fabrics in the core of the vast majority of the pluton. These fabrics are overprinted by flat submagmatic to solid state shear zones which are locally dominant.

This pattern reflects an early E-W shortening of orogenic root associated with extrusion of the lower crust lubricated by sills of mantle – derived melts. The magma ascended vertically along pre-existing vertical anisotropies and major thrust boundaries forming positive flower structure. Subsequent large – scale wrenching is responsible for sinistral rotation of the Variscan fabric. In the studied area, the differential rotation is responsible for progressive movement and rotation of the original eastern margin to the north creating final triangular shape of the pluton. These movements are responsible for magma flow parallel to the western flat dipping margin of the pluton and for partial or complete reworking of the early steep fabrics. This work demonstrates the role of changing boundary conditions for emplacement of a large pluton in a time span of 15 Ma.

Hydrothermal Mineralization Beneath the Upper Silesian Basin, Czech Republic: The Record of a Possible Tectonic Driving Fluid Flow

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A sulphide mineralization (including sphalerite, galena, chalcopyrite, pyrite and marcasite) has been encountered in several deep boreholes drilled through the front zone of the Carpathian nappes and the Carboniferous rocks to the south of Ostrava in the Czech Republic (Fig. 1). An uncertain age of this mineralising event within a time period from the Permian to the Late Tertiary has been reported (Češková 1978, Bernard 1991, Vaněček et al. 1985, Slobodník et al. 1999).

Underlying the eastern part of the Upper Silesian Basin (Kotas 1982) a stable basement is formed by the Brunovistulicum unit of the Upper Silesian Block. Deposited on the stable basement are a thick sequence of Devonian and Lower Carboniferous carbonates (often massive reef limestones) and clastics at the top succeeding basal conglomerates. The overlying coal-bearing sequences are of Late Carboniferous age. Early Badenian siliciclastics transgressed over and rest unconformably on the eroded Palaeozoic surface, and later the Carpathian nappes moved over these siliciclastics during the Styrian tectonic phase (Carpathian-Badenian). Important faults, namely Frýdek-Místek – Považská Bystrica F. (NNW-SSE, Buday and Ďurica 1994), Bludovice F. and Orlov F. trending W-E and NNE-SSW, respectively (Dopita et al. 1997), cut through the mineralized area.

The hydrothermal sulphide mineralization occurs in Early Carboniferous carbonate rocks and to a lesser extent in the overlying siliciclastics. The present depth of the mineralization from surface is some 1000 and 1200 m and the mineralization extends over a vertical borehole interval some tens of meters thick. All the main sulphides succeed the earliest quartz having been precipitated within the first mineralizing stage. Sphalerite is the most common ore mineral but chalcopyrite, galena, pyrite and marcasite occur less frequently. Calcite is the most important gangue mineral. Two generations of calcite (I, II) with minor pyrite and marcasite succeed the Zn-Pb-Cu sulphide phase. The third calcite generation (III) forms the second mineralizing stage cementing fragments of earlier mineral phases.

A microthermometric study revealed Th values between 81 and 118 °C, 70 and 130 °C, 56 and 155 °C for quartz, sphalerite and calcite generations, respectively. Salinities of fluids in inclusions of the same mineral phases range between 17.8 and

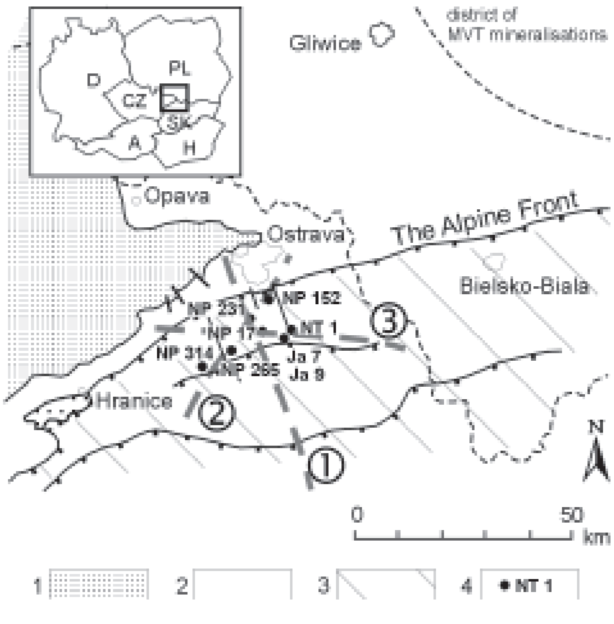

Fig. 1. The geological sketch map of the Ostrava area and position of boreholes with hydrothermal Mineralization. 1–Palaeozoic sediments (siliciclastics prevail), 2–Upper Tertiary sediments (the Carpathian Foredeep), 3 – Carpathian nappes (Cretaceous and Lower Tertiary sediments prevail), 4 – boreholes with hydrothermal Mineralization. Faults under the Tertiary units: Ŕ – Frýdek-Místek– Považská Bystrica fault, Á– Orlov fault, Â – Bludovice fault.

