Redaktion: Dr. HANS DIETRICH LANG
unter Mitarbeit von: B. MESSNER und H. STRAUCH

Anschrift des Herausgebers: Alfred-Bentz-Haus, Postfach 51 01 53, 3000 Hannover 51

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[Geological Map of the Chalkidhiki Peninsula and adjacent Areas 1 : 100 000 Explanatory Note]

Summary:

The paper presents the regional mapping of the Chalkidhiki peninsula and its adjacent areas towards the north, carried out at a scale 1 : 50,000 during the years 1962/63 and 1968/70 on behalf and with support of the Institute for Geology and Mining Research, Athens by personnel of the Federal Institute for Geosciences and Mineral Resources, Hannover. It includes a short description of all mapped lithological units and a list of occurrences of economic minerals in the area. It compiles the work of P. ANTONIADIS, J. BORNOVAS, H. GUNDLACH, M. GUY, K. IOANNIDIS, F. KOCKEL, A. LEUBE, H. MOLLAT and H. W. WALTHER (see map sheet SE). Laboratory work and fossil determinations were carried out by G. CHRISTODOULOU, H. FAUTH, F. GRAMANN, G. KAUFFMANN, E. KEMPER, P. MÜLLER, P. RASCHKA, D. STOPPEL and TH. WEISER.

The nomenclature of the metamorphic rocks follows the recommendations of H. G. F. WINKLER (1967, p. 227), that of the plutonic rocks the recommendations of the IUGS subcommission on the systematics of igneous rocks (STRECKEISEN 1974).

The investigated area comprises from East to West the following major geotectonic units: (see map sheet SE)

a) The western part of the Rila-Rhodope Massif, following the definition of MEYER & PILGER 1962 and KOCKEL & WALTHER 1965.

b) The total width of the Serbo-Macedonian Massif, following the definition of DIMITRIEVIĆ 1963, and its sedimentary cover.

c) The innermost units of the Vardar Zone sensu KOSSMAT 1924, that is the easternmost parts of the Hellenides.

d) The central parts of the Vardar Zone, that is the central Peonias Zone sensu MERCIER (1966/73).

These geotectonic units differ in their geological evolution, their grade of metamorphism and structure.

The Rila-Rhodope Massif includes the crystalline complexes east of the river Strimon, the Rila and Pirin Mountains in Bulgaria as well as the Pangaeon and Menikion Mountains, the Vrondou, the Bos Dagh, the Tsal Dagh and the isle of Thassos in Greece. Its eastern border is formed by the "Nestos line", a major zone of dislocation following the Nestos River (LUNDBERG 1976, unpublished). In the West it is overthrusted by the Serbo-Macedonian Massif along the "Strimon thrust fault", which has been recognized in the western and northern Pangaeon Mountain (KOCKEL & WALTHER 1965, SCHENCK 1971) and in the western Angistron Mountains (KOUKOUSAS 1972). The Rila-Rhodope Massif litho-

logically is characterized by a marble sequence (No. 56, 60[1]) of considerable thickness (up to 8.000 m) in the upper parts of the metamorphic suite. Metamorphism reaches only grades of the higher greenschist facies. Broad domes with axes striking ENE and ESE prevail, in the cores of which granitoid bodies (No. 61) intruded ± parallel to the regional foliation.

The age of the metasediments and their orogenetic deformation rests unknown. A post-precambrian age of the marble sequence has been proved. Metamorphism is supposed to be alpidic (Meyer 1966).

The part of the Serbo-Macedonian Massif, investigated in this paper is the southernmost extension of a long and narrow, more or less N—S-running geotectonic element, which begins at Beograd in the N. Its importance for the regional geology of the Balkan peninsula has been stressed by Dimitrijević (1966, 1974). It is a prealpidic consolidated piece of crust surrounded by alpidic mountain ranges. A lower metamorphic series, the Kerdilion Formation (No. 1), includes several mappable marble horizons (No. 2). In the upper metamorphic sequence, the Vertiskos Formation (No. 3), meta-ophiolites (No. 5, 6, 7) and ultrabasic lenses (No. 4) are common. Smaller gneissose granitoidic intrusions (No. 9) are widespread. Regional metamorphism reaches the almandine-amphibolite facies; anatexis (No. 10), as well as the formation of pegmatoids and palingenetic granitic bodies are characteristic.

The age of the consolidating orogeny and metamorphism is not ascertained. Yougoslavian authors assume a first, late precambrian orogeny — the pre-Vlasina phase, and a second, ordovician refolding. Hercynian K/Ar-ages (Borsi, Ferrara & Mercier 1964) may be due to later rejuvenations.

