placed by amphiboles and biotite. Even the amphiboles reflect the two stages. A tschermakitic amphibole being part of the metamorphic assemblage forms corona–like reaction rims around the pyroxenes. The actinolitic to ferro–actinolitic amphiboles reflect the magmatic (subsolidus) stage. A myrmekitic reaction zone of oligoclase and quartz, locally including biotite is common between the two assemblages.

Temperatures around 765 °C have been calculated for the older granulitic paragenesis using the two pyroxene thermometry. According to the Al content of the tschermakitic amphibole the metamorphic granulite facies event occurred at rather high pressures. The actinolitic to ferroactinolitic amphiboles indicate a low pressure granitic evolution which is defined by complex chemical zoning of the coexisting magmatic feldspars. The subsolidus thermal history is shown by different stages of micropertitic exsolution and followed by a later microclinisation.

Two types of zircons could be detected: an idiomorphic long–prismatic type with core and rim and a short–prismatic one with a strong overgrowth. Based on $^{207}Pb/^{206}Pb$ evaporation data the rim and the overgrowth zones yielded 320±10 and 326±3 Ma respectively. The ages of the core range from 498 to 549 Ma with a moderate error. The younger ages are probably due to the Variscan intrusion of the Weinsberg granite. The Early Paleozoic ages reflect probably the formation of the protolith in granulite facies. According to the wide variation of the Early Paleozoic ages a complex mixing of Pb components of different ages has to be considered. The SiO_2 content of the quartz monzodiorite ranges from 54–62% which is identical with the range of the common diorites. MgO, CaO, and Cr is significantly lower, K_2O, Zr and Ba higher than in the diorites. Their geochemical composition resembles that of charnockites contaminated by some upper crustal components. The Weinsberg granite itself ranges from 63–74% SiO_2 forming a distinct evolution trend with the quartz monzodiorites.

The petrography and the geochemistry of the quartz monzodiorites indicate an important contribution of granulitic lower crust to the formation for the Weinsberg granitic melt.

NEW GEOLOGICAL WALL–MAPS (STRUCTURAL RELIEFS) OF CENTRAL EUROPE 1 : 800 000; ENGLAND, WALES, AND IRELAND 1 : 1 000 000 AND FRANCE 1 : 1 000 000

K.-O. KOPP, I. & K. HAEVECKER ET AL.

Lehrstuhl für Geologie, Techn. Universität München, Lichtenbergstr. 4, U – 85748; Garching, .Deutschland

At the Department of Geology of the Technical University of Munich a new kind of geological wall–map has been developed. It selects and combines the advantages of different "styles" of reproduction: constant scale, topographical contents and habitual colours are taken from normal geological maps, perspectivic view and orientated cross–sections from bloc–diagrams, underground structures from subcrop maps, and tectonic structures are visualized by what Hans CLOOS introduced and called as "Structural Reliefs". By all these means, synoptically employed, the map becomes highly illustrative, particularly for those who are not yet perfectly trained to interpret geological maps in the third dimension. The map is recommended, therefore, for use in university lectures, highschools, earthscience–bound offices, museums, etc.

MID – LATE DEVONIAN ARC–TYPE MAGMATISM IN THE BOHEMIAN MASSIF: Sr AND Nd ISOTOPE AND TRACE ELEMENT EVIDENCE FROM THE STARE SEDLO AND MIROTICE GNEISS COMPLEXES, CZECH REPUBLIC

J. KOŠLER[1] & C.M. FARROW[2]

[1] Department of Mineralogy, Geochemistry and Crystallography, Charles University, Albertov 6, 128 43 Prague, Czech Republic

[2] Department of Geology and Applied Geology, University of Glasgow, Glasgow G 12 8QQ, Scotland

Within the Moldanubian zone of eastern Hercynides in the Bohemian Massif there are metamorphic complexes with the gross form of roof pendants in the mid – late Hercynian granitoids of the Central

