GEOLOGICA BALCANICA, 31. 1-2, Sofia, Jun. 2001, p. 89-91

Earthquakes and structures within northern Moesian Plate

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Although most Romanian geologists consider that the Romanian territory hosts at least three main geotectonic plates/sub-plates (East European Plate (EEP), and Intra-alpine (IaP) and Moesian (MoP) sub-plates) appropriate evidence to outline and describe their contacts have not been provided yet.

The paper focuses on the northern Moesian Plate in an attempt to answer several important questions:

- location of its northern and northeastern boundaries
- deep crust structure;
- deodynamics of the area.

Gravity, magnetics, magnetotelluric soundings (MTS), deep seismic soundings (DSS) and seismological studies were used on this purpose.

Based on geophysical evidence, two lithosphere contacts were pointed out within the area as MoP wedges: Peceneaga-Camena fault (PCF), separating North Dobrogea and MoP, and Trans-Getica fault (TGF), the MoP northern boundary.

The Trans-Getica fault, as the MoP northern boundary, was sharply outlined in the filtered images of both gravity and national ground vertical component geomagnetic maps of Romania in the southern part of South Carpathians. The model is fully supported by active seismicity registered along its path. The pattern of the geomagnetic field and large similitude of the rocks within westernmost MoP with rocks belonging to EEP (Visarion et al., 1988) strongly suggests a strike-slip character for TGF. It seems that an important segment of EEP was derived toward WSW along TGF.

Re-interpreting geomagnetic and gravity information revealed a new PCF track beneath the platform sedimentary cover (Besutiu, Nicolescu, 1999). Unlike previous hypothesis, it seems that the fault extends northwestward, toward the Carpathians, and vanishes in the Vrancea active seismic area. MTS and DSS data do not conflict this model.

Data provided by seismological studies (Oncescu et al., 1998) were used to decipher the deep crust structure features of the area. By using the polynomial regression technique, epicenters of the last millennium-registered earthquakes on the Romanian territory could be lined up along the track of several major faults that seem to manage the MoP structure at the bottom of the crust (Fig. 1). In its turn, a thorough analysis of the recently obtained consistent geomagnetic images over the southwestern margins of EEP (Besutiu et al., 2000) suggested that the whole SE Carpathians foreland was cut into "slices" by several major, NW trending faults.

It seems that under the action of the northwestward motion of the Aegean sector, determined by the last 9 m.y. anticlockwise rotation of Africa (Dewey, 1999), major brittle crust block-bounding faults occurred, splitting the MoP into several sub-slabs, that relatively move each to another. Their displacement generates normal earthquakes whose epicenters are lined up along the contacts. Among these crust blocks, the most active seems to be the compartment located immediately south PCF, where the main geotectonic effort was directed. It advanced hardly toward Carpathians, taking along from time to time, by friction, the neighbouring blocks and playing an important role in the Alpine chain bending. Micro-tectonic studies within the Carpathians bending area (Lăzărescu and Popescu, 1984) pointed out a

