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**Microbeam analysis - Electron probe microanalysis -
Quantitative analysis of anhydrous carbonate minerals**

微束分析 电子探针显微分析 无水碳酸盐矿物的定量分析方法

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part

1. Structure and drafting rules for standardization documents" Drafting. Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document was proposed and coordinated by the National Microbeam Analysis Standardization Technical Committee (SAC/TC38). This document was drafted by: China University of Geosciences (Wuhan) and Institute of Mineral Resources, Chinese Academy of Geological Sciences. The main drafters of this document. Yang Shuiyuan and Chen Zhenyu.

Carbonate minerals are widely distributed in various geological bodies, and accurate quantitative analysis of their elemental composition is very important in earth science. Probe analysis is the main method for quantitative analysis of the micro-area composition of carbonate minerals. Under beam bombardment, element evaporation occurs, causing the counting intensity to change over time. In addition, carbon in carbonate minerals is generally not directly used for Therefore, it is necessary to develop a carbonate mineral quantitative analysis method. Standard for quantitative electron probe analysis of mineral components, working conditions, analysis process and reference materials in electron probe analysis of carbonate minerals Carbonate minerals can be divided into anhydrous carbonates and hydrous carbonates. The quantitative analysis of the composition of hydrous carbonates is more influencing. This document is mainly aimed at the quantitative analysis of anhydrous carbonate minerals by electron microprobe. Microbeam analysis

Electron probe microscopy Quantitative Analysis Methods for Anhydrous Carbonate Minerals

1 Scope

China's national method for the quantitative electron probe microanalysis of anhydrous carbonate minerals. Electron probe microanalysis measures composition at a spot a micron across by exciting characteristic X-rays with a focused electron beam, and it is the standard technique of quantitative mineralogy. Carbonates are among its hardest subjects. They decompose under the beam, losing carbon dioxide and changing composition while being measured; they are poor conductors, so charge builds up and deflects the beam; and the light elements they contain are exactly the ones the technique measures least well. The reason to persist is that carbonate composition records the conditions in which the mineral formed - the magnesium content of a calcite, the trace elements in a dolomite - which is how sedimentary and diagenetic history is read, and how carbonate reservoirs and ore deposits are understood.

This document specifies the instrumentation and materials, reference materials, sample preparation, analysis, and Analysis steps, calculation of element content, result processing and analysis report. This document applies to the quantitative analysis of anhydrous carbonate minerals by X-ray spectrometry.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document. For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document.

GB/T 4930 Guidelines for the technical conditions of standard samples for microbeam analysis electron probe microanalysis

GB/T 8170 Rules for rounding off values and expression and determination of limit values

GB/T 15074 General rules for quantitative analysis by electron probe

GB/T 15246-2022 Electron probe quantitative analysis method for microbeam analysis of sulfide minerals

GB/T 17366 Preparation of samples for electron microprobe analysis of minerals and rocks

GB/T 21636 Microbeam analysis Electron probe microanalysis (EPMA) Terminology

3 Terms and definitions

The terms and definitions defined in GB/T 21636 and the following apply to this document.

3.1 It is composed of carbonate and metal cations, and the anion only contains carbonate, without other additional anions (such as OH⁻, F⁻, Cl⁻, etc.) and H₂O compounds.

Note. Anhydrous carbonate minerals can be represented by M_x(CO₃)_y (M represents one or more cations), such as calcite (CaCO₃), dolomite [CaMg (CO₃)₂], magnesite (MgCO₃), siderite (FeCO₃), smithsonite (ZnCO₃), cerussite (PbCO₃), strontium carbonate (SrCO₃), rhodochrosite (MnCO₃), barium carbonate (BaCO₃, also known as witherite), etc.

4. Instruments, Equipment and Materials The equipment and materials are as follows:

---Electron probe microanalyzer. beam stability should be better than $\pm 1.5\%/h$ under recommended measurement conditions;

---Vacuum coating apparatus. vacuum degree is better than $1 \times 10^{-2} Pa$;

---Conductive adhesive or double-sided conductive tape;

---Carbon rods, carbon ropes or carbon filaments.