

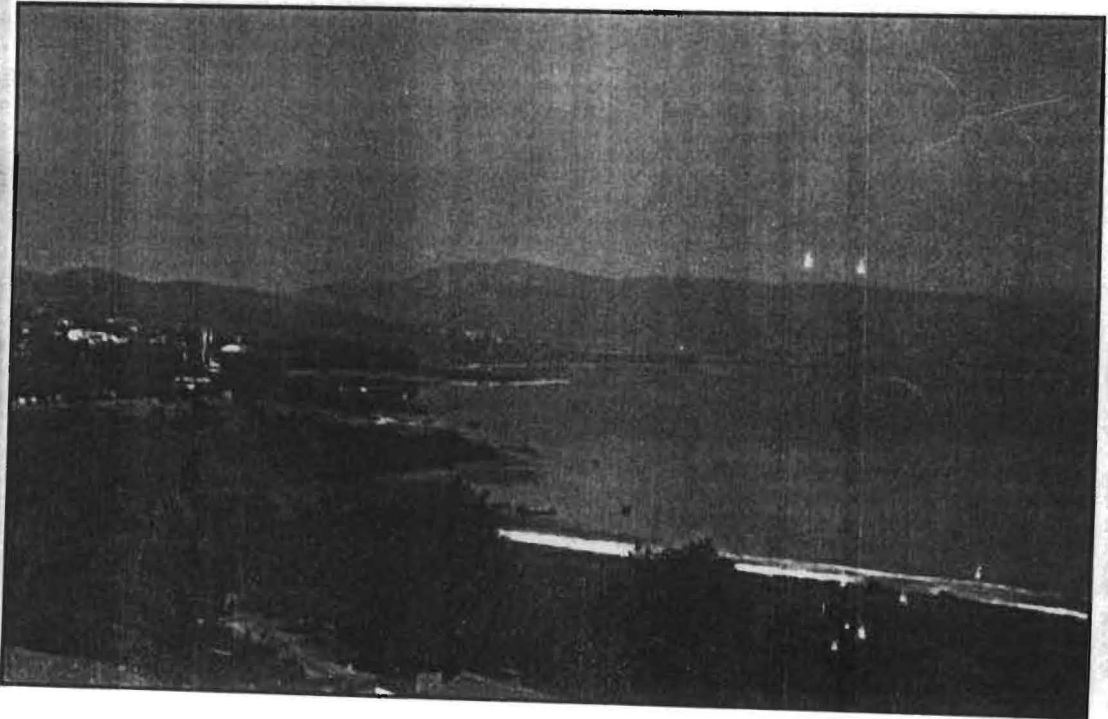


SYMPOSIUM - ANNUAL MEETING



PROCEEDING

*MAGMATISM, METAMORPHISM AND METALLOGENY OF THE
VARDAR ZONE AND SERBO-MACEDONIAN MASSIF*



*PLATE TECTONIC ASPECTS OF ALPINE METALLOGENY
IN THE CARPATHO-BALKAN REGION*

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A neogene orogenic tectonics of East Macedonia (with use of the morphostructural analysis)

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Abstract

It was disclosed that structures of modern relief of Eastern Macedonia reflect the tectonic forms of Neogene period. Active oreforming processes took place in that period. The neogene structure forms was reconstructed on the basis of morphostructural method. These structures have major role for control of metallogenic units. Three ranges of ring structures and zones of linear dislocations, that are orecontrolling structures, were disclosed on the territory of Eastern Macedonia.

Key words: Eastern Macedonia, Morphostructural analyses, Orogenic structures, Lineaments.

Results and Discussion

Development of a neogene magmatism and the ore in Macedonia is dated for a tectonic zone of a northwest extension. This zone is traced from Serbia through Macedonia in Greece and is submitted by a system of longitudinal cracks. Besides along this zone within the limits of the Serbo-Macedonian array arched structures were selected, the development of which is connected to processes of neogene activation. Linear systems of cracks and the arched raisings have the important value at learning of accommodation of an ore. The indicated above structures managed to be revealed only under the geological data, which not always it is enough for renovation of structures of neogene period. Was proved earlier, that many modern structural forms within the limits of Macedonia have long and inherited development. Besides spent together with the scientists of Macedonia research on learning deep structures and modern tectonic elements has shown on their tight communication.

