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Sr ISOTOPES OF BEDDED BARITES: GUIDE TO DISTINGUISHING BASINS WITH Pb-Zn MINERALIZATION

J. B. MAYNARD,

Department of Geology, University of Cincinnati, P.O. Box 210013, Cincinnati, Ohio 45221

JOHN MORTON,

Department of Geology, Miami University, Oxford, Ohio 45056

E. L. VALDES-NODARSE, AND A. DIAZ-CARMONA

Empresa Geologo-Minera Pinar del Rio, Sta. Lucia 22400, Cuba

Introduction

When barite is deposited, small amounts of Sr are incorporated in its crystal lattice. Very little Rb is taken in, however, so the isotopic composition of the original Sr is preserved, thus providing a tracer for the source of the Sr and hence of the Ba in the barite (Whitford et al., 1992; Paytan et al., 1993; Martin et al., 1995). We have studied Sr in barites from several barite deposits, some of which are associated with commercial-scale Pb-Zn mineralization and some of which are barren.

Barite deposits can be assigned to two different categories based on tectonic setting (Maynard and Okita, 1991; Maynard, 1991; Maynard and Klein, 1995). Bedded barites associated with continental margins in peripheral foreland basins, for example, those of the Ouachita Mountains of Arkansas, are barite only, containing no commercial Pb or Zn. By contrast, intracratonic rifts can be host to two styles of barite mineralization. The most familiar occurs as a distal facies of stratiform Pb and Zn mineralization, such as Meggen and Rammelsberg in Germany and Jason in the Selwyn basin of western Canada. This distal barite could be used as a pathfinder for the Pb-Zn deposits. Also present, however, in the same terranes as the Pb-Zn-Ba deposits, are barite-only occurrences. The Selwyn basin has a number of these barites, for example, the Tea deposit (Lydon et al., 1985).

Because of the association of barite with large-tonnage Pb-Zn deposits, either directly in the ore or elsewhere in the same stratigraphic interval, barite could serve as a useful exploration guide, but a way is needed to differentiate barites that might reasonably be associated with Pb-Zn mineralization, like Meggen, from barren barites like those in the Ouachitas with a low probability of having undiscovered commercial Pb-Zn. Maynard and Okita (1991) proposed that the two types of barite are associated with different types of crust, continental margin, or Ouachita-type deposits with oceanic crust and intracratonic rift or Meggen-type deposits with continental crust. Tectonic subsidence analysis provides support for assigning these two groups of deposits to different basin types (Maynard and Klein, 1995).

If this distinction is correct, Sr in the continental margin deposits should be less radiogenic than Sr from rift-related deposits. The barite in these deposits would preserve a record of the $^{87}Sr/^{86}Sr$ signature of the mineralizing fluid, which in turn should reflect the oceanic vs. continental character of the rocks through which the fluids have moved, and thus should help to distinguish between the two main types of barite mineralization.

Although in some cases reconstructing the tectonic setting of a barite occurrence is straightforward, more often it is not. The usual case is that the tectonic framework of a deposit is not worked out until the mine is well established. For Precambrian terranes, the tectonic setting may never be reconstructed to everyone's satisfaction, and some younger areas are open to controversy. For example, several authors have argued against the Maynard and Okita (1991) interpretation of fundamentally different tectonic settings for the coeval Nevada and Selwyn basin deposits. Turner et al. (1989) maintained that the two regions were essentially the same in tectonic behavior and emphasized the dominance of extension. Conversely Smith et al. (1993), although they also believed the two areas were essentially the same, concluded that compression in a foreland setting was the dominant theme. Accordingly, we conclude that consensus on tectonic reconstructions is difficult to achieve without years of study, so it would be useful to have a technique to help discriminate between our two tectonic categories of barite deposits that could be applied at an early stage of exploration.

Methods

Samples were prepared by grinding in an agate ball mill, followed by selective dissolution of the Sr component. Five grams of sample powder was weighed into a 250-ml teflon beaker and 100 ml of 1*N* HCl added. This preparation was allowed to stand for one day, the acid decanted, and a fresh 100 ml of HCl added. The acid rinse was employed to remove any readily soluble carbonate material or exchangeable cations in any admixed clay. Paytan et al. (1993) and Martin et al. (1995) used a similar acid leach, but followed with HF treatment to remove silicates. Because all of our samples are barite ores, silicate contamination was minimal, and we did not employ a more aggressive acid attack. After standing in acid for another day, the sample was rinsed six times with quartz-distilled water. Finally, 250 ml of quartz-distilled water was added, the beaker covered with a teflon watch glass, and