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ELECTRON MICROPROBE INVESTIGATION OF UNUSUAL ZINCIAN DOLOMITE FROM THE WARYŃSKI MINE (UPPER SILESIA)

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A b s t r a c t. Electron microprobe study of zincian dolomite from the Waryński mine confirmed the previous statement of its unusually high Zn content replacing Mg. The Zn : Mg atomic ratio in its crystal lattice is approximately equal to or even exceeds 1. Uneven, zonal distribution of Zn found in some Silesian-Cracovian zincian dolomites suggests their metasomatic origin, probably connected with supergene processes.

A dolomite with high Zn content in its crystal lattice has been first described from Tsumeb deposit (Hurlbut 1957). Several authors gave evidence for the occurrence of zincian dolomites in the Silesian-Cracovian zinc and lead ore deposits (Ważewska-Riesenkampf 1959, 1960, Żabiński 1959, Zawiślak, Kubica 1970, Zawiślak 1971).

A zincian dolomite with unusually high Zn : Mg ratio (nearing to 1 : 1) has been found to be a chief mineral component of an oxydized zinc ore (galmei) from the Waryński mine, near Bytom, being accompanied by calcite, smithsonite, goethite and gypsum (Żabiński 1959). The identification of this dolomite was previously based on the chemical, thermal and X-ray analyses. It has been proved, that after leaching the ore with Low's solution, which dissolved completely smithsonite and gypsum, the insoluble parts of the ore (consisting of a carbonate with dolomite structure, calcite and goethite admixture) retained more than 10% ZnO, in spite of the fact that any zinc sulphides nor silicates were present in the residue. The occurrence of Zn^{2+} in the crystal lattice of dolomite caused a lowering of the first endothermal effect on the DTA curve of this carbonate by 110°, as compared with pure standard dolomite (Żabiński 1959).

In this paper supplementary data on the nature of zincian dolomite from the Waryński mine are given. The present authors have re-examined the above mentioned sample using „Cameca" type MS 46 of electron microprobe (accelerating potential — 20 kV, beam current — 150 μA, sample current — 15 nA). These investigations were carried out on polished ore sections. The standards used for this study were: fluorite (51.3% Ca) and

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pure Fe, Mg and Zn metals. Electron absorbed and backscattered images as well as X-ray scanning images showing the distribution of Ca, Zn, Mg and Fe have been registered. The cooccurrence of Ca, Mg and Zn in a mineral grain was taken as an unmistakable proof for the replacement of Mg^{2+} by Zn^{2+} in the dolomite crystal lattice, no other mineral containing these three elements being present in the Silesian-Cracovian ore deposits.

Line scan along the polished section of the ore in question revealed indeed many mineral grains containing Ca, Mg and Zn. Phots. 1*a*—*b* show electron images of one of such grains, and phots. 1*c*—*f* present X-ray images of Ca, Zn, Mg and Fe. The profile scans along the line *A*—*A* marked on phot. 1*a* are shown on fig. 1. It is clearly visible, that the distribution of Ca in the investigated grain is fairly uniform, while Mg and Zn content display local antagonistic fluctuations. Quantitative determinations of the above mentioned elements made in many points of the grain surface gave the following results: Ca 16 — 18%, Zn 10 — 14%, Mg 3 — 4%, Fe < 1%.