Bohemian Pluton. Two of the complexes (Staré Sedlo and Mirotice) consist of strongly foliated mylonitic biotite- and amphibole-bearing gneisses associated with K-feldspar-bearing mylonite schists – ultramylonites – blastomylonites. Petrographical and geochemical evidence is consistent with the gneisses and schists having an igneous protolith corresponding to tonalite – granodiorite and alkali-rich granite, respectively. A crystallization age of the plutonic protolith of the gneisses is indicated by U – Pb and Pb – Pb zircon ages in the range of 380 – 365 Ma (mid – late Devonian; *Košler et al.,1993*).
The compositions of the gneisses and schists are consistent with derivation of their protolith in a magmatic arc type-regime where periods of compression followed by slip and extension account for multiple intrusion and variability in magma chemical composition. Depletion of high field strength elements relative to large ion litophile elements in both the gneisses and schists indicates the derivation of their respective protoliths in a continent-based magmatic arc. The depleted whole-rock Sr and Nd isotopic compositions for most of the gneisses and schists from the Staré Sedlo and Mirotice complexes (Fig.1) indicate that their protoliths did not have a long crustal history before their crystallization at mid – late Devonian times. Both the low εSr_{369} and positive εNd_{369} values for most of the Staré Sedlo and Mirotice gneisses and schists suggest that their protoliths were derived from a depleted mantle source which was isotopically similar to OIB – enriched MORB. Temporal and spatial association of the gneisses and schists from the Staré Sedlo and Mirotice complexes with eclogites and granulites from the Moldanubian zone together with the corresponding Sr and Nd isotopic compositions of the gneisses, schists and eclogites suggest that all these rocks represent products of the same tectonomagmatic regime. Assuming the composition of HT eclogites from the Moldanubian zone *(Beard et al.,1992)* corresponds to that of mantle source of the Staré Sedlo and Mirotice gneisses and schists, their corresponding crystallization ages and OIB-like isotopic compositions indicate the growth of continental crust within the Moldanubian zone in the Bohemian Massif in mid – late Devonian times. Within the framework of a plate tectonic model for the Hercynian orogeny these rocks can be correlated with products of an arc-type magmatism on the southern margin of Armorica (Liguro – Moldanubian Cordillera; Cogné and Wright,1980) that took place at an earlier stage (mid – late Devonian) than much of the deformation, metamorphic and igneous activity (early Carboniferous) in this orogen.

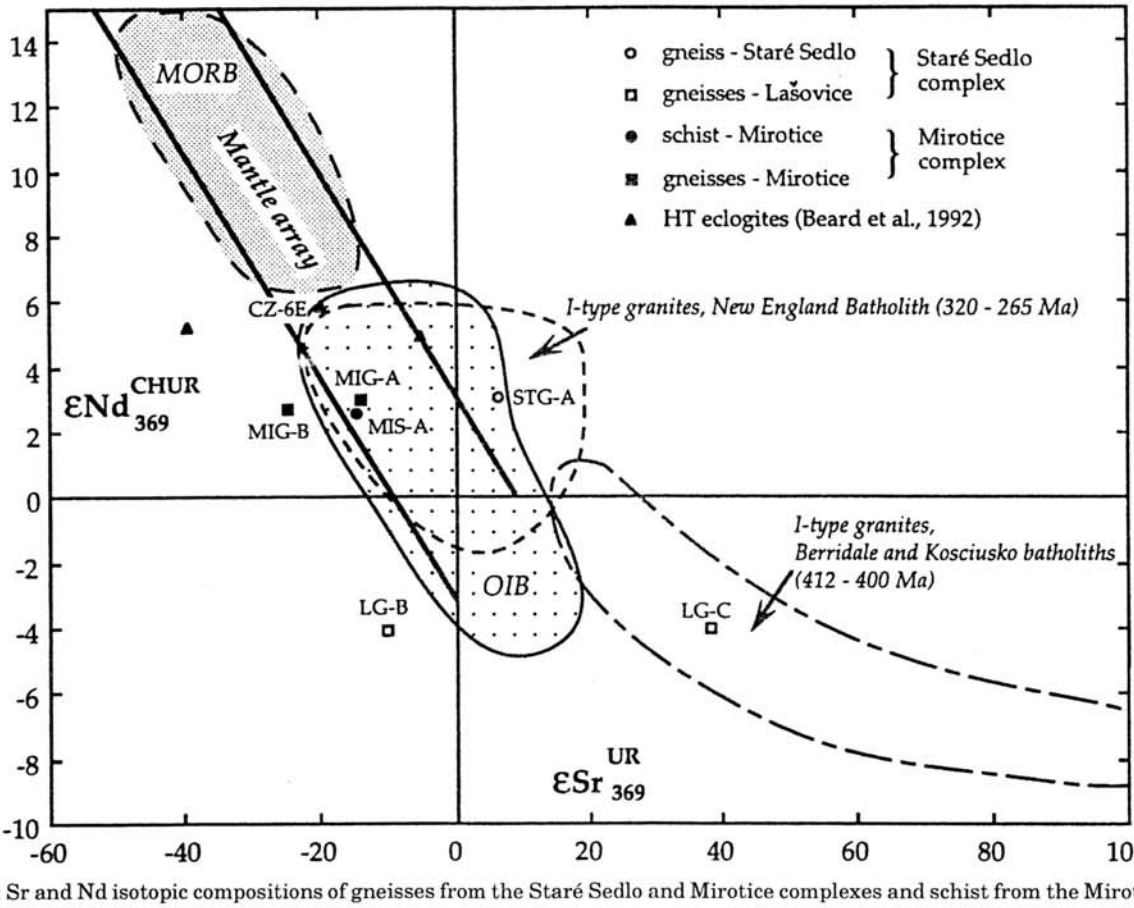

Fig. 1: Sr and Nd isotopic compositions of gneisses from the Staré Sedlo and Mirotice complexes and schist from the Mirotice complex

