

TABLE I. PYROPHYLLITE REACTION PRODUCTS

Pressure (kilobars)	Temperature (° C.)	Reaction Products		
		(principle)	(secondary)	(trace)
10 ⁻³	500	pyrophyllite		
10 ⁻³	1000	modified pyrophyllite		
10 ⁻³	1500	mullite	SiO ₂ glass	α -Al ₂ O ₃
13.5	500	pyrophyllite		
13.5	1000	pyrophyllite		
13.5	1770	α -Al ₂ O ₃	quartz	
27.0	25	pyrophyllite		
27.0	500	pyrophyllite		
27.0	1000	pyrophyllite		
27.0	1500	kyanite	coesite	α -Al ₂ O ₃
27.0	1900	kyanite	coesite	α -Al ₂ O ₃
40.5	1500	coesite	kyanite	
40.5	2070	coesite	kyanite	
47.25	2100	coesite	kyanite	
54.0	25	pyrophyllite		
54.0	500	pyrophyllite		
54.0	1000	pyrophyllite		
54.0	1500	coesite	kyanite	α -Al ₂ O ₃
54.0	1950	coesite	kyanite	α -Al ₂ O ₃
54.0	2000	coesite	kyanite	α -Al ₂ O ₃
67.5	25	pyrophyllite		
67.5	500	pyrophyllite		
67.5	1000	pyrophyllite		
67.5	1500	coesite	kyanite	α -Al ₂ O ₃
67.5	2000	coesite	kyanite	α -Al ₂ O ₃
81.0	25	pyrophyllite		
81.0	1000	pyrophyllite		
81.0	2000	coesite	kyanite	α -Al ₂ O ₃

coesite onset at a temperature between 1000° and 1500° C. and a pressure between 13.5 and 27 kilobars. Kyanite is slightly more predominant than coesite up to a pressure between 27 and 40.5 kilobars, above which coesite is the principal phase. The "modified pyrophyllite" obtained at standard pressure and 1000° C. is essentially a dehydrated phase, the x-ray diffraction pattern of which is only slightly changed from that of the original pyrophyllite. This is probably the same phase as that noted by Carte (1955).

Petrographic examination of the alteration zone material obtained at 67.5 kilobars and 2000° C. showed essentially two phases (Fig. 4): a very fine-grained, markedly birefringent, rod-like material (kyanite), and a somewhat more coarsely grained, flaky phase of lower birefringence

(coesite). The kyanite appeared more uniform in crystallite size, averaging approximately $1 \times 5 \mu$. Coesite, on the other hand, showed fragments as small as 1μ and large flakes up to $40 \times 85 \mu$.

Since the original synthesis of coesite (Coes, 1953), interest in this material has grown steadily, the pace having been quickened by its recent discovery at Meteor Crater, Arizona (Chao, Shoemaker and Madsen, 1960). This positive identification of a natural occurrence firmly estab-

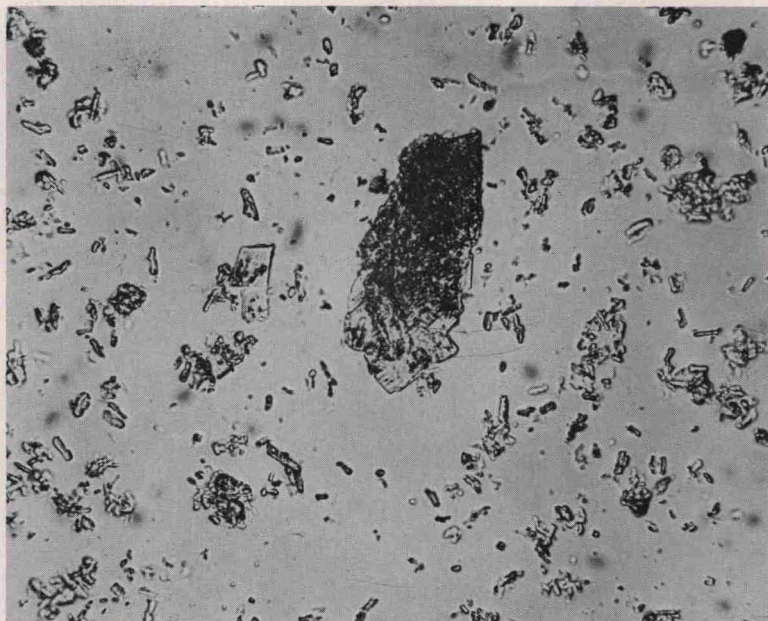


FIG. 4. Photomicrograph showing kyanite (fine-grained, rod-like) and coesite (large flakes) from alteration zone material obtained at 67.5 kilobars and 2000°C .; transmitted light, 1.54 immersion oil ($390\times$).

lishes the mineralogical name coesite, as opposed, for example, to the term "silica-C" (Sosman, 1954). The general crystallography of coesite (Ramsdell, 1955) and its crystal structure (Zoltai and Buerger, 1959) have been described, along with further accounts of its synthesis and characteristics (Khitarev, Slutskiy and Arsen'yeva, 1957). In addition, several studies have been made of quartz-coesite relationships (MacDonald 1956; Dacheille and Roy, 1959; Boyd and England, 1960).

As of 1954, the synthesis of kyanite had not yet been achieved, the difficulty having been ascribed to the required octahedral coordination for Al^{3+} (Roy and Osborn, 1954). More recent investigations, however,