

# **SOME MINERAL COMPONENTS AND THEIR GENESIS IN THE MIDDLE MIOCENE (BADENIAN) SALT-CLAY (ZUBERS) FACIES FROM THE CARPATHIAN FOREDEEP (S POLAND) IN THE LIGHT OF SEM STUDIES**

E. STARNAWSKA and G. CZAPOWSKI

*Polish Geological Institute, Rakowiecka 4, 00-975 Warsaw, Poland; [star@pgi.waw.pl](mailto:star@pgi.waw.pl), [gcza@pgi.waw.pl](mailto:gcza@pgi.waw.pl)*

Middle Tertiary (Badenian) mixed salt-clay (zuber) deposits from the Carpathian Foredeep (Wieliczka, Bochnia mines, S Poland) are a specific mixture of halite clasts (frequently chevron and hopper), lithoclasts of flysch rocks, sulphate nodules and pelitic (clay, carbonate) material as a matrix. They characterize with dominant chaotic structure and varied thickness from dcm to several tens of meters and extent reflecting infill of bottom depressions. This facies was considered as reworked sediment of molasse type (K. Bukowski, 1994), accumulated in the marginal foredeep zone due to high input of clastics and evaporates from uplifted and eroded evaporitic mudflats.

The SEM studies of thin sections of zuber rocks enabled to define and illustrate the multiphase processes of generation and transformation of mineral components, being undetected with the classic microscopic methods.

Most of halite clasts characterize with a micrograined structure and frequent dissolution phenomena, from disrupted external rims with increased porosity to deep incisions and erosional holes, secondary infilled with synsedimentary silica.

Analysis of calcium sulphate concentrations precised the secondary genesis of observed anhydrite, evidenced by increased porosity of fibrous structures noticed both within sulphate clasts and pseudomorphoses after gypsum. Occurrence of dolomitic matrix accompanied by celestine and halite as well as dolomitic-celestine clasts suggest slow slumps of carbonate muds onto fractured and partially dissolved (by fresh marine or meteoric waters) salt (chloride) sediment, covering bottom of salt pans. These muds were subjected to synsedimentary metasomatic transformations of high-Sr aragonite to dolomite in conditions of increased salinity of evaporating marine waters and also existed there high strontium content could provided celestine precipitation.

Locally within the clay-silty matrix were observed pyrite (as regular phramboids bacterially generated in anoxic bottom conditions) accompanied by epigenetic marcasite, and sphalerite crystals, with diameter of 10-20  $\mu\text{m}$ . Rock matrix consists of illite, smectite and rare chlorite and contains angular and rounded grains of quartz, albite, feldspar, muscovite and biotite plates as well as seldom rutile and zircon grains. Described minerals indicate a provenience of siliciclastic components of studied zuber deposits from weathered magmatic rocks or/and alkaline piroclastics, which also may be a source of secondary silica. Tuffite interbeds of similar composition are noticed within and above zuber units in sections from Wieliczka and Bochnia (K. Bukowski et al., 1996; Garlicki A., 1979; J. Wiewiórka, 1979). Volcanic activity, registered during the Badenian and the Sarmatian by several widespread tuffite horizons in the Miocene foredeep profile (S. W. Alexandrowicz, 1997), may be also responsible for zinc ion supply and local mineralisation of fractured rocks.

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**Key words:** zuber petrology, SEM data, Middle Miocene, Carpathian Foredeep

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