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Geological setting and genesis of stratabound barite deposits at Múzquiz, Coahuila in northeastern Mexico

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ABSTRACT

The opening of the Gulf of Mexico during the Mesozoic led to the formation of the Sabinas Basin. Large carbonate platforms were developed throughout the Lower and Middle Cretaceous. The basin provided ideal conditions for the formation of a suite of carbonate-hosted, stratabound deposits such as barite, celestine, fluorite, and lead–zinc of Barremian–Aptian age. These deposits resemble Mississippi Valley-type (MVT) and associated deposits. The mining district of Sierra de Santa Rosa is located approximately ~7 km SE from Melchor Múzquiz in the state of Coahuila, Mexico. Barite is the economic mineral and the shape of the ore bodies is considered "mantos", the gangue minerals are calcite, local gypsum, traces of celestine, silica, and iron (oxy) hydroxides. The barite deposits show relict textures such as rhythmic, alternating black and white bands due to the presence of organic matter, and globular clusters similar to the "chicken-wire" anhydrite, typical of evaporites. A fluid inclusion and stable isotope analysis (S from barite, C and O from carbonates) were conducted. The lower manto yielded a melting ice temperature between −26 °C and −5 °C (salinities of 7.9 to 27 wt.% NaCl equiv.) and a homogenization temperature ranged between 59 °C to 155 °C. The eutectic temperature was −51 °C ± 2 °C denoting a primary calcic brine. The upper manto yielded a melting ice temperature between −22 °C and −15 °C (salinities of 18.6 and 24 wt.% NaCl equiv.) and a homogenization temperature was ranging from 60 °C to 126 °C. Isotopic analysis of barite showed $\delta^{34}S_{VCDT}$ ranges from +14.9‰ to +19.5‰ (average of 16.9‰). Sulfur isotope data for barite from the Sierra de Santa Rosa is consistent with a sulfur source formed during the Lower Cretaceous, which coincides with the age of the Cupido Formation. The carbon isotope analysis of the host limestone yielded a $\delta^{13}C_{VPDB}$ range from −0.01‰ to +0.11‰. The $\delta^{13}C$ values for clear and gray calcites ranged from −0.15‰ to −1.5‰, and −1.41‰ to −2.3‰, respectively. The oxygen isotope analysis showed a range between $\delta^{18}O_{VSMOW}$ −4.55‰ and −10.04‰. Fluid inclusion microthermometry and isotopic measurements lead us to conclude that brines from the Sabinas Basin led to the replacement of the evaporite strata (gypsum) by barite in the Cupido Formation and thus classify these deposits within the category of MVT and associated deposits.

1. Introduction

The ore deposit types which were likely formed during the Mesozoic in the sedimentary-diagenetic domain of northeastern Mexico are: 1) sedimentary-exhalative or SEDEX deposits, like the manganese Molango deposit in Hidalgo, (Zantop, 1978; Alexandri and Martínez, 1986; Okita, 1992); 2) Mississippi Valley-type and associated deposits of: fluorite, such as La Sabina and El Tule in Coahuila and Las Cuevas in San Luis Potosí; celestine, such as La Tinaja and San Agustin in Coahuila (González-Sánchez et al. 2007); barite, such as La Paila, and Mayran in Coahuila and La Huicha in Nuevo Leon (Clark and De la Fuente, 1978; Kesler and Jones, 1981; Puente-Solís, et al., 2005; Camprubí, 2009, 2013); Zn–Pb sulfides, such as Sierra Mojada and Reforma in Coahuila and El Diente in Nuevo Leon; 3) Cu–Co deposits; such as, El Huizachal in Tamaulipas, San Marcos in Coahuila, and El Coyote and Las Vigas in Chihuahua, (Clark and De la Fuente, 1978); and 4) U deposits in detrital sequences, or Kupferschiefer-type "red beds"; such as, Sierra de Gómez in Chihuahua, and El Nopal, Las Margaritas, La Coma and Buenavista in Tamaulipas. With the exception of the SEDEX deposit, which is largely syngenetic, these deposits are epigenetic and occur in basins of Mesozoic–Cenozoic age associated with the opening of the Gulf of Mexico, with

