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REPORT ON THE IGP-ACTIVITIES OF THE INSTITUTE FOR PETROLOGY

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During the periode of the I. G. P. 1971—1979 petrological problems involved in geodynamics have been tackled by working groups of the Institute of Petrology (former Mineralogisch-Petrograpisches Institut).

The most important item in this respect is the ophiolite problem in the Eastern Alps. The basic problem to be solved by the presented study is to what extend the serpentinites and periodtites of the metamorphic zones can be considered to be ramnents of a former oceanic curst. A paper about this item will be presented in full length during the Int. Geol. Congress, 1980, Paris. The relations of the igneous and metamorphic basement of the Northern Alps in Eastern Austria to the "Zentral Gneiss Zone" of the Hohen Tauern have also been studied [13].

As a result of this work "Zentral Gneiss Zone" is considered to be the ultimate fringe of the Northern plate of the alpine geosyncline in Austria.

A geotraverse between the SW-part of the Wechsel fenster and the "Grazer Paläozoikum" (Geotraverse East) has been studied to evaluate the available tectonic-geodynamic models in the light of petrological datas.

A complete geologic mapping was carried out (Blatt Birkfeld 1 : 50.000). The plate tectonic model of TOLLMANN [11] seems to fit the best to the results of petrological work in this area.

1. Contributions to the occurence and genesis of ultramafitites and related rocks of the Eastern Alps.

On the boundary of the Western and the Eastern Alps the Penninic zone is dipping below the East-Alpine nappes and reappears in several tectonic windows. These are from the west to the east the Gargellen — the Unterengadin — and the Tauern window and the window group of Rechnitz-Bernstein. The detailed correlation of the Penninic formation of the Eastern Alps with the troughs of the Penninic zone of the Western Alps is difficult and contradictionary. TOLLMANN [12] compares the Hochstegen welt facies of the Hohen Tauern with the Brianconnais of the Western Alps. The "Schieferhüllen" nappes were correlated with the Piemontese. The lower of these nappes is characterized by the prevalence of calcareous phyllites and micaschists which correspond to the "Bündner Schiefer" of Switzerland. Serpentinites, metagabbros, greenschists, metavolcanites, prasinites and rodingites are associated with the calcareous metapelites. Metaradiolarites and manganese rich rocks are also characteristic for these association of Jurassic-Cretaceous age. The ultramafititic-mafititic rock association is considered to be "ophiolites" following the definition of the Penrose field conference of the A. G. S. 1972. But this term must be used careful and critically taking into account the complicated stratigraphy and structures of the metamorphic zones of the Alps. Peridotites and serpentinites of the Praetriassic metamorphic basement of the Eastern Alps do not belong to the alpine ophiolite association. Even those peridotites ocurring within the Tauern window but belonging to the "Untere Schieferhülle" cannot be considered as members of the alpine ophiolite family. If we agree to plate tectonic models developed by DEWEY et al. [1], DIETRICH [2], TOLLMANN [11], only those ultramatitic and mafititic rocks can be considered to be alpine ophiolites for which a generation by ocean floor spreading during Jurassic or Cretaceous time is probable.

The "Mittelostalpin" sensu TOLLMANN [12] is divided into two tectonic units of preaealpidic origin and metamorphoses: the Muriden and the Koriden. Both these units contain ultramafitites. The deeper Muriden nappe consists of lower grade metomorphic rocks like garnet micaschists, staurolite schists, gneisses and marbles, eclogites do not occur in this unit. The large ultramafitite complex of Kraubath belongs to this unit. The lense shaped NW-SE striking body has a length of 14,5 km and is associated with amphibolites. It consists predominantly of dunites and orthopyroxenites, which are partly serpentinized. The Kraubath peridotite is the largest of the ultramafitite lenses which are embedded in amphibolites. These amphibolites surround the Gleinalpe consisting of banded gneisses.

The dunite of Hochgrößen is situated farther to the west in a different tectonic position. It is fringed by eclogites which are partly transformed to amphibolites by a regressive metamorphism. As a result of detailed studies it is supposed that the dunite of Hochgrößen is derived by tectonic movements from the Penninic zone below. The Koriden nappe consists of kyanite schists, gneisses, micaschists, amphibolites and eclogites. Peridotites are bound to the Plankogel formation consisting of micaschists and characteristic manganese quartzites.

