Details of Crustal Structure in Northern Calabria Derived from Seismic Refraction measurements

by

K.-G. SCHÜTTE

Institut für Geophysikalische Wissenschaften, Frei Universität, Berlin (R.F.A.)

In October 1972 a refraction seismic program was carried through within the scope of a cooperation of Italian and German Research Institutions (Fig. 1). This paper deals only with the measurements made in Northern Calabria. From these measurements a first approximation of a crustal model has been derived for an orogene (Calabrian Massif), its foredeep (Gulf of Taranto) and its hinterland (Tyrrhenian Sea) (Fig. 2).

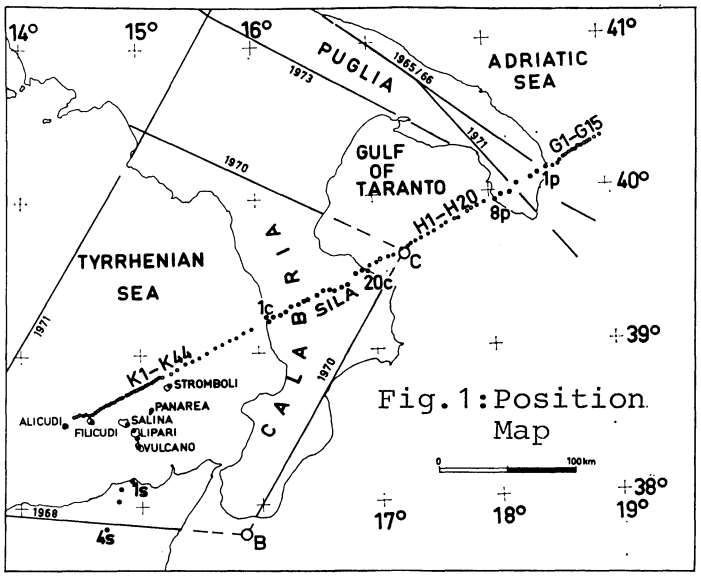

Fig. 1: Position Map

Under the Gulf of Taranto, the crust/mantle boundary lies at a depth of about 30 km and dips in the direction of Calabria, where the crustal thickness amounts to about 40 km and 45 km are also possible in accordance with the observations. At a depth of about 15 km under the Ionian coast of Calabria lies a zone of high xelocity dipping towards S.W. It is underlain by a strong low-velocity layer, and its effect is that the average low velocity cannot be estimated quantitatively. That such a channel exists, however, is proved by the long delays of the P^m-group, observed from the Ionian side.

Under the Tyrrhenian Sea, crustal thickness amounts to 20 km, increases in direction of Calabria and reaches about 29 km under the SW border of the Sila. Here, a low-velocity layer is situated at a depth of 20 km, rising towards SW. In the upper crust, the velocity lines are pointing upwards to the region of low-temperature — high pressure metamorphites as well as granulites and kinzigites respectively.

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The break-off not only of the Tyrrhenian crust/mantle boundary but also that of the Ionian crust/mantle boundary can be caused by the geometrical configuration of the shotpoint and receiver positions. A wide extension of the shallow Tyrrhenian crust/mantle boundary in NE direction, however, is improbable because the Ionian crust/mantle wave group P^m could be observed up to the midst of Northern Calabria. On the other hand, it cannot be excluded that the velocity line V = 8.0 km/s, coming from the Ionian side, extends farther SW-wards under the Tyrrhenian crust/mantle boundary.

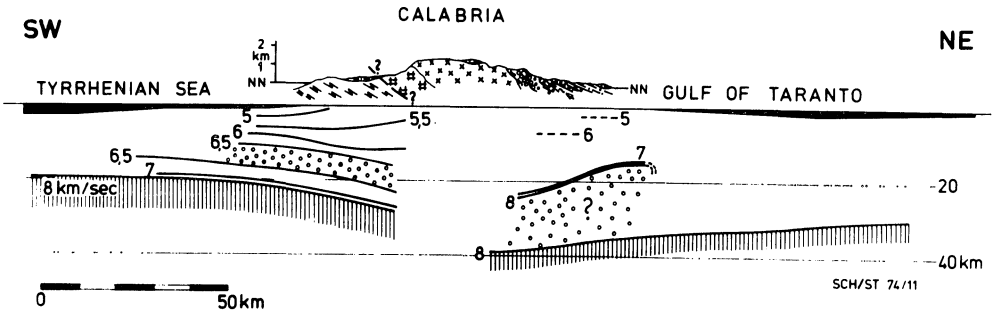

FIG. 2. : Crustal model for Northern Calabria.

Besides the great differences in crustal thickness of the Tyrrhenian and Ionian side, a simple crustal structure is met in the Tyrrhenian part, while under the Sila region it is very complicated. Just in that region where the total crustal thickness has the highest value, rocks, typical for the lower crust, are exposed. These two facts suggest the correlation of intermediate and basic rocks to the high-velocity zone detected in the Sila region at a depth of only about 20 km. The results of the measurements call for a strong velocity decrease below this high-velocity zone. Though the quantitative value of the minimal velocity cannot be strated till now, this low-velocity layer has to be correlated to sialic rocks. So we obtain a picture that shows the Calabrian Massif as a crystalline nappe with a thickness of about 20 km, lying over sialic material.

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