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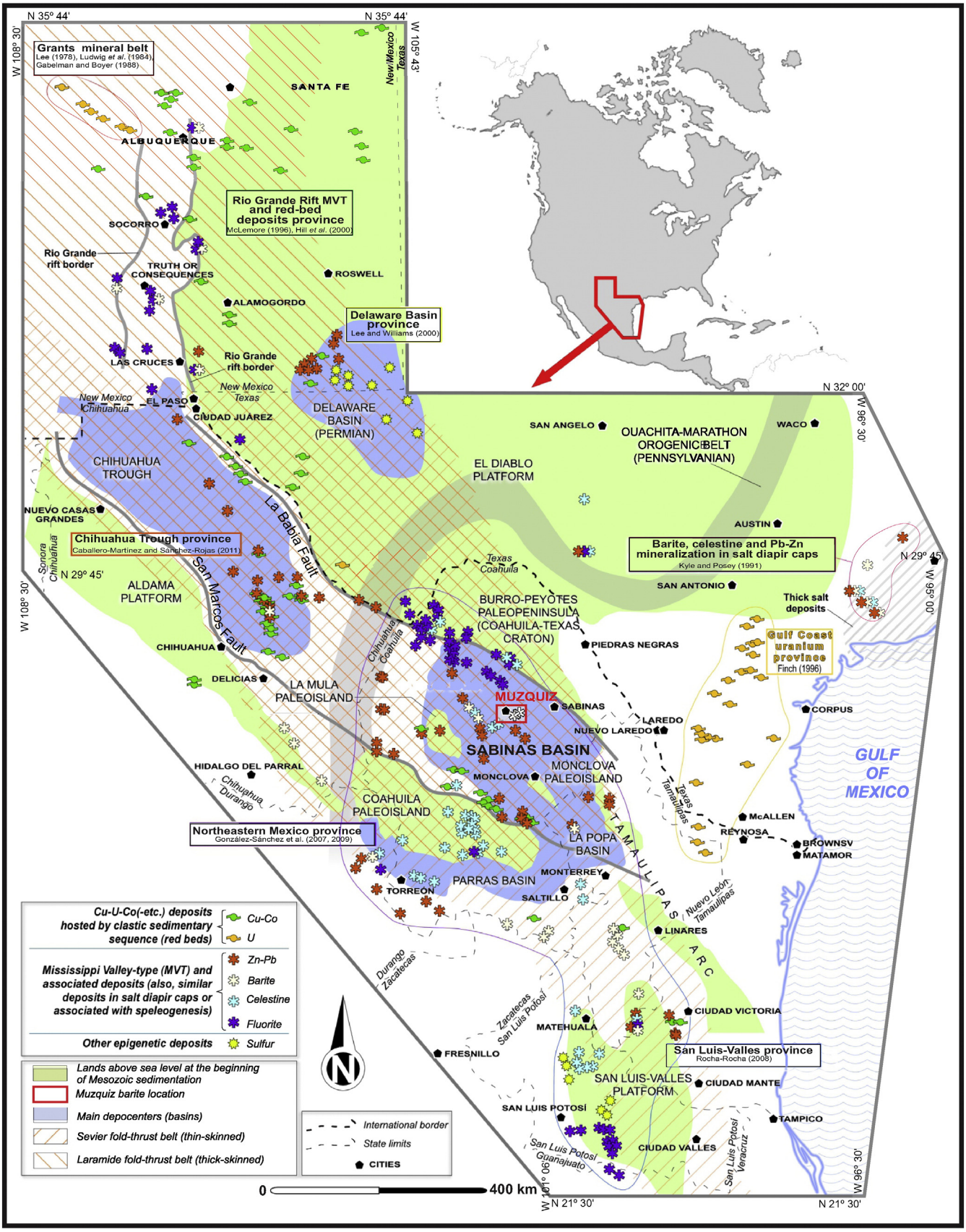

Fig. 1. Distribution of stratabound deposits in northeastern Mexico, and southern United States showing the main manifestations of mineralization linked to uranium, lead–zinc, barite, celestine, fluorite and copper in red-beds. Slightly modified from (Camprubí, 2013).

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