Abstract

Geochemical analyses and microscopic observations of sphalerite rhythmites of the Trzebionka mine, in the strata-bound Pb-Zn district of Upper Silesia-Cracow, show that they are very similar to diagenetic crystallization rhythmites of other strata-bound deposits in shallow water carbonate facies. The presence of this type of texture can therefore not be used as an argument for an epigenetic origin of this district; rather, some sort of normal diagenetic evolution must have produced these textures, reflecting a clear diagenetic crystallization differentiation.

1 Introduction

In the Trzebionka mine, in the Upper Silesia-Cracow ore district, certain rhythmic ore textures occur, mainly formed by sphalerite, but involving also other sulphides, as well as carbonates and quartz. Among others, Bogacz et al. (1973) offered a description and interpreted the rhythmic ore textures as the result of “epigenetic vein deposits produced by mineralizing solutions spreading along sedimentary interfaces in indurated carbonate rocks”. It is assumed by them that this process allows the “preservation of sedimentary patterns” such as bedding, cross-bedding, and slump structures. The rhythmic ore textures were considered by these authors to serve as an argument for an epigenetic origin of the Cracow-Silesia ore deposits.

The present paper presents an alternative hypothesis for the origin of the rhythmic ore textures of the Trzebionka mine. The comparisons with similar textures of many other localities and also with other rhythmic textures of Trzebionka constituted of dolomite, as also with various other diagenetic crystallization features, led to the suggestion that they originated by crystallization differentiation during diagenesis, with the development of several crystal growth generations. The rhythmic textures of Trzebionka would then be another example of diagenetic feature for certain shallow water carbonate facies with and without associated strata-bound ore deposits (Fontboté 1981; Amstutz and Fontboté, in press).

The main characteristics of the Upper Silesia-Cracow ore district are known through numerous papers and monographs (Althaus 1891; Stappenbeck 1928; Assmann 1948; Keil 1956; Ekiert 1959; Gruszczyk 1967; Pawlowska et al. 1979; Dzulynski and Sass-
Gustkiewicz 1980, and others). They can be summarized as follows: (1) a great geometric congruence of the ore textures on all scales with the enclosing rock which is almost exclusively a relatively thin stratigraphic section (about 50 m) of the Lower Muschelkalk over a distance of more than 30 to 40 km. (2) The ores occur in carbonates, mostly dolomites, formed in tidal flat environments in proximity to the coast. (3) The Lower Muschelkalk represents, in this region, the first main transgressive phase, which overlaps evaporitic and clastic-sediment of Lower Triassic and Permian age and the Hercynian basement. (4) Karst processes have affected the whole area over at least one time span during Mesozoic; but perhaps some of the karst features are penecontemporaneous with the tidal flats. The ore district of Upper Silesia-Cracow correlates with other strata-bound Pb-Zn-(Ba-F-Cu-) deposits which occur at the borders of the Triassic (and Permian) germanotype basins linked with transgressive phases in central and southern Europe (Amstutz and Fontbote, in press).

Detailed geologic, stratigraphic, and mineralogic descriptions of the Trzebionka mine can be found in Smolarska (1968), Sliwinski (1969), and Pawloska and Szuwartynski (1979).

2 Description of Examples of Diagenetic Crystallization Rhythmites of Trzebionka

The characteristic banding of the ore rhythmites of Trzebionka is due to the repetition of three geometric elements which correspond to subsequent crystallization generations. Table 1 represents schematically the main features of each crystallization generation.

In example “A” (Fig. 1a–d), generation I is a medium crystalline aggregate of sphalerite with numerous inclusions of dolomite (ϕ 100–200 μ) and sometimes of roundish patches of authigenic quartz. Up to 50% of this first generation can consist of dolomite. Generation II consists of sphalerite without inclusions. Two subgenerations can be distinguished, IIa consisting of schalenblende and IIb of subhedral sphalerite. Generation III is represented in this example by the empty central spaces.

A microprobe profile made in this example “A” (Table 2) reveals that the Fe-content of the sphalerite is extremely low. On the contrary, Cd reaches values around 1% in the sphalerite of generation I and in the schalenblende of subgeneration IIa. The subhedral sphalerite of generation IIb is almost pure ZnS.

Fig. 1a–f. Different aspects of a diagenetic crystallization rhythmite of example “A”: it consists almost only of sphalerite; a is a handspecimen view; b is a thin section (N/1), c is a polished section (N/2) view; d shows the same polished section with half-crossed nicols to bring out the zoning of generation II (Iia and IIb). The composition of generations, I, Iia, IIb, and III is given in the text. The black line indicates the microprobe profile of Table 2. e Handspecimen of dolomite of the same ore-bearing horizon showing a very similar texture; f is a thin section (N/1) of the same sample. It can be recognized that the white bands in the handspecimen correspond to medium to coarsely crystalline subhedral dolomite of generation II. The dark parts are constituted of finely to medium crystalline anhedral dolomite of generation I.