PETROLOGY AND CHEMISTRY OF PROBABLE IMPACT MELT ROCKS AT THE ŠEVĚTÍN CRATER;

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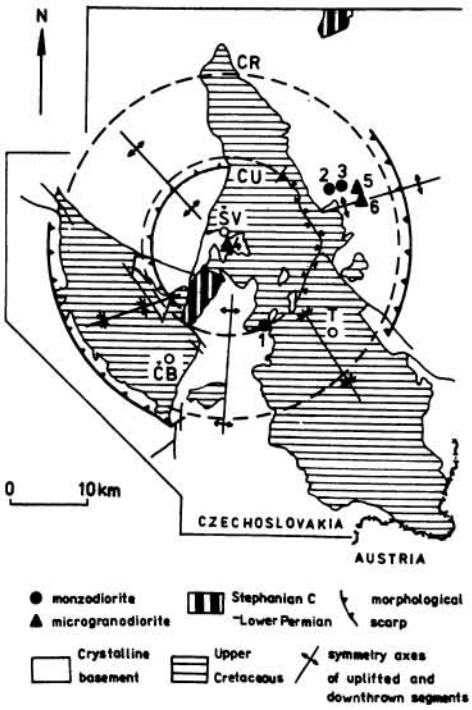
There are two types of probable melt rocks interpreted as injections in the fundament of the deeply eroded Ševětín crater (1, 2): 1. Pyroxene-biotite quartz monzodiorite /MD/, /loc. 1 to 3, Fig. 1/, 2. Microgranodiorite /MG/, /loc. 4 to 6, Fig. 1/. These rocks, endemic to the Ševětín structure, were dated as Upper Permian (3).

MD outcrops at loc. 1 were originally mapped as the Štěpánovice dyke, 3 km long, but 7 drill holes around a quarry in the south show that MD constitutes here 3 sheet-like bodies up to 25 m thick, moderatelly dipping and separated by screens of two-pyroxene mafic granulite. MD at loc. 2 and 3 was studied in loose blocks. The rock is moderately clast-laden: quartz clasts max. ø 20 cm, up to max. 20 clasts/m^2 showing rims of clinopyroxene + Kfs-Qtz micrographic intergrowth; centimetric leucogranite clasts are transformed to granophyre with lathy plagioclase; host rock mafic granulite clasts are rare; fibrolitic sillimanite microclasts, showing reaction to hercynitic spinel, corundum and diaspore, appear to be inherited from paragneiss of the basement. A vesicular facies /Qtz, Kfs, Cal ± amphibole, titanite in the vesicls/ is documented locally. MD has subophitic texture of plagioclase and augite, contains ~15 vol.% biotite /> 5 wt.% TiO_2/ and minor brown-green hornblende. Chlorite spheroids ø 0.5 - 1.5 mm make ~8 vol.% of the rock. Rare lechatelierite relics /Fig. 2/ occur exclusively in the spheroids; granoblastic quartz aggregates after lechatelierite are also rare. Sulphide grains and aggregates are enriched in the spheroids /pyrhotite, pentlandite, pyrite, sphalerite, chalcopyrite, galena and Ni-cobaltite with ~11 wt.% Ni/. Altogether 34 minerals identified in MD /24 analyzed with microprobe/ demonstrate the highly disequilibrium nature of this rock. Three pyroxenes are identified: major augite / $Wo_{42}En_{45}Fs_{13}$/, rare low-Ca augite /10 wt.% CaO/, and very rare hypersthene mainly altered to "bastite". The early accessory minerals - $ZrSiO_4$ /?zircon, <10 μm/, ilmenite /up to 0.30 wt.% Cr_2O_3/ and apatite are in skeletal crystals and indicate a high cooling rate during the early stages of crystallization. The absence of magnetite and of other oxides containing ferric Fe indicates a low oxygen activity; the Cr content in ilmenite, similar to those of ilmenite in chondrites, also indicates a low O_2 activity. The chlorite spheroids are apparently very early, as suggested by their relation to ilmenite and augite; they are interpreted as drops of an immiscible liquid dispersed and solidified in the main mass of melt (cf. 4, 5). The rock composition is similar to that of mafic granulite, but Ni and Cr are enriched in MD by factors of 15 and 3 respectively, relative mafic granulite. However, MD is also enriched in the REE /Fig. 3/ and it shows an anomalous Pb and As enrichment: 219 - 2 900 ppm Pb, 42 - 549 ppm As in five samples.