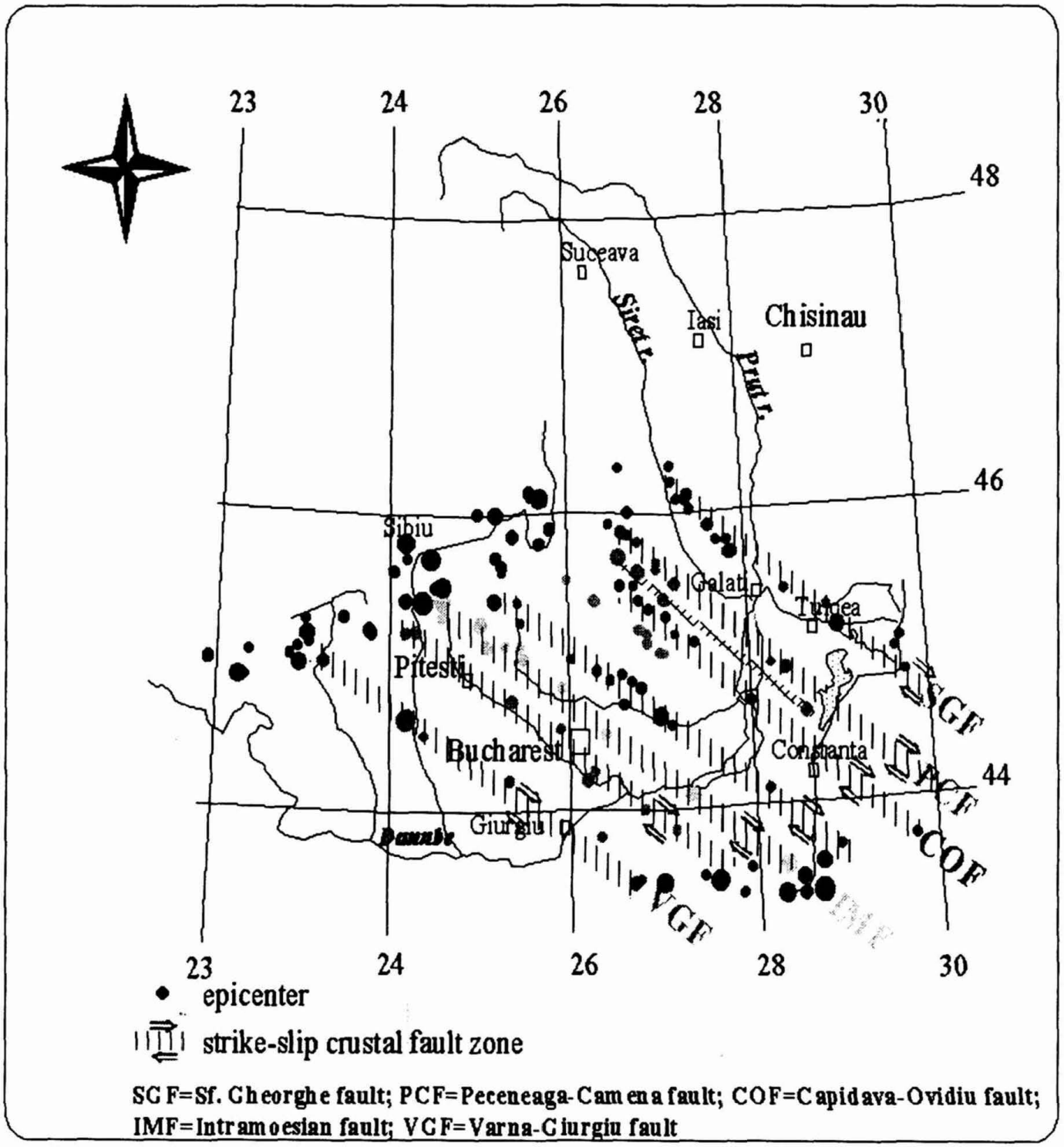

Fig. 1. Crustal faults splitting the bottom of the crust of the Moesian Platform (as revealed by the last millenium recorded earthquakes). Epicenters location according to ROMPLUS catalogue (Oncescu et al., 1998). Dot size corresponds to the magnitude moment (Mw). Alternate shades of gray used to discriminate various faults tracks

total NW displacement of 10-12 km, which corresponds to a rate of MoP underthrusting beneath Vrancea area of about 3 mm/year.

During the years, many models, more or less successful, but all based on subduction hypothesis, have been built in order to explain the intermediate-depth earthquakes occurrence. The pattern of the intermediate-depth seismicity in the Vrancea seismic zone suggests a nearly vertical parallelepiped seismic body. The small size and geometry of the seismic zone have made it difficult to interpret the kinematics of subduction and continental collision in the area.

The new geophysical data analysis suggested the idea that PCF, TGF and TESZ meet within Vrancea active seismic region into a continental unstable triple junction complicated by the twin-faults structure of TESZ. Therefore, the collapse of a lithospheric block along the above-mentioned faults is proposed instead the subduction hypothesis. Convective cells and phase transform processes accompanying the thermo-dynamic disequilibria created by the penetration of the sinking colder body into the hotter upper mantle could be responsible for the Vrancea intermediate earthquakes.

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