The upper paleozoic and early mesozoic cover of the basement has been preserved in synforms and imbricate structures. Terrestrial permo?-skythian sediments (Examili-Formation, No. 11) prevail in the NW, triassic carbonates (Svoula Group, No. 14) in the central part. During a mid-jurassic phase of folding and metamorphism these remnants of the former sedimentary cover have been incorporated in the basement, which for its part in places suffered a diaphthoritic remobilization. During this orogenic event syn- and late orogenic quartzdioritic (No. 36) and granitoidic (No. 28—35) intrusions penetrated the southwestern margin of the massif.

Postorogenic porphyritic stocks and dykes of paleogene age (No. 44—51) intruded the basement complex and its western margin. Neogene and quaternary vertical movements lead to a disintegration of the once homogeneous massif into swells or horsts and basins or graben structures filled by neogene and quaternary sediments (No. 52) respectively, which today are the dominant morphological features.

The boundary of the Serbo-Macedonian Massif towards the innermost units of the Vardar Zone is not well defined over its whole length. In the NW a steep reverse fault thrusts the basement upon its mesozoic cover. SE of the Apollonia depression this boundary is no longer a fault. It is formed by the erosional limit of the continuous cover of mesozoic metasediments. Due to the intense folding together with the basement it is multifariously lobated. On Sithonia peninsula the boundary is concealed by large granitoid batholiths (No. 32—35) which intruded the southwestern margin of the massif as well as its mesozoic foreland. Nevertheless a turning of this border region from the general NW—SE-direction into an E—W-direction and towards the NE on Ayios Oros peninsula is obvious.

The innermost units of the Hellenides correspond with the "Zone Serbo-Macédonienne" und the eastern "Zone de Péonias" of Mercier 1966/73. They together

[1]) The numbers refer to the mapping units in the legend of the geological map, NE-sheet.

form a new geotectonic element, named "circum Rhodope belt" by Kauffmann, Kockel & Mollat 1976. To the East it is bordered by the Serbo-Macedonian Massif. Its western and southwestern margin is nearly entirely concealed by neogene sediments. Only between Monopigadhon and Glynthos a narrow band of basement crystalline rocks of Serbo-Macedonian appearance has been observed, which to our opinion, plays a major rôle in the geotectonic pattern of the region, limiting the circum Rhodope belt towards the West. The basement inliers of the Kotsa- and Kour Dere west of Axioupolis, the outcrops of gneisses near Latomion and the basement slab between Bogdanci and Valandovo in southern Yougoslavia are supposed to form its northern continuation.

Based on facial differences during the mesozoic, the grade of metamorphism and structural development, a subdivision into several subunits is justified.

The Deve Koran-Doubia-unit is known only from the northwestern section of the area. It more or less corresponds to the "Zone Serbo-Macédonienne", the "Unité de Metallikon" and the "Unité de Levendochori" of Mercier (1966/73). In this unit only the lowermost parts of the upper paleozoic-mesozoic sequence are preserved, beginning with continental deposits and acid igneous rocks of permo-skythian age (Examili Formation, No. 11 and Volcano-sedimentary Formation, No. 12, 13). The middle and upper Triassic (No. 15) is represented by mainly neritic limestones. The lower Jurassic pelagic limestones (No. 16) and intercalated basic rocks are only occasionally preserved. East-dipping imbricate structures and overturned folds prevail. Metamorphism is low, intrusive rocks are absent.

Further to the SE the Melissochori-Cholomon-unit verges directly on the Serbo-Macedonian Massif. It corresponds to the "Unité de Megali Sterna", parts of the "Unité de Levendochori" and the occurrences of the "paleozoic flysch" of Mercier (1966/73). The southwestern border of this unit is formed by a major east-dipping thrustfault, into which slices of highly diaphthoritic basement have been incorporated. The lowermost continental Triassic is lacking. The middle and upper Triassic carbonate rocks (limestones and marbles of the Svoula Group, No. 14) are more pelagic. The lower and middle Jurassic rocks are typical continental margin sediments, turbidites and intercalated olistostromes (No. 17, 18). Isoclinal folds with mainly vertical axial plains are characteristic. Metamorphism is low only in the northwestern section. Southeast of the road Thessaloniki—Langadhas it increases and reaches grades of the upper greenschist facies. Late orogenic Jurassic granitoid bodies intrude the metasediments in the Cholomon area (No. 31) and on Sithonia peninsula (No. 32, 33, 35).