It is a remarkable fact that ultramafitites associated with metasediments of Upper Mesozoic age are completely serpentinized whereas those of Praetriassic age contain many relicts of primary minerals specially olivines, pyroxenes and spinels. We suppose that this striking fact is caused by the implacement of the Penninic ultramafitites in water rich sediments. The emplacement of the Prealpidic ultramafitites took place obviously in a more dry perhaps metamorphic environment.

Within the Tauern Window the ultramafitites are represented by antigoritites in the Unterengadin and in the Rechnitz window group chrysotile lizardite serpentinites with completely preserved primary textures occur. Higher temperatures during alpine metamorphose within the Tauern window seem to be responsible for this characteristic feature. A metamorphism by constant volume explains the complete preserved primary structures in spite of the total replacement of the primary minerals by serpentine and other minerals. Secondary Ni-minerals have been found in most serpentinites. The primary olivine-pyroxene spinel associations points to an upper mantle origin of the Praetriassic peridotites. The same origin is supposed for the serpentinites of the Penninic zone. In spite of some difficulties the rhythmic layering of clinopyroxenites, dunites and wehrlites of the Stubachtalkomplex PETRAKAKIS [7, 8] may be caused by a cumulus process within the upper mantle. Metamorphic olivines characterized by low Ni- und Fe-content are proved for the Stubachitcomplex and are supposed for the dunite of Hochgrößen.

The Unterostalpine serpentinites are included into the group of alpine ophiolites. The lack of ultramafititic rocks in the Unterostalpine of the Semmering-Wechsel window is explained by the absence of Jurassic-Cretaceous strata and the existence of continental crust in this region. Pumpellyite-prehnite alpidic metamorphism has been confirmed in the Unterengadin window. The ophiolites of Rechnitz-Bernstein window group are recrystallized in higher pressure greenschist facies.

This is confirmed by the evidence of new generated magnesio-riebeckites in metagabbros [5]. Chrysotile and lizardite have been proved in the accompaning serpentinites. In these rocks primary textures are completely preserved by chrysotile and lizardite. A detailed study was devoted to serpentinite lenses of the flysch zone near Kilb and Gstadt [9]. According to X-ray tests of the Gstadt serpentinite lizardite is the unique detectable serpentinite mineral in this rock. From relictic textures we conclude, that mostly rocks of harzburgitic petrography have been the source rocks of the serpentinites. The regional distribution primary textures seem to indicate an isovulmetric metamorphism in an open system. Chlorite embedded in some serpentinites may be deri-

ved from pyroxenites, supposed metamorphism is approximately isochemical. Summing up our observations serpentinisation after the implacement of peridotites and related rocks into the Jurassic-Cretaceous Penninic sediments seem probable.

The ultramafitites of the Tauern belonging to the alpidic ophiolite suite are transformed to antigoritites. The antigorites form plates up to 2 mm in diameter. The average Al_2O_3 content is distinctly higher compared with typical chrysotile serpentinite. In spite of the lack of primary textural relicts the derivation from dunites, harzburgites and other ultramafititic rocks is evident. The evolution of Tauern antigorites is comparable to that of the other Penninic zones (Unterengadin, Rechnitz). Formation of chrysotile is caused by a higher grade metamorphism. Comparing alpine and praealpine ultramafititic-mafititic rock suites, it is a characteristic feature that metavolcanites characteristic for the former are lacking completely in the latter.

The question to what extend praealpidic ultramafitites could be considered as remnants of Paleozoic ocean floor is up till now an open one. Plankogel formation, Habach- and Greiner formation and the lower part of the Gleinalpen "Schieferhülle" and their ultramafitites are probably elements of a Caledonian or Variscian geosyncline. The basic problem of praealpidic ultramafitites is the question of direct mantle origin versus gravitative differentiation from a basic melt. The Paleozoic ultramafitites are genetically associated with metabasites (mostly amphibolites). The volume of peridotites surpasses that of the basic rocks many times over. In our opinion this is explained easier by consideringy the basic zones as a product of partial melting and the peridotite as a residual product. Spinelpyroxenites within the peridotites confirm this supposition.

