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Stability of Epidote Minerals

A NUMBER of silicate minerals have proved difficult to synthesize by the commonly employed methods involving hydrothermal crystallization of glasses or reactive oxide mixes of suitable composition. Failure to synthesize a phase may be caused by the experimental conditions not being within the region where the phase is thermodynamically stable. But, in some cases, failure simply reflects a large nucleation barrier to the formation of the stable phase so that metastable phases which nucleate with ease form, and may persist indefinitely. Several workers¹⁻³ have considered this problem in relation to the epidote minerals, and the consistent failure of low-pressure synthesis could indicate that these phases may be stable only under relatively high-pressure conditions. Geological occurrence does not entirely support this proposition. The results presented here indicate that with these minerals nucleation is a sluggish process at low pressures, and if this step is by-passed, growth is readily achieved from the phases which normally form in synthesis. This sluggish nucleation is possibly related to the structure of the minerals.

Proof that the epidote minerals (zoisite, clinozoisite, epidote) are stable relative to the phases commonly formed in synthesis from their composition has been approached as follows. When zoisite is thermally decomposed at one atmosphere, reaction proceeds according to the reaction:



Similar reactions can be written for other members of the epidote family. When zoisite synthesis is attempted at low pressures and temperatures from a mix of appropriate composition, phases on the right of the above equation tend to be formed, or if leaching of silica occurs hydrogarnets may form. In the present experiments two starting materials were used; an iron-poor clinozoisite and an epidote which, judging from refractive index, contained around 13 per cent iron sesquioxide (Fe_2O_3). These phases were first thermally decomposed to form the high-temperature assemblages and then mixtures of the epidote mineral and high-temperature products