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LATE PALEOZOIC EPITHERMAL GOLD AND SILVER DEPOSITS RELATED TO GRANITE–PORPHYRY INTRUSIONS IN THE KURAMA OROGENIC BELT (CENTRAL ASIA)

V. KOVALENKER[1], V. RUSINOV[1], K. LEVIN[1], F. ISLAMOV[2]

[1] *Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry RAS, Staromonetny per., 35, 109017, Moscow, Russia*

[2] *Geological Survey of Republic Uzbekistan, PGO "Tashkentgeologiya", Usman Nasyr 142a, 700059 Tashkent, Uzbekistan*

Late–Paleozoic Kurama orogenic volcano–plutonic belt is one of the scarce examples of regions where well preserved pre–Tertiary epithermal gold and silver deposits were identified. These deposits can be classified as of sericite–adularia or acidic–sulphate type (according to Heald et al.1987) and subdivided further into sulphide–poor and sulphide–rich types.

Sulphide–poor gold–silver deposits of sericite–adularia type (Kyzylalmasay, Chadak, Kauldy, Shkolnoye et al.) are characterized by a low sulphide content (1–3 vol %), they are enriched in silver (gold fineness is low – 150–600). Acanthite, naumannite, rarely hessite, minerals of tetrahedrite-freibergite series and Ag–Sb sulfosalts represent silver mineralization. Besides quartz, as a gangue mineral, carbonates, sericite, adularia are important. Sulphide–poor silver–base metal (with gold) deposits of this type (Lashkerek, Kanimansur, Taryekan etc.) contain galena, sphalerite, chalcopyrite, pyrite, sometimes bornite in predominance. Native gold (fineness 750–850) does not form detectable accumulations. Silver mineralization is represented mainly by native silver, along with acanthite and by various Ag–Sb and Ag–Pb–Bi sulfosalts. Quartz and carbonates prevail, sericite, chlorite and adularia occur in veins as gangue minerals. Ore mineralization of acidic–sulphate type forms pipe-shaped bodies (enriched in sulphides) of explosion–hydrothermal breccia (Kochbulak deposit), quartz-sulphide veins at Akturpak deposit, lenticular bodies at Burgunda deposit, as well as sulphate rich (barite, anhydrite), but sulphide–poor ore shoots (Kayragach deposit). Among ore minerals pyrite , Te–sulphosalts goldfieldite, minerals of famatinite–luzonite series, enargite, various minerals of tellurium with gold, silver, bismuth and other metals, as well as Ag–Cu–Pb–Bi sulphosalts (often seleniferous) are of considerable representation in these deposits. Among gangue minerals there occur diaspor, andalusite, sericite, kaolinite. Adularia is absent and quartz predominates over carbonates. High Au finesses (800–995) is characteristic of this type.

The deposits usually occur in Late–Paleozoic (C_{2-3}) andesite–dacite volcanics and less commonly in metamorphosed sediments and magmatites of pre–orogenic (S–D) basement (sulphide–poor Au–Ag deposits of sericite–adularia type), or in younger (C_3 – P_1) acid volcanics (sulphide–rich silver-base metal deposits of sericite–adularia type). Both types of deposits show a spatial association with stocks and dykes of porphyry granitoids of increased alkalinity, whose age (280–290 m.y.) is close to that of the deposits. This fact, as well as the results of stable and radioactive isotope studies allow us to suppose that the porphyritic granitoids were the main source of heat and ore components for the origin of epithermal mineralization. According to these data, ore–forming fluids had mixed meteoric–magmatic origin. The contribution of magmatic water to the fluids of acidic–sulphate type was higher than to the fluids responsible for sericite–adularia type of mineralization.

Of special interest are the rare cases of a spatial coincidence of both type mineralization, namely in Kochbulak, Kayragach and Akturpak deposits. Moreover, ore veins of Akturpak deposit were spatially combined with Au–Cu–Mo porphyry mineralization of Kalmakkyr deposit (Almalyk ore field). There are numerous geophysical, mineralogical and geochemical indications, that below the epithermal mineralization of Kochbulak the body of porphyry granitoids (of elevated basicity and