To plan the main structural plan of territory of Macedonia there was the rather small-scale learning of a relief. However for definition of an internal structure of detected earlier structures and allocation of main ore-controlling elements there was necessary the learning of a modern surface in a larger scale. For this purpose the structure-geomorphological analysis, permitting to select diverse on the diverse forms sizes and age of a underlay tectonic elements of a modern relief, was spent. For their detection earlier developed methodical methods, among which generalization of a relief, learning of a figure of a river network, decoding of space photographs (1975) were used. The analysis of a relief was spent with the help of topographical plane tables and space photographs in a scale 1:200000. In an outcome the morphostructural scheme of East Macedonia was composed in the same scale. The investigated region is in a country between two rivers Strumica and Vardar. It mainly mean mountains, located in limits Osogovo mountain and raising Plackovica. The raisings are dismembered by valleys of the rivers Bregalnica, are curve etc.

Osogovo mountain is on the average elevated up to altitude of 2000-2500 m., Plackovica - up to altitude 1500-2000 m. The river valleys, dismembering raisings, have a saucer the figurative or plane cross-sectional forms. Width of valleys is various - from 1 up to 6 kms in a diameter. The slopes of some broad valleys are good terraced, and narrow - sharp, abrupt. Many valleys, irrespective of their width, have the form of grabens.

On the morphostructural scheme the main tectonic plan of a modern surface of a relief is reflected and are selected typomorphic of a structure, which have the important value at learning of the ore-controlling factors (Fig. 1).