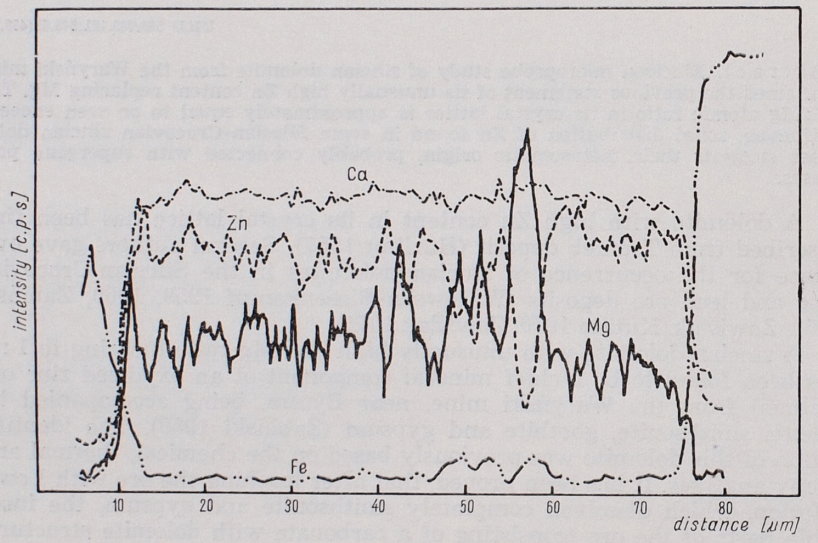

Fig. 1. Scan along the line *A*—*A* (Phot. 1*a*) for Ca, Zn, Mg, Fe

These data are most probably somewhat lowered, what may be at least partly due to some uneveness of the surface of the polished section. Thus it can be assumed that Ca, Mg and Zn content of the grain agrees quite well with the chemical formula of zincian dolomite with an atomic ratio Zn : Mg equal to or even exceeding 1 : 1. A small Fe content is certainly connected with dispersed goethite phase.

The rapid decrease in Ca, Mg and Zn content seen in the left and right side of the diagram (Fig. 1) connected with raise of Fe content indicates, that the electron beam passes already to the neighbouring iron-rich phase (goethite).

The presence of zincian dolomite was also found in several samples of galmei ores from Orzeł Biały mine. One of the most interesting example is shown on phots. 2*a*—*f* and fig. 2. Electron images present the rhombohedral grain of dolomite, sharply delimited from the neighbouring mineral phases. Two distinct parts of the grain can be seen differing — as clearly visible from X-ray scanning images — in Zn and Mg content. X-ray profiles along the line *B*—*B* marked on phot. 2*a* (Fig. 2) reveal more detailed the features of Ca, Mg and Zn distribution in the Zn enriched part of the grain. While Ca content is fairly constant, Mg and Zn display local antagonistic fluctuations.

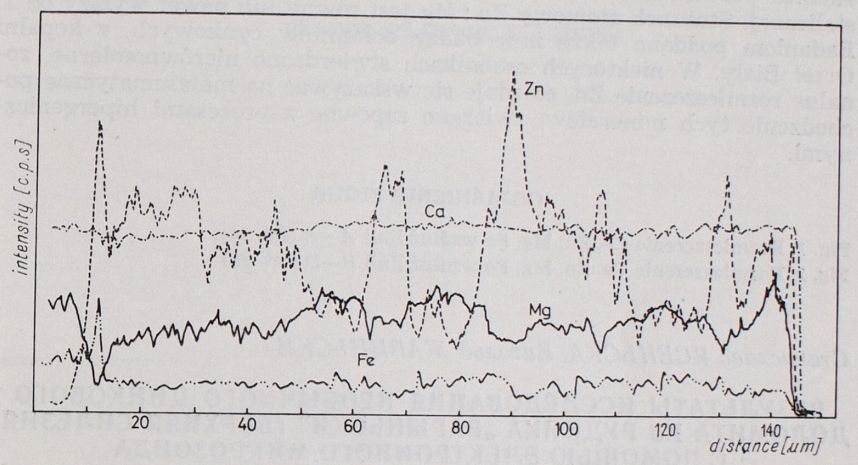

Fig. 2. Scan along the line *B*—*B* (Phot. 2*b*) for Ca, Zn, Mg, Fe

The results of these investigations confirm previous statement on the occurrence of zincian dolomites in the Silesian-Cracovian ore deposits. Some dolomites contain unusually high Zn in their crystal lattice. Uneven, zonal distribution of Zn in some zincian dolomites suggest their metasomatic origin, most probably connected with supergene processes.