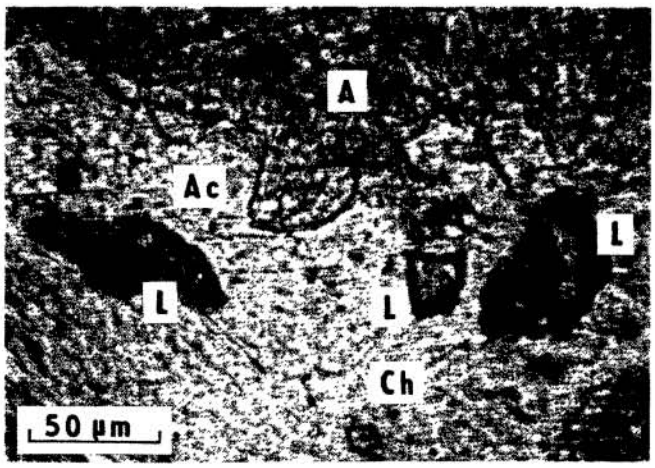


Fig. 1. Location of probable impact melt rocks at the Ševětín crater. CU - central uplift, CR - crater rim; ČB - České Budějovice, T - Třebon. Fig. 2. /above/ Lechatelierite /L/ in a chlorite /Ch/ - actinolite /Ac/ spheroid; A - augite. Pyroxene-biotite quartz monzodiorite, locality 1 /Fig. 1/

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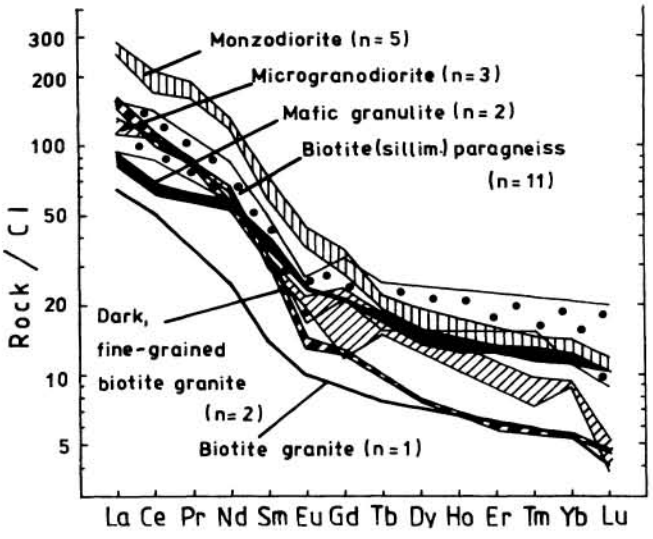

Fig. 3. REE patterns for monzodiorite, microgranodiorite and several rock types of the basement. Biotite /sillim./ paragneiss data from (6)

Microgranodiorite /MG/ is close in composition to quartz monzonite and quartz monzodiorite. Its composition /Fig. 4/ is very similar to the biotite /sillim./ paragneiss of the Moldanubian crystalline complex (6). MG is enriched in Ni and Cr but HREE are lower compared to paragneiss. The rock is fine-grained, contains <5 vol.% of clasts, mainly minor plagioclase and quartz xenocrysts which give the rock a pseudoporphyric texture. The rock was first introduced (1) under the name granodiorite microporphyry. The texture is dominated by lathy plagioclase, intersticial K-feldspar, chlorite and quartz. Primary pyroxene is chloritized, relics of hypersthene are very rare. Apatite, ilmenite and pyrite are accessory. Mineralogy of this fine-grained rock is not completely studied. Biotite gneiss and fibrolitic sillimanite clasts were also observed.

Pre-impact platform cover sediments - Stephanian C - Lower Permian /CP/ preserved in two downthrown segments /Fig. 1/ indicate a two layer target with sedimentary cover >1 000 m, overlying basement. This provides for two kinds of melt . Estimates of the target composition at the present erosion level give 65% paragneiss and migmatitic gneiss, 25% biotite granite, 8% felsic granulite and acid orthogneiss, 2% mafic granulite. At the pre-impact setting, paragneiss and migmatitic gneiss possibly constituted about 80% of the target below the CP cover. Since the CP are continental deposits, their average composition should be similar to the regional average for the basement, but petrological study on CP shows notable, local clastic monazite enrichment, e.g. in arkossic sandstone. Petrochemical data for CP sediments are lacking for mixing calculations. K-Ar dating of the two types of melt rocks (3) gave rather broad age limits of 277 Ma - 228 Ma. Dating by the Ar/Ar method could probably delimit the age narrowly. This information will be essential for consideration of MD and MG as two melt rocks produced by a single impact event. Also essential will be analyses of Ir in the melt rocks.

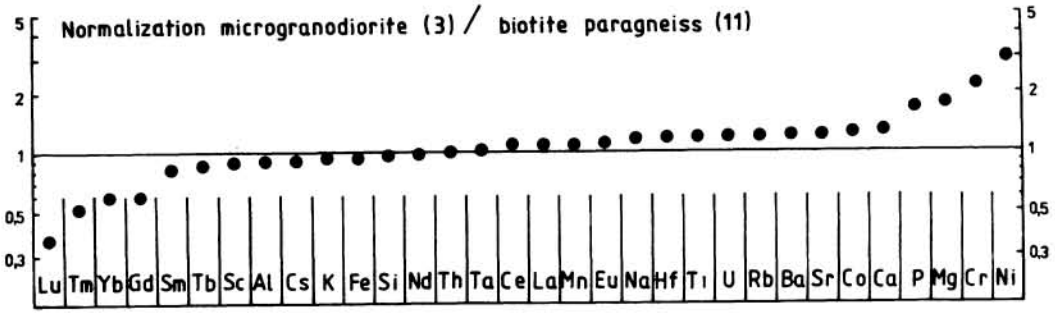

Fig. 4. Microgranodiorite, locality 4, Ševětín quarry, normalized to biotite /sillim./ paragneiss data for the Varied Group (6)

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