Characteristics of Crustal Structure in Some Mediterranean Orogenic Systems

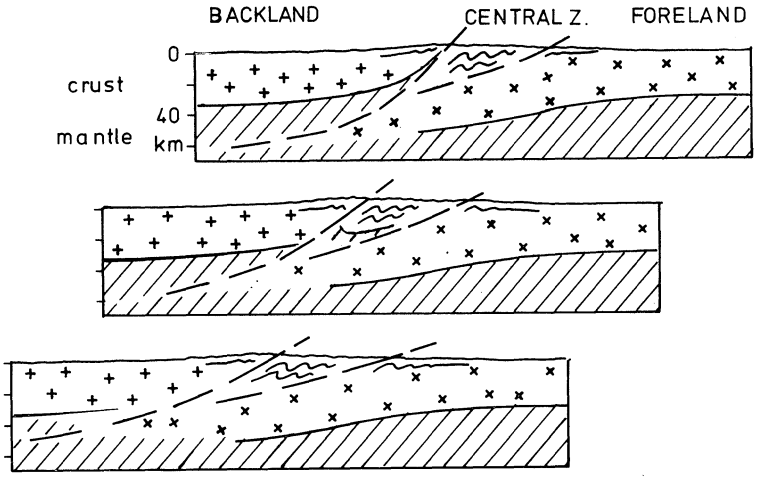
by

P. GIESE, C. MORELLI and J.N. PAVLENKOVA

Osservatorio Geofisico Sperimentale, Trieste (Italie)

The following paper deals with the crustal structure of the transition between the axial zone and the backland of some Mediterranean orogenic systems.

Regarding a cross-section in the Southern Apennines running from the foreland (Puglia) through the central zone to the Tyrrhenian Sea as backland, the crustal thickness increases continuously from Puglia (30 km) in SW direction towards the axial zone (45 km). Under northern Calabria, a high-velocity layer could be detected at a depth of 20 to 25 km. The lower crust must be composed of sialic material due to its very low velocity values, whereas the high values in the upper crust have to be explained by the existence of basic or even ultrabasic rocks. W and SW of Cosenza in the direction of the Tyrrhenian Sea, the backland, the crust shows a thickness of no more than 20 to 25 km. The same structure, in principle, has been found in Western Sicily and in Campania, regions with similar tectonic structures.



Different types of crustal structure in the transition between the central zone and the backland.

In the western foreland of the Western Alps, a crustal thickness of 30 - 35 km has been found. Towards the central zone, the M-discontinuity dips down and reaches a maximum depth of 50 - 60 km in the Penninic zone (Central Alps). The inner arc of the Western Alps, partly bordering the Po-plain, is characterized by the steep gravity of Ivrea.

The high-velocity material of the Ivrea body has a direct link to the crust-mantle transition and the upper mantle east of the gravity high to the hinterland of the southern Alps and the western Po-plain.

Rapp. Comm. int. Mer Médit., **23** 4a, pp. 109-110, 1 fig., (1975).

The zone of velocity inversion between 20 and 40 km is the eastern continuation of the generally present low-velocity zone in the lower crust of the Central Alps. Such zone does not exist in the lower crust under the Po-plain.

From the foreland of the Eastern Alps towards the central zone, crustal thickness increases from 30 to 50 km. Contrary to the previous examples, no remarkable change in crustal thickness and structure could be detected when passing the Insubric Line.

The orogenic system of the Crimean Highlands is situated between the Skythian platform and its adjacent Siwash depression in the N and the Black Sea as hinterland in the S. from N to S, total crustal thickness increases from 40 to 50 km. Just S of the Crimea, crustal thickness decreases abruptly from 50 to about 30 km. A reinterpretation of the data revealed that the high-velocity layer, situated in shallow depth in the Southern Crimea, does not reach down to the crust-mantle boundary but is interrupted by a low-velocity zone in a depth between 20 and 35 km. The situation looks similar in the Eastern Carpathians.

Summarizing these facts, it can be stated that the mountain systems discussed here are characterized by nappe tectonics and lateral compression. We must postulate the original place of their layering to have been in that region where now the hinterland is situated. Consequently, during the orogenic movements, the hinterland has overridden the original place of the nappes with its underlying crust. The same result will be achieved by reversedly directed movements. The low-velocity layer under the thin crust and portions of the uppermost mantle of the hinterland can be seen as root zone and the top of the subduction zone. In case the crust of the hinterland consists of sialic material only, it is difficult or even impossible to separate it from the crust of the overthrust or subducted sialic zones. This situation may prevail in the Eastern Alps.

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Discussion

Après l'exposé de ***M. Giese, M. Grinda*** intervient « Dans le modèle de subduction que vous avez exposé et qui est également celui du Dr CLOSS, on devrait observer, au-dessus de la plongée d'une plaque, des séismes d'extension, comme dans la Cordillère des Andes. Est-ce bien le cas?

Dans le séisme classique de surrection de chaîne des montagnes accompagné de la formation d'une racine il n'est question que de séismes de compression et dans les Alpes c'est bien ce que l'on a constaté pendant la courte période qui nous sépare de l'avènement de la Séismologie moderne jusqu'à ce jour ».

Morelli répond " There exist testion or distension earthquakes at least in one part of those considered, that is Southern Italy ".

Matthews : Can you tell us a little about the methods of interpretation that you used, for example in interpreting the profile with shots in the Tyrrhenian Sea a seismometer on land in Calabria. It has seemed to me to be doubtful whether you could be sure that your solution, consistant with the arrival times and their amplitudes, was a *unique* solution, when the line one or more major crustal discontinuities.

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