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Plutonic Emplacement in the Eastern Karavanke Alps

Granitni in tonalitni pas v Vzhodnih Karavankah

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Rudniki svinca in topilnica Mežica

In the Eastern Karavanke Alps two nearly parallel plutonic belts extend in the west-east direction. The northern belt is characterized by granite associated with gabbro and monzodiorite, in the southern, however, tonalite prevails. They are separated by a narrow phyllite stripe overprinted by contact metamorphism. Their origin, and age in particular, involved many difficulties. Since some phyllite blocks have been found in tonalite at Ravne above Šoštanj, the solution became easier. It is noteworthy that a large phyllite block is intruded and impregnated with granite. Hence follows that the granite rock association is older than tonalite. From radiometric dating it results that granite is related to the Variscan orogeny and tonalite to the Alpine magmatism. Along the northern border of the granitic belt, a clear north vergence occurs. The southern contact of the tonalitic belt, however, shows various structural features. The southern contact is considered to be a part of the great Periadriatic Lineament. Finally it should be noted, that no genetical relations exist between the Karavanke plutonism and lead-zinc ore deposits occuring in the Eastern Karavanke Alps as the latter appear to be of Triassic age.

V Vzhodnih Karavankah potekata približno vzporedno od zahoda proti vzhodu dva pasova globočnin. Severni sestoji v glavnem iz granita, za južnega pa je značilen tonalit. Oba pasova magmatskih kamenin loči ozek pas kontaktno metamorfoziranega filita. O starosti karavanških globočnin so doslej menili prav različno; toda odkar so bili na Ravnah nad Šoštanjem v tonalitu odkriti bloki filita, od katerih je eden intrudiran in impregniran z granitom, je postalo jasno, da je granit starejši od tonalita. Radiometrične meritve so med tem že potrdile, da je granit variscičen, tonalit pa alpidski. Vzdolž južnega roba tonalitnega pasu poteka periadriatski lineament. Triadna svinčevo-cinkova orudenja v Vzhodnih Karavankah nimajo ničesar skupnega s karavanškim plutonizmom.

The Eisenkappel emplacement of the Eastern Karavanke Alps is made up of two parallel magmatic belts separated by a narrow phyllite stripe. The structure is 42,5 kms long and extends in east-west direction. In the northern belt of the breaking up zone a porphyritic granite prevails associated with gabbro, diorite and monzodiorite. This rock association appears to be genetically related (C. Exner, 1971, 104). The prevailing rock of the southern belt is quartz-biotite-hornblende diorite showing a distinct parallel structure; mostly it is named tonalite. Usually the northern belt is named granitic belt and the southern one tonalitic belt. In the tonalitic belt also some transitional rocks like quartz-biotite diorite and granodiorite occur. At its south-eastern end occurs a porphyritic rock showing indistinct parallel structure. All the rocks of the tonalitic belt are genetically close related. They can hardly be discerned with the naked eye (E. Faninger, 1976, 196—199).

Unsolved is the question of the stratigraphic position of the phyllite in between the magmatic belts. In all probability it is to be compared with the highly phyllitized lower suite of the Magdalensberg series (F. Kahler, 1953, 14), which belongs to the Ordovician period (G. Riehl-Herwirsch, 1970). As this schistose rock exhibits a clear contact-metamorphic overprint, it is here designated as contact-metamorphic phyllite.

At all times there was disagreement between the geologists about the age of the plutonic rocks. According to F. Teller (1896, 32) granite was considered to be the youngest rock. Similar suggestions have been made by H. W. Graber (1929) and C. Exner (1971). According to A. Zorc (1955, 69) the granite was assumed to be older than tonalite, and perhaps even older than Triassic rocks. The age of the tonalite was resumed after C. Germovšek (1952) to be Upper Cretaceous to Miocene in age. I. Štrucl (1965, 161; 1970, 6; 1974, 385) supposed that granite is of Variscan, whereas tonalite of Alpine origin. His contention is supported by the field work of F. Isailović and M. Miličević (1964), who found phyllite blocks intruded and impregnated with granite within tonalite. L. Kober (1938, 156) wrote about the old Eisenkappel granite and about the young (Alpine) Eisenkappel tonalite. J. Duhovnik (1956, 25) supposed that both intrusions are of Tertiary age, and after B. Berce (1960, 246) granite appears to be younger than Lower Scythian. Finally E. Faninger (1976, 204) succeeded in proving that the granite rock association and tonalite have been derived from two magmatisms different in ages. Through his additional field work and microscopic examination it became evident that the tonalite is younger than granite.

