

Fig. 3. An approximate diagram showing the region of stability of eclogites (region bounded by *Z-K-H*) in a system with excess water. For further details see text

dehydrate serpentinites to give the stable combination amphibolite plus peridotite. It is worth noting that partial melting can lead to diminished water pressure but this aspect of the problem will be discussed elsewhere.

Two factors alter the position of the dehydration curves mentioned. The first is the effect of increasing  $P_{\text{Load}}$  for constant  $P_{\text{H}_2\text{O}}$ . This cuts back the field of high volume hydrates, such as serpentine, but hardly effects the breakdown of amphiboles. Thus serpentinite buffer reactions are moved even further into the field of amphibole stability. The second factor is the substitution of eclogite for the normal basaltic dehydration products of amphibolite. This increases the vapour pressure of amphibolite breakdown, but not to the extent required to cut the dehydration curves of minerals like serpentine.

It thus appears that the following points can be noted regarding crustal eclogites:

(1) Although the basalt-eclogite equilibrium curve is not well known at low temperatures, for dry rocks eclogite can be assumed to be a stable low pressure and temperature assemblage. Whether such assemblages occur then becomes a problem of all the factors involved in solid state reaction kinetics.

(2) If partially wet assemblages are depressed in the crust, we would anticipate a primary reaction producing appropriate hydrate mineralogy, followed by eclogitisation. Such a mixture of hydrous and anhydrous minerals could be in equilibrium, or may react to an equilibrium assemblage of minerals of intermediate water content.

Many problems remain unsolved. Why, for instance, are some eclogitic rocks so curious in composition that they appear to be metasomatic rocks? Metasomatism generally implies activity of an ample fluid phase. We suggest that some of these metasomatic processes may occur prior to the total destruction of the basalt mineralogy, and are followed by the draining of free water by hydration reactions. Sealing of the rocks by increased load pressure could then be followed by eclogite formation. The metasomatism may thus be part of early diagenetic or zeolite facies reactions.

ESSENE and FYFE (1967) suggested that some eclogites in the low temperature regime of California might be formed in the thermal aureoles of deep basic intrusives. This must still be considered a possibility for such heating of dry basaltic material might well be sufficient to overcome the kinetic barrier of eclogite formation in this generally cold environment.

And what of the eclogite facies? Does it exist in the crust? We prefer to leave these questions to those concerned with nomenclature. It would be premature to eliminate the facies or to restrict it to mantle inclusions in volcanic rocks until we understand these processes better. The important thing now is that we recognise wet and dry equivalents of metamorphism at the same  $P_{\text{Load}}$  and  $T$  or metamorphism where total pressure and water pressure are significantly different.

## References

- ESSENE, E. J., and W. S. FYFE: Omphacite in Californian metamorphic rocks. *Contrib. Mineral. Petrol.* **15**, 1-23 (1967).  
 FYFE, W. S., F. J. TURNER, and J. VERHOOGEN: Metamorphic reactions and metamorphic facies. *Geol. Soc. Am. Mem.* **73** (1958).