TURNER wrote as follows: "ESKOLA (1939, p. 345) discussed the possibility of erecting a zeolite facies to include the many and varied assemblages of zeolites and associated minerals formed by deuteric and hydrothermal processes at low pressures and relatively low temperatures. He rejected the idea, however, on the supposition that such assemblages do not represent systems in equilibrium. He noted, moreover, that because of their hydrothermal origin, their nature 'depends largely upon the composition, reaction and concentration of the introduced solution'." Largely on the basis of field and petrographic studies in southern New Zealand (COOMBS, 1954) TURNER then proceeded to revive the "zeolitic facies" (hereinafter referred to as the zeolite facies) "to cover only regionally developed zeolitic assemblages that largely replace the pre-existing rocks and conform to the mineralogical and chemical requirements of a metamorphic facies as specified in Chapter I."

The purpose of this paper is to present field and laboratory evidence bearing on this problem, to explore the extent to which equilibrium is attained, and to suggest that the facies concept can justifiably be extended to the zones of diagenesis and low grade metamorphism.

Irrespective of the exact definition that is used for a metamorphic facies, in our view the stimulus and long-range value of the facies concept rests in the belief that, in time, the physicochemical conditions under which a rock of given bulk composition forms a given assemblage of minerals will be determined within definite limits.

If we wish to follow, say, the complete evolution of a granulite from an unmetamorphosed sediment, we must be prepared to examine each stage in the process and to recognize as markers each observable change of phase. This has been done in some detail for transitions from greenschist assemblages onwards, but lower grades have not been widely recognized.

FYFE (1955a) suggested that it was unlikely that greenschists would form much below 300°C. If there is any substance in this view, then, for so long as we ignore this gap of 300°, we are ignoring about one-third of the possible thermal range of normal regional metamorphism. Field and laboratory evidence, imperfect as they may be, indicate that this neglect is not justifiable and that a large number of important phase changes may occur in this temperature interval. Zeolites are sometimes major rock-forming minerals and show a significant number of such phase changes.

In considering any facies covering the lowest grades of metamorphism it is obvious that certain difficulties will arise which may be less apparent in higher grades. First, at low temperatures, the replacement of pre-existing minerals will tend to be a slow process and may not reach completion.* The second difficulty arises from the fact that in low-temperature environments metastable phases may have a considerable chance of formation and survival. In the task of reconstructing

* Partly for this reason it is convenient to consider some zeolitic rocks in terms of the mineral facies concept (ESKOLA, 1920, pp. 145–146), rather than in terms of metamorphic facies, the assemblage of coexisting minerals concerned forming perhaps an interstitial microaggregate in a sediment or a single zone in an amygdale. On the other hand some of the rocks described can appropriately be considered metamorphic in the sense that they are extensively or even completely reconstituted.