Further to the Southwest, the Aspro Vrisi-Chortiatis-unit corresponds to the "Unité de Aspro Vrisi", the "Unité de Vafiochori" and the "Unité de Arzan" of Mercier. The lower parts of the sequence, especially the permo-skythian continental deposits and the neritic carbonate rocks of the middle and upper Triassic (No. 15) show close relations to the Deve Koran-Doubia-unit.

In the upper parts, shales and black cherts of Jurassic age (No. 19) seem to be the equivalents of the turbidites in the Melissochori-Cholomon-unit, indicating deeper water conditions. Diabases are intercalated. The unit is characterized by a high portion of metamagmatites, ranging from ultramafics (No. 20, 21), gabbros (No. 22) and metadiorites (No. 24—26) to acid metagranitoids (No. 27), which now form the greenschist belt of Thessaloniki. Isoclinal folding and eastwards dipping imbricate structures are dominant. Metamorphism generally reaches the higher grades of the greenschist facies.

These four units together have been consolidated and metamorphosed as well as intruded by late orogenic granitoids before the sedimentation of the Upper Jurassic. The Tithonian Molasse formation (No. 14) transgressively overlies the meta-sediments and already contains pebbles of metamorphosed lower mesozoic rocks. Posttectonic sediments

are the eo-oligocene conglomerates and limestones (No. 43) near Langadhas and the widespread continental, brackish and lacustrine basin fill of upper Miocene to Quaternary age (No. 52).

The central Peonias zone, corresponding to the "Unité de Guevgueli" of MERCIER, differs from the former units in many respects. It comprises the western Chalkidhiki and the Kassandhra peninsula as well as the most western margins of Sithonia peninsula. Lower mesozoic rocks have not been recognized. Upper Jurassic reef limestones (No. 39) and calc-turbidites rest upon and are intruded by ophiolitic rocks (No. 38), pillow lavas, dolerite dykes and finegrained gabbros (No. 37). Metamorphism only reaches grades of low temperature greenschist facies.

The geological history of the area can be subdivided into 5 major epochs. The first, prealpidic cycle comprises sedimentation, consolidation, magmatism and metamorphism of the crystalline basement of the Serbo-Macedonian Massif. It ends probably with the late precambrian pre-Vlasina orogenic phase of the Yougoslavian authors.

The second cycle begins with the Permian sedimentation upon the old massif, runs through an epicontinental stage in the western foreland, comprises the development of a continental margin at the western fringes of the Serbo-Macedonian Massif and ends with the consolidation, metamorphism and acid magmatic activity during the middle ? Jurassic.

The sedimentary and magmatic events of the Upper Jurassic — Lower Cretaceous cycle are mainly confined to the central Peonias zone. It comprises the formation of great masses of ophiolites, the creation of reefs and sedimentation of turbidite. The cycle ends with a comparably feable deformation and metamorphism during the lower Cretaceous (Aptian-Albian) (MERCIER 1966/73).

An Upper Cretaceous cycle, proved in the more westerly zones by MERCIER, is not determinable in the area of investigation.

The next cycle starts with the Upper Lutetian and ends with the Lower Oligocene. Deposition of molasse type sediments prevail. Deformation is even less pronounced than in the former cycles. Upthrusting occurs at the margins of the Serbo-Macedonian Massif. Porphyritic stocks and sills intrude the consolidated basement.

The Neogene-Quarternary cycle begins with the subsidence of basin regions without relations to the former orogenic structural pattern. The continental, fluviatile and lacustrine sedimentation in these basins only in places is interrupted by brackish or marine ingressions. The main tectonic activity is lower Pleistocene in age with vertical movements along NW, NNW and NNE and ENE striking faults. Strike-slip movements with considerable amounts of dislocation occur predominantly along WNW and E—W-striking fault zones. Limited magmatic activity and the ascension of hydrothermal solutions is linked to these fault lines.

A great number of economic minerals occurrences has been observed and many of them are described in table No. 4 and pl. 1. Altogether 172 occurrences of copper, lead, zinc, pyrite, gold, manganese, chromite, tungsten, bauxite, talc, asbestos, magnesite, baryte, graphite and other industrial minerals have been recorded. Minerable ore deposits are worked only at Stratoni-Stratoniki (Pb, Zn, Cu, Py), at Olimbias (Pb, Zn, Ag) and in the western Chalkidhiki ($MgCO_3$), a few others require further investigation.

Inhaltsverzeichnis:

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