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WYNIKI BADAŃ NIEZWYKŁEGO DOLOMITU CYNKOWEGO Z KOPALNI WARYŃSKI (GÓRNY ŚLĄSK) PRZY POMOCY MIKROSONDY ELEKTRONOWEJ

Streszczenie

Opisany uprzednio (Żabiński 1959) dolomit cynkowy z kopalni Waryński poddano kontrolnym badaniom za pomocą mikrosondy elektronowej. Analiza potwierdziła niezwykle wysoką zawartość Zn w jego sieci krystalicznej. Stosunek atomowy Zn : Mg jest równy lub nawet wyższy od 1. Badaniom poddano także inne okazy dolomitów cynkowych, z kopalni Orzeł Biały. W niektórych osobnikach stwierdzono nierównomierne, zonalne rozmieszczenie Zn, co zdaje się wskazywać na metasomatyczne pochodzenie tych minerałów, związane zapewne z procesami hipergenicznymi.

OBJAŚNIENIE FIGUR

Fig. 1. Rozmieszczenie Ca, Zn, Mg, Fe wzdłuż linii *A—A* (fot. 1*a*)
Fig. 2. Rozmieszczenie Ca, Zn, Mg, Fe wzdłuż linii *B—B* (fot. 2*b*)

Станислава ЯСЕНЬСКА, Витольд ЖАБИНЬСКИ

РЕЗУЛЬТАТЫ ИССЛЕДОВАНИЯ НЕОБЫЧНОГО ЦИНКОВОГО ДОЛОМИТА ИЗ РУДНИКА „ВАРЫНЬСКИ" (ВЕРХНЯЯ СИЛЕЗИЯ) С ПОМОЩЬЮ ЭЛЕКТРОННОГО МИКРОЗОНДА

Резюме

Описанный ранее (Жабиньски 1959) цинковый доломит из рудника „Варыньски" подвергался контрольным исследованиям с помощью электронного микрозонда. Анализ подтвердил чрезвычайно высокое содержание цинка в кристаллической решетке доломита. Соотношение атомов Zn : Mg равно или даже превышает 1. Испытывались также другие образцы цинковых доломитов из рудника Ожел-Бялы. В некоторых индивидах наблюдалось неравномерное, зональное распределение цинка, которое может служить указанием на метасоматическое происхождение этих минералов, связанное, вероятно, с гипергенными процессами.

ОБЪЯСНЕНИЯ К ФИГУРАМ

Фиг. 1. Распределение Ca, Zn, Mg, Fe вдоль линии *A—A* (фото 1*a*)
Фиг. 2. Распределение Ca, Zn, Mg, Fe вдоль линии *B—B* (фото 2*b*)

PLATE I (PLANSZA I, ТАБЛИЦА I)

Phot. 1. Zincian dolomite from the Waryński mine
a — absorbed electron image, *b* — backscattered electron image, *c* — Zn K_α X-ray image, *d* — Mg K_α X-ray image, *e* — Ca K_α X-ray image, *f* — Fe K_α X-ray image

Dolomit cynkowy z kopalni Waryński
a — obraz elektronowy absorpcyjny, *b* — obraz elektronów rozproszonych, *c* — obraz rentgenowski Zn K_α, *d* — obraz rentgenowski Mg K_α, *e* — obraz rentgenowski Ca K_α, *f* — obraz rentgenowski Fe K_α

Цинковый доломит из рудника Варыньски
a — образ электронного поглощения, *b* — образ электронного рассеивания, *c* — рентгеновский образ Zn K_α, *d* — рентгеновский образ Mg K_α, *e* — рентгеновский образ Ca K_α, *f* — рентгенновский образ Fe K_α