According to radiometric dating, the rocks of the granitic belt are of Variscan age (244—216 million years) and those of the tonalitic belt originated by relatively young Alpine orogenetic events during the Tertiary period (29—28 million years) (R. Cliff, H. F. Holzer & D. C. Rex, 1974; H. J. Lippolt & R. Pidgeon, 1974; S. Scharbert, 1975).

Some details observed during our field work could give us certain information about the geologic age of the Karavanke plutons. In the east, the northern belt of the breaking up zone borders on Tertiary deposits containing pebbles derived from granite and tonalite (E. Faninger, 1970, 100). F. Teller (1898) supposed that these deposits belong to the Socka beds of Oligocene age.

Recently they are considered to be equivalent to Middle Miocene Eibiswald beds (P. Mioč, 1976). Therefrom it results that Karavanke plutons are of pre-Middle Miocene age. In this way the upper boundary of the intrusion interval is determined. North of the granite the early Paleozoic Magdalensberg series occurs indicating the lower limit of the granitic intrusion. H. W. Graber (1929) and C. Exner (1971, 64) dealt with the contact metamorphism related to the intrusion. The contact between the granite and Magdalensberg series, as well as between granite and Triassic beds, is for the most part tectosequent. The section Topla-Koprivna appears to be an exception as there a contact—metamorphic schist and hornfels are joined to the granite (H. W. Graber, 1929; I. Štrucl, 1954, 1965). No contact effects could be found in the Triassic beds occuring at the contact with granite in the section Črna—Topla (I. Štrucl, 1954). That is why a pre-Triassic age of granite was supposed (A. Zorc, 1955; I. Štrucl, 1965).

As to the age of the tonalite, it could be supposed only that it is younger than the contact-metamorphic phyllite in which tonalite apophyses occur. The contact-metamorphic phyllite has been considered to be a schistose cover of the tonalitic intrusion (F. Teller, 1896, 22). The Triassic beds lying in the south of the magmatic emplacement can not give any information of the age of the intrusion, as the contact tonalite/Triassic rocks is of tectonic nature.

It results from the above explanations that a rather wide intrusion interval is in question, involving an intrusive phasis from Variscan to Alpine igneous activity. The problem under consideration appears to be insolvable according to the geological features shown in Teller's geological map (F. Teller, 1898). The tonalitic and granitic belts there are plotted to be separated in their whole extent by contact-metamorphic phyllite (fig. 1). The solution of the age problem is somewhat advanced since S. Isailović and M. Milićević (1964) called our attention to the phyllite blocks enclosed within tonalite in its easternmost part. A large phyllite enclosure intruded and impregnated with granite is particulary interesting (fig. 2). Nothwithstanding, the tectonic contact between phyllite and tonalite appears to be problematic. But no large displacement could be indentified there, as a remnant of a schistose cover is in question. The problem can be explained in the following way:

Firstly phyllite was impregnated with granite and affected by contact-metamorphism. At a later period the tonalitic intrusion followed, and at that time the contact-metamorphic phyllite turned to the cover mass of the tonalite. Such a succession of the geologic events does agree with radiometric dating mentioned above.

