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ZINCIAN DOLOMITE: THE PRESENT STATE
OF KNOWLEDGE. A SUPPLEMENT

Abstract. The author reviews the recent papers dealing with the minerals of the isomorphous series $CaMg(CO_3)_2$ — $CaZn(CO_3)_2$, which throw new light on their nature and origin.

Since the summary of the present state of knowledge about zincian dolomite was published (Żabiński 1981), several papers have appeared which throw a great deal of light on their nature and origin. As zincian dotomites seem to arouse great interest among mineralogists and geologists concerned with ore deposits, the author thought it advisable to write a short supplement to his earlier paper.

In 1982 Garavelli *et al.* described a new mineral, minrecordite (from the Tsumeb mine), which is a virtually pure end-member of the zincian dolomite series $CaZn(CO_3)_2$. Besides, some zincian dolomites and magnesium minrecordite were found there. The results of chemical analyses of the above-mentioned minerals seem to indicate the existence of a complete solid solution series $CaMg(CO_3)_2$—$CaZn(CO_3)_2$. It is worth mentioning that according to Garavelli *et al.*, some previously described Zn-containing dolomites from the Silesian-Cracow ore deposits, in which the Zn : Mg atomic ratio sporadically exceeds 1 (Jasieńska, Żabiński 1972), might be classed within the Mg-minrecordite range.

The optical properties (refractive indices) of the minrecordite from Tsumeb are in excellent agreement with those anticipated by the present author (Żabiński 1981) in a simple way, as a mean arithmetic value of the indices of calcite and smithsonite (Table 1). As regards the lattice constants, the agreement is not so perfect. Both a and c parameters of the minrecordite from Tsumeb are somewhat smaller than those calculated in a similar way as the refractive indices (Table 1). Considering the fact that the lattice constants of pure dolomite are nearly equal to the artihmetic mean value of the respective parameters of calcite and magnesite, it seems probable that the presence of Zn affects the lattice constants of dolomite not only because of the difference between the ionic radii of Mg^{2+} and Zn^{2+} but presumably also because the coordination octahedra around calcium (CaO_6) and zinc-magnesium ions $(Zn, Mg)O_6$ are subject to slightly different deformation than those around calcium and magnesium ions in pure dolomite. The significant Fe content in the minrecordite from Tsumeb must also have some influence on its lattice constants.

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Table 1

Refractive indices and lattice constants of minrecordite

Comparison	Refractive indices		Lattice constants	
	n_e	n_0	a	c
Minrecordite, Tsumeb (Garavelli *et al.* 1982)	1.550	1.750	4.8183	16.0295
$CaZn(CO_3)_2$ calc. (Żabiński 1981)	1.55	1.75	4.821	16.043

It is interesting to compare the observed reflection intensities for natural minrecordite with those calculated theoretically (Whittaker, Żabiński 1983 — Table 2). The agreement is fairly good, the small differences being easily accounted for by experimental factors, as well as by the fact that natural minrecordite contains small amounts of Mg, Fe and Mn.

New light on zincian dolomites has been thrown by the electron diffraction investigations carried out by Kucha *et al.* (1985) on specimens from Upper Silesia. These studies suggest the presence of a periodic antiphase domain structure of zincian dolomite, its unit cell consisting probably of three units: $CaMg(CO_3)_2$ as a basal unit, $CaZn(CO_3)_2$ and $CaCO_3$ domains. The upper limit of $CaZn(CO_3)_2$ domain size is supposed to be ca. 100 Å. In the cited authors' opinion, $CaZn(CO_3)_2$ alone would be unstable, but its domains are stabilized by the external dolomite lattice. The positive misfit of the $CaZn(CO_3)_2$ domain to the host dolomite lattice limits the size of the former. The authors point to Ca excess in the investigated dolomite, which is in agreement with the presented domain concept. Worth noting

Table 2

X-ray reflection intensities of minrecordite

$hk\bar{i}l$	Minrecordite, Tsumeb (Garavelli *et al.* 1982)	$CaZn(CO_3)_2$ calc. (Whittaker, Żabiński 1983)
0003	—	9.1
10$\bar{1}$1	10	8.9
01$\bar{1}$2	20	21.0
10$\bar{1}$4	100	100
0006	3	0.0
01$\bar{1}$5	3	0.3
11$\bar{2}$0	25	20.7
11$\bar{2}$3	20	3.4
02$\bar{2}$1	3	0.0
20$\bar{2}$2	15	18.8
02$\bar{2}$4	10	8.5
01$\bar{1}$8	33	19.9
11$\bar{2}$6	40	20.5
21$\bar{3}$1	5	5.8
12$\bar{3}$2	8	5.9

is the fact that $CaCO_3$ excess was also noted by Garavelli *et al.* (1982) in most analysed zincian dolomites and minrecordites from Tsumeb, as well as by Birch (1983) in the zincian dolomite from Broken Hill, N.S.W. High-resolution electronographic studies of the minrecordites from Tsumeb could throw new light on the problem of stability of $CaZn(CO_3)_2$ end member of the isomorphous series in question.

The occurrence of minrecordites from Tsumeb and Zn-dolomites from Broken Hill in the oxidation zone of these deposits confirms the earlier opinion that these carbonates may be of supergene origin. However, the study of Zn-dolomites from the Silesian-Cracow deposits implies that at least a part of them may be connected with the early stages of deposit formation, preceding the main stages of sulphide mineralization (Żabiński 1981, Bąk — pers. comm.). Recently, Kucha (in press) and Kucha and Czajka (1984) postulated a two-stage carbonate-sulphide model of the origin of these deposits. In the first, H_2S-free stage, Fe, Zn and minor amount of Pb were introduced into the structure of rhombohedral carbonates. Poorly ordered Mg-calcites and dolomites played an important role in this process. During the second stage, primary metal carbonates were converted into sulphides as a result of H_2S concentration. According to these authors, the ability of Zn, Fe and Pb to enter the structure of rhombohedral carbonates led to their separation from other heavy metals (mainly Cu) that had been present in the metal source.

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AKTUALNY STAN ZNAJOMOŚCI DOLOMITU CYNKOWEGO. UZUPEŁNIENIE

Streszczenie

Od chwili, gdy autor podsumował stan wiadomości o dolomicie cynkowym (Żabiński 1981), ukazało się kilka prac, które rzuciły wiele nowego światła na zagadnienie minerałów szeregu izomorficznego $CaMg(CO_3)_2$—$CaZn(CO_3)_2$. Ponieważ minerały te wzbudzają coraz szersze zainteresowanie mineralogów i geologów złożowych, opracowano krótkie uzupełnienie do wspomnianego artykułu.

Витольд ЖАБИНЬСКИ

АКТУАЛЬНОЕ СОСТОЯНИЕ ИЗУЧЕННОСТИ ЦИНКОВОГО ДОЛОМИТА. ДОПОЛНЕНИЕ

Резюме

От момента, когда автор обобщил состояние знаний о цинковом доломите (Жабиньски, 1981), появилось несколько работ, которые пролили новый свет на вопрос минералов изоморфного ряда $CaMg(CO_3)_2$—$CaZn(CO_3)_2$. Поскольку эти минералы вызывают растущий интерес среди минералогов и рудных геологов, автором составлено краткое приложение к вышеупомянутой статье.