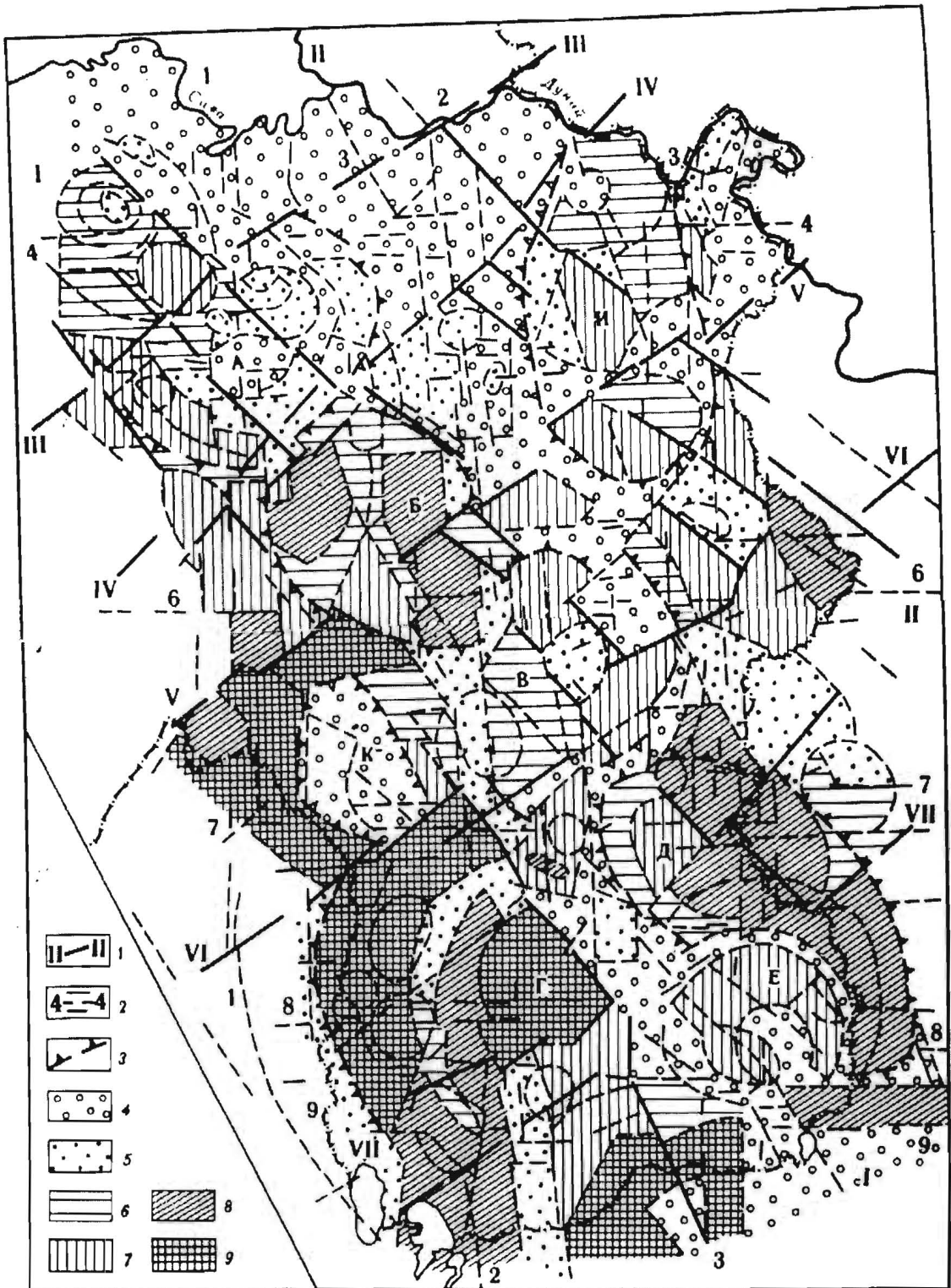


Fig. 1.- Schematic presentation of structural forms of present relief of Serbia and Macedonia
 1. Basic fracture zones of diagonal strike, 2. Basic fracture zones of orthogonal strike, 3. Boundary of concentric structures, 4 - 9. Hypsometric peaks (m), 4 - to 600, 5. 600 - 1000 m, 6. 1000 - 1400, 7. 1400 - 1800, 8. 1800 - 2000, 9. 2200 - 2600.

First of all it is concentric structures of different ranks and through linear zones. To concentric structures of the first rank it is necessary to

attribute the Macedonian arch, east half of which is taken by investigated territory. This arch, reaching in diameter 250-300 kms was

graphically justified N. T. Kocneva, K. Romic, (1981), and palaeotectonically - S. Jankovic and V. S. Kravcov, (1981). The structure of the Macedonian arch is underlined by presence of a central cavity, filled by high cretaceous, Palaeogene and quaternary adjourment, arched peripheral raisings and centripetal figure of arrangement of main inflows r. Vardar (Vancarov etc., 1984).

The main features of the arch are reflected by isomeric ash value of an anomalous gravitational field. In the crust of the intended arch area of a maximum is located which is surrounded by ring-type zones of gravimetric minima. In east half of the Macedonian arch in a country between two rivers Vardar and Struma two local arches (D and Å), have in diameter 70 and 64 km., (Fig. 2) are selected which earlier together with the geologists of belgrade university were intended here at structure-geomorphological researches (1981).

Orbed raising, located in northern part of East Macedonia and conterminous to pool of the rivers Pcinja and is curve, is a little bit asymmetrical in the scheduled image. The southern its part is biased on east rather northern. Inside the local arch four sectorial units, have a various hypsometric level, are selected.

The southern local arch Å, located in a country between two rivers Bregalnica and Vardar in a modern relief is submitted by slanting raising, delineated by a broad depressed zone. The internal structure of the arch Å is underlined by concentric tectonic elements of a relief. It is necessary to mark, that both local arches are dismembered by cracks of a passing here linear system of a northwest extension. In places of the greatest partition by these dislocations the local arches D and Å are complicated by derived ring-type sags, have in a diameter 30-40 kms. The derived arches are clearly exhibited in modern structures. They are interesting by that for a Nim the largest ore units Kratovo-Zletovo and Buchim-Borov Dol are dated. The boundaries Kratovo-Zletovo of a ring-type structure are traced on valleys of the rivers Kamenicà, is curve, Bregalnica, Karataci. The internal part is constructed is very difficult. It is composed by group of ring-type facilities, have the form or cauldronics constructions or domes, surrounded of with a ring-type depressed belt.

Other derived the Buchim structure, located in pool of the rivers is curve and Lakavica. This structure has an elevated central part, divided by

a linear grabenshaped cavity and peripheral ring-type depression. This structure is good decoded on space photographies as an orbéd dark spot, located on interception of two large linear zones. At palaeotectonical renovations à Dys per self attention the fact, that areas of distribution of sedimentary neogaeen derivations underline Kratovo-Zletovo and Buchim derived structures, detected in a modern relief. So arched outlines of eocene sedimentary rocks agrees surround from west Kratovo-Zletovo structure, for a central part of which outputs of volcanic and subvolcanic derivations are dated. The rim of the southern local arch and northern half Buchim of a derived structure are compatible with outlines of accommodation. Pliocen of sedimentary rocks. To the third order of ring-type facilities structures, have the sizes from 15 up to 15.5 km. a diameters and extending mainly by chains along linear zones of a northwest extension, concern. The structures of the third order are very diverse on the internal structure. Is the most difficult constructed ring-type structures, located within the limits of units of interceptions extended different strike of extended linear zones Among huge quantity of structures of the third order those were selected only from them, which have tags endogenic of an origin.