Finally let us make some remarks about the Alpine/Dinaric boundary (L. Kober, 1938, 156), and the "Ostalpin" and "Südalpin" (H. Bögel, 1975, 176) respectively. The northern and the southern boundaries of the crystalline breaking-up zone are characterized by important displacements. In the north, there a clear north vergence occurs; in the south, however, the fault appears to be vertical. The north vergence of the granitic belt is evident from thrust faults and overthrusts occurring in the North Karavanke range of mountains. In the south, however, the relations are rather unclear. Therefrom both the north- and south vergence are reported: According to C. Exner (1971, 8—9)

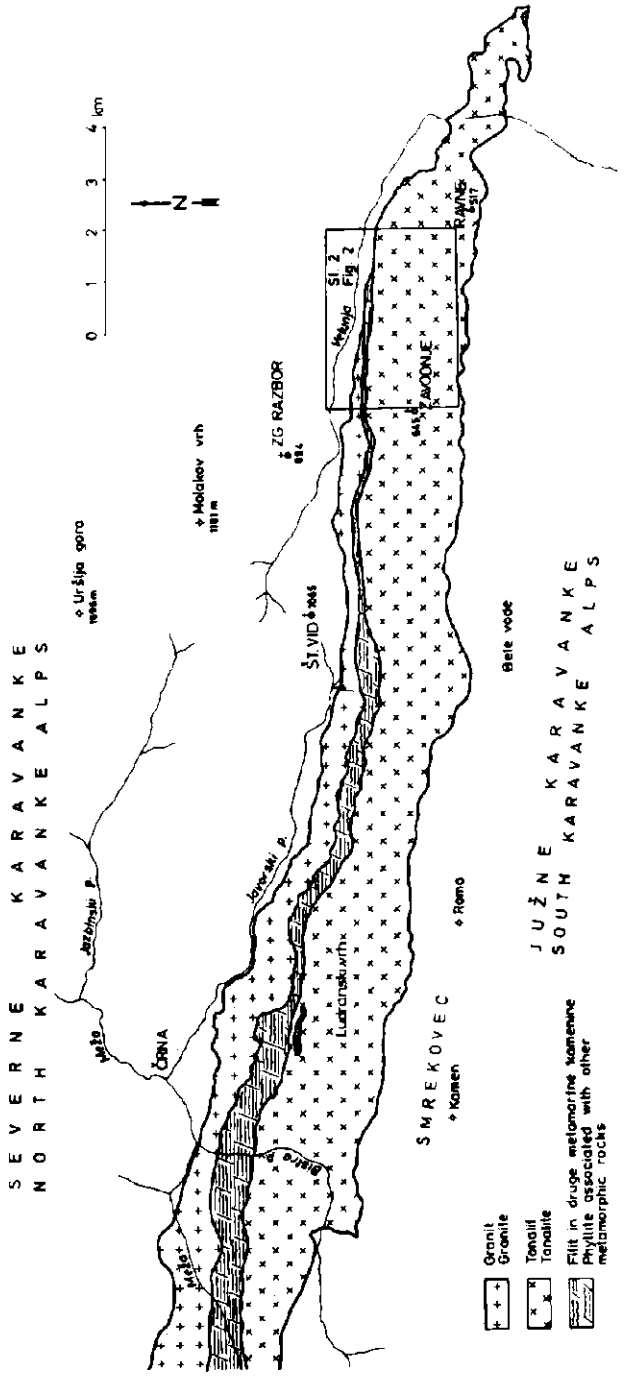

Fig. 1. Outline map of the Eisenkappel plutonic emplacement (according to F. Teller, 1896)

Sl. 1. Geološka skica železnokapelskega magmatskega pasu (po F. Tellerju, 1896)

