although all orientations are present (fig. 1). Their size varies from very tiny to as big as $2'' \times \frac{3}{4}'' \times \frac{3}{4}''$ and rarely even bigger individuals are present. Their surface is generally coated with a brownish micaceous material while the freshly broken surfaces show the typical bluish colour of kyanite. Inside the pseudomorphs the kyanite blades are arranged in completely haphazard manner, minor amounts of quartz and muscovite are also present, the latter being at least partly of alteration origin. The kyanite gave: α 1·713, β 1·720, γ 1·725 (all $\pm$0·002, measured in filtered white light), $2V_\alpha = \sim 82°$, sp. gr. = 3·43.

The shape and the interpenetration twinning of the andalusite is so well preserved (fig. 2) that shearing stress, in the sense of Harker

(1939), does not appear to have played any significant role during pseudomorphism. On the basis of field observations, it is concluded that the inversion took place when the hornfelsed meta-sediments were acted upon by confined hydrostatic pressure that had developed during the





FIGS. 1 and 2: FIG. 1 (left). Sketch of a rock bearing kyanite pseudomorphs after andalusite. Note a broken crystal at the top. FIG. 2 (right). Photograph of a kyanite pseudomorph after twinned andalusite.

expansion of the granite body. This mode of formation compares well with that of the Southern Rhodesian pseudomorphs (Workman and Cowperthwate, 1963) and proves that Harker's theory of stress dependence of the transformation, andalusite to kyanite, is not of universal application. This inversion can take place under the influence of pure hydrostatic pressure as well.

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