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Short Communications

STUDIES ON THE THERMAL DISSOCIATION OF SOME CARBONATE MINERALS

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Differential thermal investigations with pure synthetic carbonate minerals revealed a general lowering of the dissociation peak for magnesite, dolomite or calcite when present together in an artificial mixture. The presence of siderite did not affect the dissociation curves of these carbonates. A systematic study of this phenomenon using pure compounds with controlled grain size and other affecting parameters may help in understanding the dissociation curves of natural carbonate aggregates.

The differential thermal analysis of carbonate minerals has been extensively reported in the literature. Such studies included pure end-members of different groups as well as various artificial mixtures of these carbonates or naturally occurring aggregates [1—10].

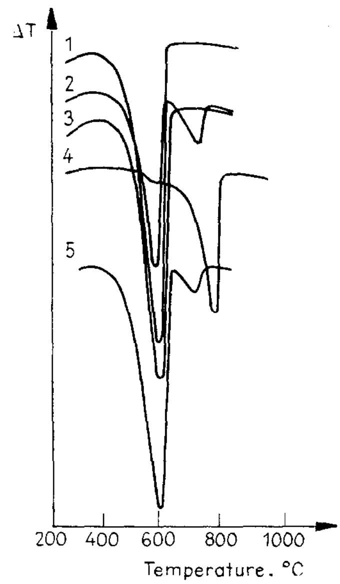

Fig. 1. Differential thermal curves of carbonate minerals. (1) Magnesite; (2) magnesite with 10% calcite; (3) magnesite with 10% siderite; (4) dolomite; (5) magnesite with 10% dolomite

In general, the dissociation temperature for any carbonate is found to vary depending on several parameters such as the presence of other cations in solid-solution, grain-size, etc. However, such studies do not clearly indicate the role of any parameter in particular in the dissociation of carbonates. In the present study, the end-members chosen are calcite, dolomite, siderite and magnesite — all made synthetically and supplied by Tem Pres Inc. (U.S.A.). Differential thermal

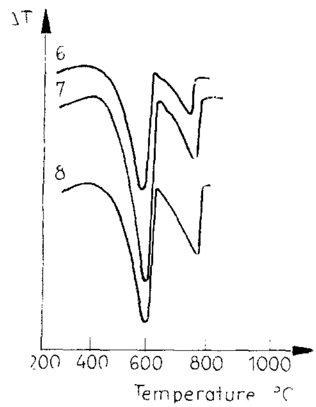

Fig. 2. Differential thermal curves for mixtures of (6) magnesite with 10% siderite and 10% calcite; (7) magnesite with 10% dolomite and 10% calcite; and (8) magnesite with 10% each of siderite, dolomite and calcite

analysis was carried out in air with a Du Pont differential thermal analyser equipped with a 1200° furnace at the heating rate of 15°/min; platinum sample cups and a matched pair of platinum-platinum 13%rhodium thermocouples were used. Automatic recording was done with a ΔT scale of 0.008 mV/inch (about 0.2°/inch), the instrument employed having a sensitivity of 0.0025°. Pure end-members and also mixtures of two or more of them, were analyzed maintaining identical conditions of packing and grain-size for all the runs. Figures 1 and 2 indicate the differential thermal curves for different samples.

Results and discussion

From the Figures, the following observations can be made: For pure magnesite (Curve 1), the peak for dissociation is at about 612°. With 10% of calcite or dolomite, the dissociation peak for magnesite is lowered to 600° (Curves 2 and 5). Siderite alone if present with magnesite does not affect the dissociation of magnesite (Curve 3); however, when siderite (10%) and calcite (10%) are present together, the peak is lowered to 585° (Curve 6). Magnesite with 10% each of calcite, dolomite and siderite gives the dissociation peak at 590° (Curve 8).

Similar changes have been noticed for calcite and dolomite in these curves. While the peak for pure synthetic calcite is at about 798°, the peak for calcite is shifted to 745° in mixtures of calcite (10%) with magnesite (Curve 2); the presence of dolomite or siderite does not appreciably change the dissociation curve for calcite (Curves 6 and 8). Changes in the dissociation of dolomite are also similar. While the peak of the dissociation of pure synthetic dolomite was at about 798°, a significant shift to 732° was noticed in mixtures of magnesite with 10% dolomite (Curve 5). The other constituents had little effect on the dissociation of dolomite (Curves 7 and 8).

Thus it can be concluded that the presence of calcite or dolomite in magnesite affects the dissociation of this compound appreciably. Siderite does not seem to influence the dissociation of any of the carbonates involved in the present study.

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Résumé — L'étude par ATD de carbonates minéraux synthétiques purs a montré un abaissement du pic de dissociation de la magnésite, de la dolomie, ou de la calcite, quand ils coexistent dans le mélange artificiel. La présence de sidérite n'affecte pas le mode de dissociation de ces carbonates. L'étude systématique de ce phénomène avec des composés purs, en contrôlant la granulométrie et les autres paramètres, a permis de comprendre le mode de dissociation des agrégats des carbonates naturels.

Zusammenfassung — Differentialthermoanalytische Untersuchungen an reinen synthetischen Karbonatgemischen von mineralischer Zusammensetzung zeigten im allgemeinen eine Verminderung in der Temperatur der Dissoziationsspitze von Magnesit, Dolomit und Kalzit, wenn sie gemeinsam zugegen waren. Siderit beeinflußte den Verlauf der Dissoziation der Karbonate nicht. Eine systematische Untersuchung dieser Erscheinung mit Hilfe von reinen Verbindungen mit kontrollierter Korngröße und anderen beinflußbaren Parametern trägt zur Klärung der Dissoziationserscheinungen von natürlichen Karbonataggregaten bei.

Резюме — Исследования, проведенные с чистыми синтетическими минералами карбонатов, обнаружили общее понижение температуры пика диссоциации для магнезита, доломита или кальцита, если они присутствуют вместе в искусственной смеси. Установлено, что присутствие сидерита не влияет на вид диссоциации этих карбонатов. Систематическое изучение этого явления на чистых соединениях с определенным размером зерен и при учёте других влияющих параметров может содействовать пониманию видов диссоциации агрегатов естественных карбонатов.