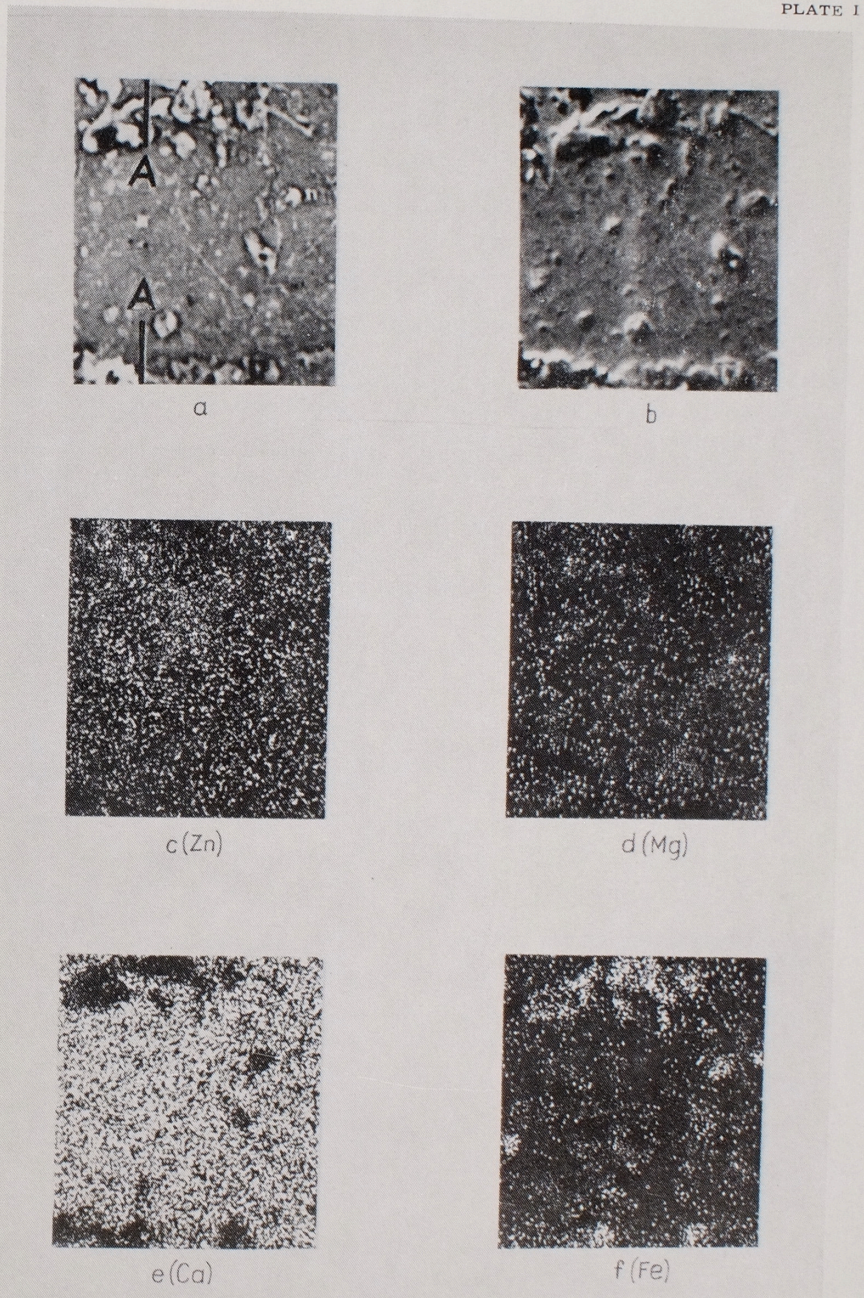

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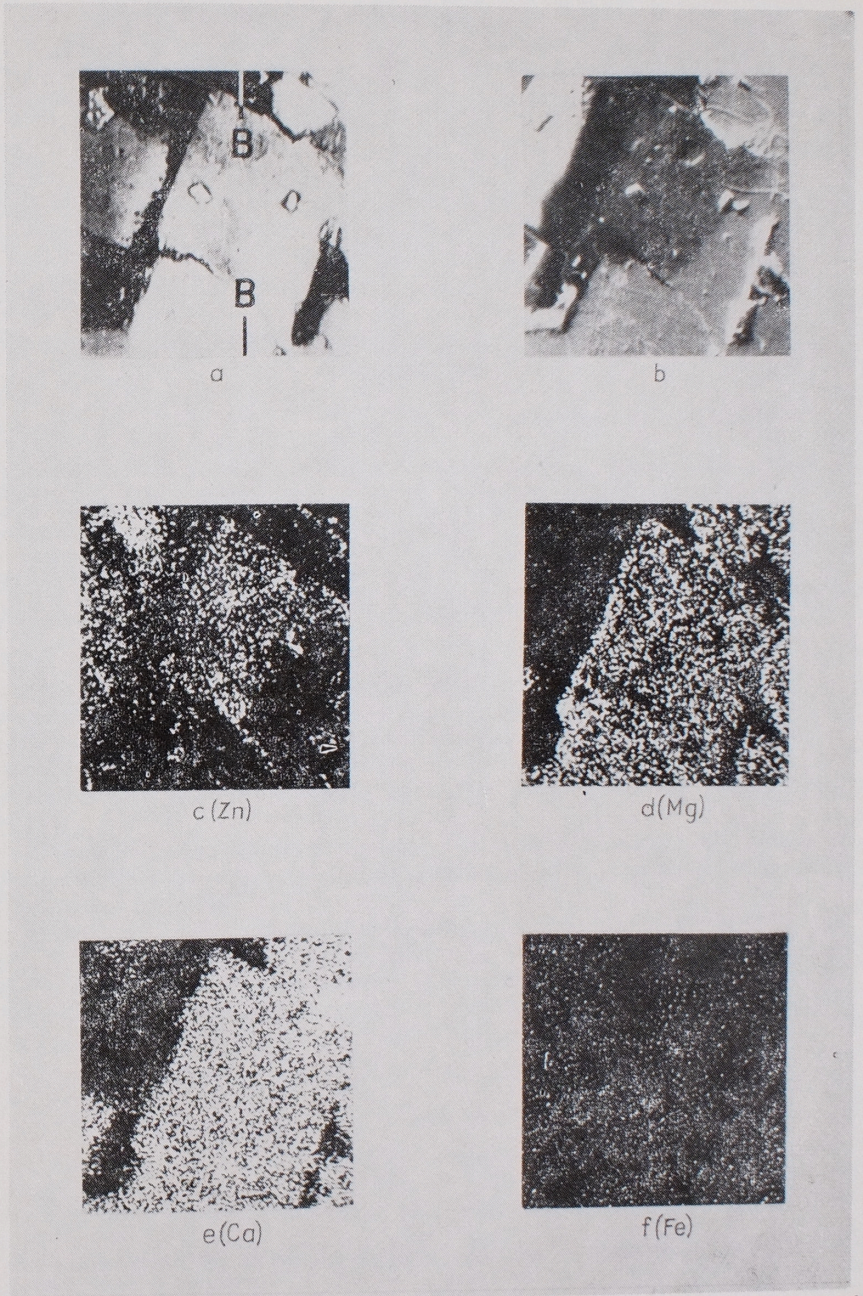
PLATE II (PLANSZA II, ТАБЛИЦА II)

Phot. 2. Zincian dolomite from the Orzeł Biały mine
a — absorbed electron image, *b* — backscattered electron image, *c* — Zn K_α X-ray image, *d* — Mg K_α X-ray image, *e* — Ca K_α X-ray image, *f* — Fe K_α X-ray image

Dolomit cynkowy z kopalni Orzeł Biały
a — obraz elektronowy absorpcyjny, *b* — obraz elektronów rozproszonych, *c* — obraz rentgenowski Zn K_α, *d* — obraz rentgenowski Mg K_α, *e* — obraz rentgenowski Ca K_α, *f* — obraz rentgenowski Fe K_α

Цинковый доломит из рудника Ожел Бялы
a — образ электронного поглощения, *b* — образ обратного электронного рассеивания, *c* — рентгеновский образ Zn K_α, *d* — рентгеновский образ Mg K_α, *e* — рентгеновский образ Ca K_α, *f* — рентгеновский образ Fe K_α



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