Except concentric structures the analysis of a relief and decoding of space photographies has allowed to select a great many of linear tectonic elements. Alongside with well-known modern cracks a number of broad zones, have a large expansion, is detected. Many of them it is possible to attribute to zones of latent character. As they play the important value at learning of accommodation of an ore, we òày on them the special attention.

As already it was marked by many contributors (Jankovic, Serafimovski, Tomson) a dominating extension of linear zones of East Macedonia is a northwest direction. To this direction many tectonic elements of a modern relief are subordinate. And they are exhibited as in prepared, and in the active along Bulgarian boundary, differs by the greatest differentiation of a structure. It is composed from separate contrast on altitude of units and is complicated by a continuous chain of ring-type structures of the third order. The most difficult tectonic figure has region within the limits of an ore unit Sasa. Group form. The linear elements of a northwest extension are grouped in four zones, distinguished by certain characteristic tags of their development. So the linear zone I-I in width up to 10 km, passing mainly of

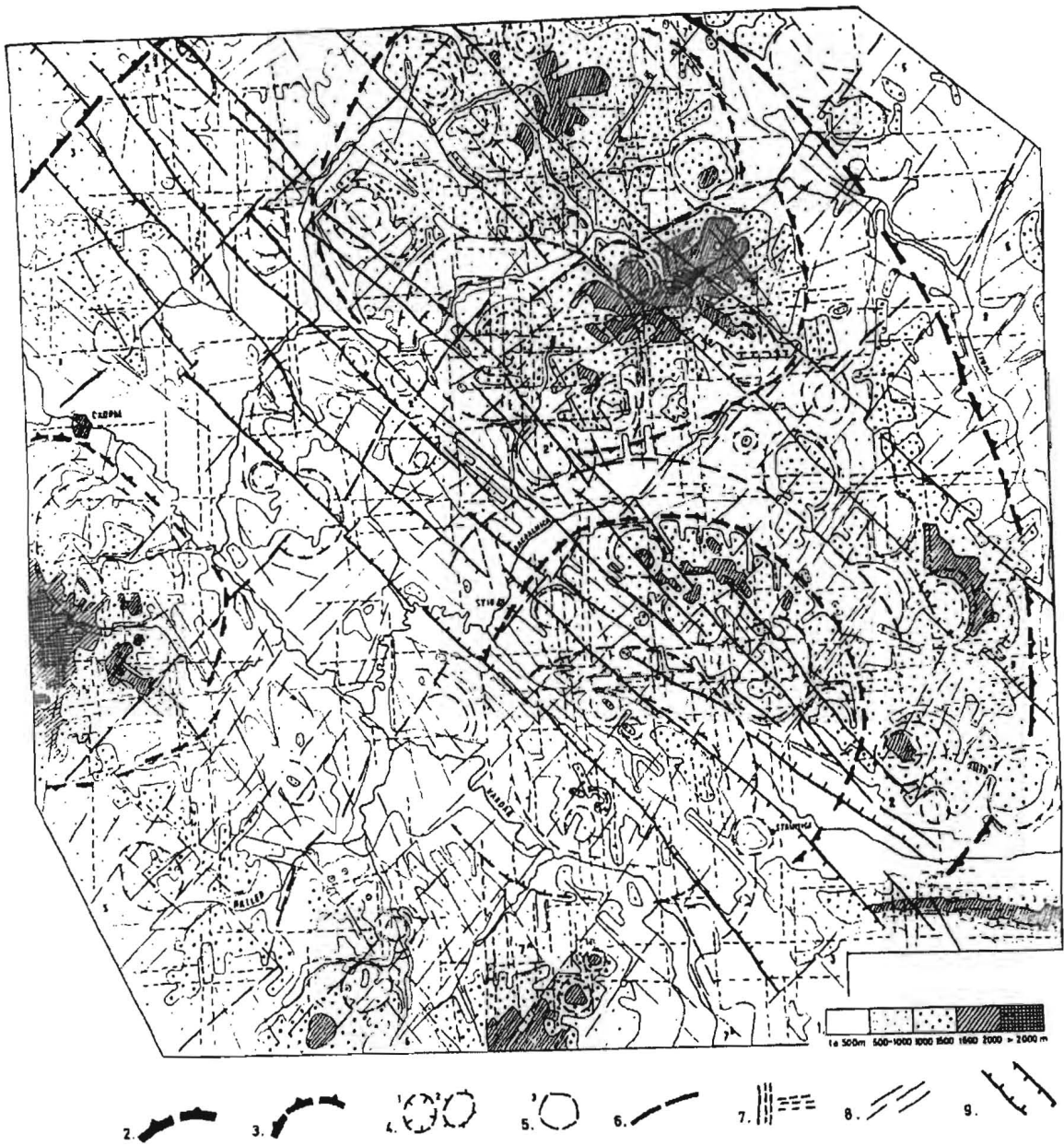


Fig. 2.- Morphostructural scheme on the East Macedonia

1. Heisht peak, 2. Boundary of Macedonian dome, 3. Boundary of local dome, 4. Boundary of concentric structures, 5. Occurrences of structures by Cosmic images, 6. Faults, 7. Faults zone systems of ortogonal strike, 8. Zones of oblique cuts of Nort -West strike.

intersectional ring-type structures and great many of diversely directed linear tectonic elements is here observed. The linear zones 2-2 and 3-3 width on 4-6 kms are composed from separate parts, biased on the attitude the friend to the friend. The zones 2-2 ÷ 3-3 on an extension bladderly are bent, and some their parts are fuzzy or vaguely are submitted in a relief. In a direction on ÷ ã -east of a zone 2-2 and 3-3 gradually approaching merge and will derivate a unified linear system. Inside these zones and their rim a circuit of ring-type structures mainly of the dome form is also selected. The exception is represented Krainovskaya by a ring-type structure, have the

form caldrons and distinguished by the large sizes. The zone 3-3 is marked also by narrow linear wave shaped structures and dismembering their linear valleys, have the form of grabens. It is necessary to underline, that the slopes of wave shaped raisings steep and have not terraced levels. A linear zone 4-4 structures basis by broad linear cavities, maintained on an extension. Except linear structures of a northeast extension, is activest exhibited in a modern relief, two broad systems of cracks (5-5 and 6-6) northeast extensions were detected.

The system 5-5, located in a country between two rivers is curve and Bregalnica, have width