19.4, 18.9 and 26.5, 0.2 and 17.4 eq. wt.% NaCl, respectively. The eutectic temperatures (Te) of the inclusions in both quartz and sphalerite ranging between –71 and –51 °C indicate the H_2O-NaCl-$CaCl_2$ system (Goldstein and Reynolds 1994). The same fluid system has been trapped in inclusions of calcite II. The Te of the fluid inclusions in calcite generations I and III is between –22 and –38 °C suggesting other salts in addition to NaCl in the aqueous solution. Inclusions containing liquid hydrocarbons are sometimes present in all mineral phases. They fluoresce white-blue indicating a presence of higher hydrocarbons (Stasiuk and Snowdon 1997).

Three calcite generations precipitated from a fluid with oxygen isotopic composition +1.9, +8.0 and +0.6‰ SMOW, respectively (calculated from the $\delta^{18}O$ values between –8.2 and –11.3 ‰ PDB), suggesting mixing and/or pulses of different fluid flow systems. Such changing and similar conditions during the mineralising process have also been reported from MVT deposits in Poland. Here, for instance, inclusions in sphalerite exhibit nearly the same range of temperature from 80 to 158 °C and salinities from 0 to 23 wt.% NaCl eq. of the same fluid systems, even with the presence of liquid hydrocarbons (Kozlowski 1995). Thus, the nature of discussed mineralizing fluids indicates a comparable origin to the world-class MVT deposits within the Silesian-Cracow district, which are situated only a few tens of kilometers further to the NE. Moreover, the geological setting of both mineralizations is nearly identical.

The nature of fluids and their volume suggest that they have been derived as basinal fluids from the thick sedimentary sequences under the Outer Carpathians. The number of occurrences suggests a large fluid flow that might have been driven by significant geological event (Slobodník et al. 1999). With respect to new facts from the Ostrava region and palaeomagnetic dating of the MVT mineralization in Poland (Symons et al. 1995), the emplacement of the Carpathian nappes is interpreted to be the common driving mechanism for migration of the mineralising fluids in the whole area considered (Kozlowski 1995) and could explain the similarities observed. The important faults, known in the area, trending more or less perpendicular toward the Alpine front, made the migration of fluids possible.

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Paleoenvironmental Changes in the Western Carpathian Basins across Eocene–Oligocene Boundary: Onset of TA4 Euxinity and Catastrophic Eutrofication

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Upper Lutetian transgression in the Central-Carpathian Paleogene Basin (CCPB) led to the shallow-marine deposition of nummulitic banks, developed in two 3rd order cycles. Nummulitic ecosystems were adapted to clear-water and oligotrophic conditions, being highly sensitive to even small increase in nutrient availability and primary productivity. During the Upper Eocene the CCPB underwent a progressively widespread eutrophication, which is consistent with climatic cooling. Therefore, the Nummulitic cycles of the CCPB, like a large foraminifera demise, disappeared due to the inversion of the Middle Eocene warm climate to cooler climate in the beginning of the TA4 supercycle. Climatic changes culminated in the "Terminal Eocene Event", which corresponds to the global cooling and glacio-eustatic regression related to the Antartic cryosphere expansion. Consequently, a carbonate factory turned off during the Zone P16 (latest nummulites – Köhler 1998), being eutrophicated and suffocated by terrigenous deposition. Cool-water influx and continental runoff into the CCPB led to fundamental paleoenvironmental changes. The water mass became stratified, developing a shallow termocline and chemocline. The water-colum stratification facilitated an oxygen deficience due to organic carbon oxidation and eutrofication of surface water. This process resulted in bottom-water anoxia (fertility crisis) and surface-water nutrification favorable for phytoplankton (*Wetzeliella, Deflandrea* – Gedl 2000), shallow-water ichnofauna (*Clu-*