Chemistry of 94 minerals was done by microprobe analyzer ARL-SEMQ.

2. Petrology and geology between the SW-part of the Wechsel Fenster and the "Grazer Paläozoikum"

The most characteristic rocks of the Lower East alpine part of the studied area coarse grained granite gneisses (abbreviated grobgneiss). The petrology of these rocks has been described in earlier reports. Radiometric dating (S. SCHARBERT personal comunication) gives the expected Carboniferous age (340 ± m. j.). Mineral ages (K, Ar, S. SCHARBERT), approximately 80 m. j. point to an old alpidic metamorphism.

Leucophyllites are chlorite-muscovite quartz schists which contain occassionally kyanite. According to the field studies leucophyllites are nearly exclusively associated with grobgneiss und bound to stress zones. The details of their formation are already published [6]. The country rocks of the grobgneisses are phyllitic micaschists. Small lenses of metagabbros containing sometimes spinel and corundum, small bands of amphibolites and lenses up to 1 m^3 of turmaline rock. On some places feldspatisation of the phyllitic mica schist is to be observed on the boundary to the grobgneiss. A Devonian age of the phyllitic-micaschists seems to be the most probable. Grobgneiss and phyllitic micaschists and the associated rocks are forming the grobgneiss formation sensu stricto.

In the last years a characteristic rock association could be separated from the grobgneiss formation. This association consists originally of staurolite-, sillimanite- and andalusite-bearing schists. Now these minerals occur only in rare relics because of a retrograde alpine metamorphism. In place of staurolite chloritoide is now widely distributed. Migmatites, arkose gneisses, medium grained metagranites (Stubenberg), migmatites and graphite-quarzites and graphite schist belong also to this rock association. Using and redefining a term introduced by SCHWINNER [10] we gave this rock association the name Strahlegg — gneiss and schist formation. The formation is distributed in the middle part of Blatt Birkfeld, E of the Feistritz Valley.

Tectonically the Strahlegg unit is overlying the grobgneiss formation. Within this formation a lithostratigraphic sequence is proposed, beginning with biotite schists with or without staurolite. The next event is a migmatisation followed by weathering and formation of metaquartzites. The metasedimentary cover of the grobgneiss formation are the Permotriassic Semmering quartzites, metadolomites and marbles, including phyllites, arkoses, porphyroides and conglomerates of the base (alpine Verrucano). The latter formation has been indentified widely distributed in the southern part of the Fischbach window.

The north-south stricking Koglhof marble complex is situated at the boundary between the Unterostalpin and the Mittelostalpin formation.

White quartzites associated with the marbles are petrographic comparable to quartzites of the Central Alps generally attributed to the Lower Trias. Rauhwackes within the marbles may also be considered as an indication for Mesozoic age. But other indications are less favorable to this opinion. Near Wieden, a village not far from Koglhof, pegmatites are crossing the marbles. After a statistical experience pegmatites in the Eastern Alps should be of Praetriassic age and probbably comparable to marbles of the Bretstein formation. Graphitic schists accompanying the marbles are an additional evidence for a higher age. We agree to SCHWINNER [10] and H. FLÜGEL [3] that presumably Paleozoic and Mesozoic strata together form the Koglhof marble complex. But in spite of detailed mapping it was not possible up till now to distinguish stratigraphic different carbonate rocks. The Mittelostalpin between the Koglhof marble and the Grazer Paläozoikum has a thickness of only 2 km. This poor thickness corresponds to the thinning out of this unit toward the frame of the

Penninic windows and toward the east end of the Alps [12]. Garnet mica- and quartzitic mica schists are the predominant rocks of this zone. Small lenses of garbenschiefer are characteristic lense shaped inclusions in the micaschists. In the Unterostalpin they are totally lacking.

Diaphthoresis is widely distributed in the upper zone of the Mittelostalpin. Therefore it is difficult to draw a sharp border line between the Mittelostalpin and the Grazer Paläozoikum. A good mean to distinguish phyllites of progressive metamorphism (Grazer Paläozoikum) from diaphthorites (Mittelostalpin) is the widespread occurence of transversal foliation in the former.

The Raasberg formation is situated between Mittelostalpin and the Grazer Paläozoikum. Some indications seem to confirm a Mesozic age for this formation [4].

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