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METAMORPHIC CONDITIONS IN A PART OF THE HALIBURTON HIGHLANDS OF ONTARIO

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Metamorphism in the Haliburton Highlands is of Miyashiro's low pressure, intermediate type. Physico-chemical conditions ranged from 3.5 to 7 kilobars total pressure and 580 to 700 °C.

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The Grenville province is the easternmost portion of the Canadian Shield. Except for a comparatively small area in central Ontario (Lumbers 1967) it is a region of an almost uniformly high grade of metamorphism, that in the Haliburton Highlands and its environs, is generally taken to be of the almandine-amphibolite facies.

The implications of this particular facies label insofar as it applies to the Haliburton Highlands is examined in the first half of this paper. The last half constitutes an attempt to deduce metamorphic conditions in this region by use of a load-pressure (P_{load}) – temperature (T) grid. The determination of physico-chemical conditions by this and other means is without doubt an important objective of geochemistry, and the use of a grid stems ultimately from Bowen (1940). However, a major drawback to Bowen's scheme is that it depends upon the delimitation of pressure-temperature fields by use of bounding univariant reactions, and the number of truly univariant reactions that are useful in a petrogenetic sense is severely limited. In fact, in the realm of crustal petrogenesis, the petrologist may find that the only usable univariant reactions are those between Al_2SiO_5 polymorphs. Even here there is some evidence that the reactions are not strictly univariant (Althaus 1969, Zen 1969). Certainly, dehydration and decarbonation reactions, being divariant in systems open to H_2O and CO_2 respectively, will be less useful than Bowen thought.

Although such difficulties inhibit the construction of a petrogenetic grid for the general case, a specific grid, applicable to a particular metamorphic area, can in many cases be set up by a judicious choice of mineralogical reactions. Such a choice is dictated by the mineralogy of the rocks studied, and it leads to a petrogenetic grid tailored to a specific problem—in Wyllie's (1964) phrase 'a metamorphic grid'.