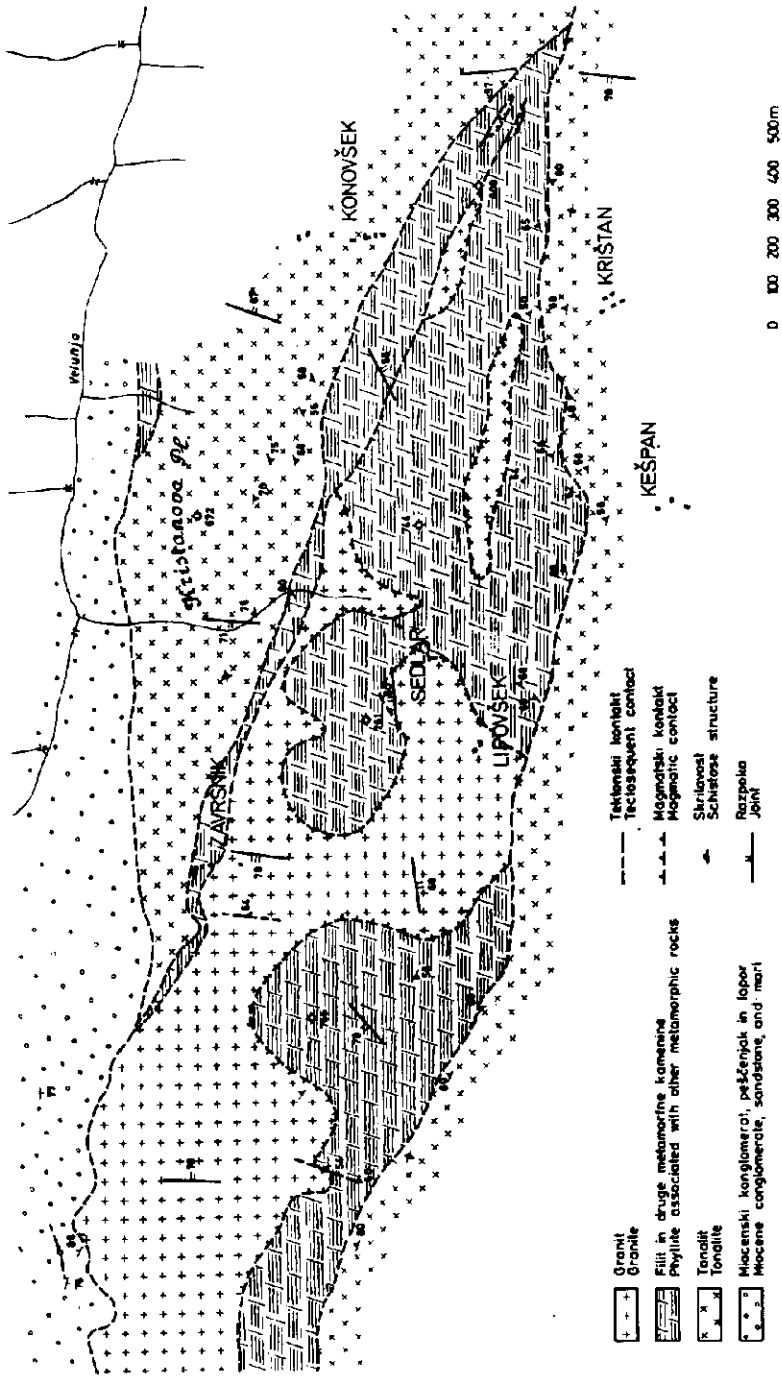

Fig. 2. Structural map of the eastern part of the Eisenkappel plutonic emplacement (according to S. Isailović & M. Milićević, 1964)

the Werfen beds of the Olševa Mt. are driven northwards over the mylonitized tonalite, whereas elsewhere in the west a perpendicular or even reversed fault occurs inclined northwards. Similar features have been found in the east where the shattered zone is some meters wide. The southern dislocation line appears to be more important compared to the northern one. This results from a well expressed mylonitization and other geological relations. A direct contact granite/Magdalensberg series is a general characteristic of the northern granite boundary. The southern contact of tonalite, however, varies more in nature and appearance. There have been brought together various lithostratigraphic sequences and different structural units as well. Moreover, Oligo-Miocene volcanic activity appears to be associated with the southern faulted structures (A. Hinterlechner-Ravnik and M. Pleničar, 1967, 237; R. W. Bemmelen, 1970, 141; I. Štrucl, 1971, 290). Consequently the southern fault does come into consideration as a part of the Periadriatic Lineament (see C. Exner, 1976, 20). The breaking up zone of the Karavanke Alps belongs in its entire extent to the Eastern Alps or to the "Ostalpin".

Along the magmatic zone, there occur some lead and zinc ore deposits, for instance Mežica. Their origin has been supposed to be associated with the granitic plutonism (B. Berce, 1960, 248). This conception could, however, hardly be taken into consideration due to a great difference in geologic age of the plutonic intrusions and mineralization. The latter appears to be of Triassic age, whereas granite is of Paleozoic and tonalite of Tertiary age.

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