up to 25 is strongly broken, is dismembered, is underlined in a relief mainly by tectonic ledges and breakaways. The system of 6-6 width up to 32-35 kms is submitted by wave shaped raisings, aligned valleys of the small-sized rivers and large valleys Vardar, is old, Bregalnica. This system 6-6 is good decoded on space photographs, where along it extensive elements of dark phototone are selected. The meridional elements of a relief are widespread on territory of East Macedonia everywhere. However the band of 7-7 width up to 40 kms has the greatest concentration of very small-sized linear anomalies of a relief. The prolongation of a band saturated by linear elements is observed and in Serbia and in Greece. In its limits are selected of a narrow belt of the greatest partitioning, only some of which it is possible to observe continuously on the whole territory. It is necessary to mark, that within the limits of broad grabens of a latitudinal extension of many meridional belt appear vaguely, displace on east, are bent. Within the limits of large ore units the meridional elements of a relief are documented with the special distinctness as on topo charts, and on space photographs. The passive forms of an expressing of meridional structures allow to assume, that they are connected to through depth zones of cracks. Opposite, the latitudinal zones are submitted very actively. They are underlined by tectonic ledges, bendings of the large rivers, modern by grabenshaped cavities. Within the limits of East Macedonia is selected two the most high-power zones - 8-8 and 9-9, the sizes of which on width reach accordingly 26 and 22 kms. Other latitudinal zones are also very precisely exhibited in a relief, but have considerably smaller width. All orthogonal zones differ by a significant expansion. It is necessary to mark, that many linear elements of a relief find the explanation under the data of geological, geochemical and geophysical materials. So for example the outlines of sedimentary Eocene-Palaeocene rocks frequently have the prolated form, agree extension of zones of a northwest direction. It is necessary to mark, that the concentric and linear structures of East Macedonia are in tight correlation. Activest exhibited in a relief Kratovo-Zletovo and the Buchim structures, concluding large ore regions, are located in units of interception of the most high-power and very extended orthogonal linear zones. Two linear zones of a northwest extension will be terraced by ring-type structures of the third order. And at interception by linear zones of arched raisings the ring-type structures are submitted shown more clearly. Thus, within the limits of East Macedonia because of of the morphostructural

analysis and outcomes of a decoding of space photographs concentric structures of different ranks both broad zones of diagonal and local dislocations were selected. Many tags indicate communication of these structures with tectonic elements of epoch of neogean activation and productive ore. The detected structures of a modern relief deserve further learning and can be used by the basis for a metallogenic card.

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