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ON THE GENESIS AND EMPLACEMENT OF THE OPHIOLITES IN THE OMAN MOUNTAINS "GEOSYNCLINE"¹⁾

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The rocks and primary structures exposed in the Semail Nappe (ophiolites) of the Oman Mountains are comparatively well preserved, so that reconstruction of the early history of the ophiolites can be attempted with some confidence.

The following conclusions have been drawn from geological and petrographical observations:

1. The site of ophiolite emplacement was a linear feature longer than 450 km within the oceanic crust (= oceanic ridge s.l.).
2. The volcanic activity along this line started in the late Permian and lasted until mid Cretaceous, when large-scale overthrusting began.
3. During the early part of the period of emplacement (until late Triassic or earliest Jurassic), the ridge was covered by only shallow water, which permitted the deposition of discontinuous patches of shelf carbonates (reefs, shoals and islands).
4. During the later periods, tectonic activity along the ridge exposed the deeper, plutonic part of the volcanic feeder zone on the ocean floor (uplift of coarsely granular gabbros).
5. By a process of uplift and expansion, the islands of volcanic rocks and shallow-water carbonates were moved away from the volcanic zone (spreading of ocean floor) and were submerged and associated with pelagic sediments. These shallow-

water carbonates now form the "Exotic Blocks" of the Oman Mountains.

6. The contacts between the suite of gabbroic rocks (olivine gabbros, troctolites, eucrite gabbros and diabases) and the ultrabasic rocks suggest that the former were intruded into the latter. The ultrabasic rocks, therefore, must have formed a *regional* frame for the very large intrusions of gabbroic-basaltic magma.
7. The contacts between the coarse-grained gabbroic rocks and the peridotites resulted in the development of basic migmatites. It is inferred that such contacts have developed at a considerable depth.
8. The presence of magmatic breccias at all stratiform levels of the ophiolite nappe suggests that movements accompanied the igneous activity. The petrographical relationships between components and matrix suggest that the fragments of relatively deep-seated rocks (e.g. coarse-grained gabbros) were reworked in magma that crystallised at shallower levels than the fragments.
9. The close association of plutonic, subvolcanic and extrusive rocks in a rather short (1-2000 m) "stratigraphic" column of the Oman Ophiolites is interpreted as the result of combined tectonic and igneous activity: the uplifted plutonic rock masses were continuously intruded, enveloped and covered by younger diabases that crystallised at a new, relatively shallower level in the volcanic "megafissure". After arrival at the ocean floor, all were covered with layers of subsequently extruded lavas.
10. Inherent in the above sequence is the suggestion that the various members of the ophiolite suite

¹⁾ Summary of talk given in Leiden on the 31st January, 1969.

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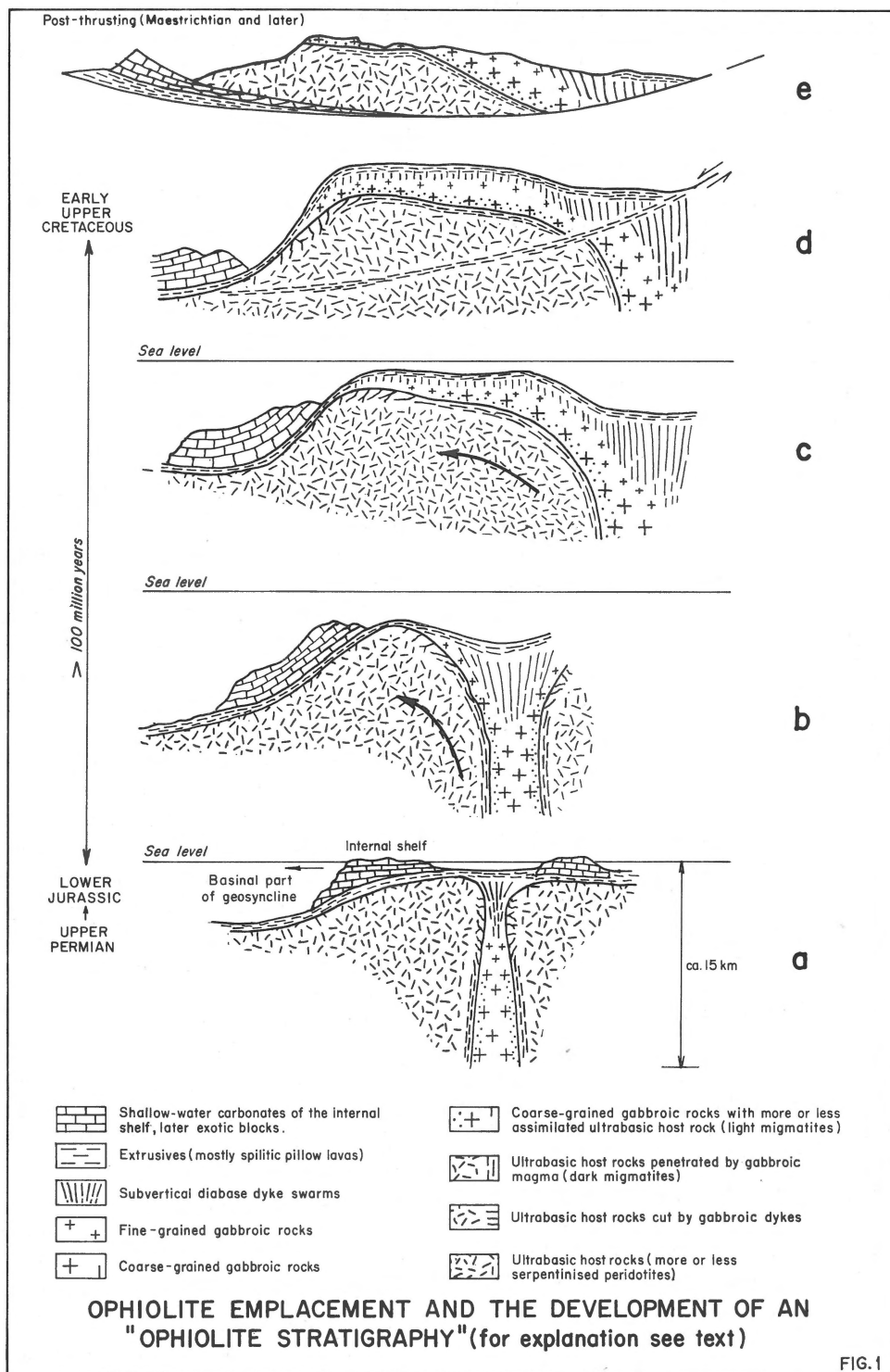


Fig. 1

Ophiolite Emplacement and the development of an "Ophiolite Stratigraphy" (for explanation see text).

have different ages of crystallisation: higher in the case of peridotites than of gabbros, with the associated subvolcanic and extrusive rocks being the youngest.

Figure 1 shows a schematic cross section through the site of ophiolite emplacement (= oceanic ridge) at various stages of the orogenic history.

- a. Relatively static period. Volcanic activity results in the extrusion of basaltic lavas and in intrusion and crystallisation of diabases and gabbros at increasing depth. Late Permian to earliest Jurassic.
- b. Early stage of tectonically active period. Jurassic.
- c-d. Exposure of the deeper parts of the "megafis-sure" by tectonic movements (spreading ocean floor) combined with continuous volcanic activity. Mainly during Cretaceous.
- e. Schematic cross section through the Semail Nappe after large-scale overthrust. The nappe has overridden the basinal sediments and the "Exotic Blocks", and all are now thrust over the autochthonous carbonate shelf of the Arabian Peninsula.