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| Title | Boron isotopic composition of tertiary borate deposits in the Puna Plateau of the Central Andes, NW Argentina |
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| Abstract | Full text: The most important borate deposits in South America are concentrated in the Central Andes. The Neogene deposits are located in the Puna Plateau of N W Argentina. These continental deposits are stratiform in the tectonically deformed Tertiary rocks. The largest borate accumulations Tincalayu, Sijes and Loma Blanca are part of the Late Miocene Sijes Formation, composed by different evaporitic and clastic units. In the main borate units of each location different phases of borates dominate. In Tincalayu the major mineral is borax with minor amounts of kernite and other rare borate minerals (ameginite, rivadavite, etc.). The principal minerals in Loma Blanca are borax with minor ulexite and inyoite. In the two main units of Sijes hydroboracite and colemanite are the major minerals. Inyoite and ulexite appear subordinately. The deposition of the borates is due to a strong evaporation in playa lakes, which were fed by boron bearing thermal fluids (Alonso and Viramonte 1990). From Loma Blanca we determined $\delta^{11}\text{B}$ values of ulexite (-6.3 ‰), inyoite (-12.7 ‰) and terrugite (-16.2 ‰). And from Tincalayu the $\delta^{11}\text{B}$ values of borax (-10.5 ‰), tincal (-12.2 ‰) kernite (-11.7 ‰) and inderite (-15.4 ‰). The borates of Sijes are hydroboracite (-16.8 ‰ to -17.2 ‰), ulexite (-22.4 ‰) and inyoite (-28.5 ‰ to -29.6 ‰). In order to get information about the $\delta^{11}\text{B}$ values and pH of a boron solution we analysed the thermal spring of Antuco. It has a $\delta^{11}\text{B}$ of -12.5 ‰ at a pH of 7.9. The presently forming ulexite deposit has a $\delta^{11}\text{B}$ of -22.4 ‰. Borates within one depositional unit show a decreasing $\delta^{11}\text{B}$ value sequence from the Na-Borates to the Ca-Borates related to the boron coordination of the minerals (Oi et al. 1989). The difference in the $\delta^{11}\text{B}$ values excludes the precipitation in equilibrium from solutions with constant pH. According to results from previous work on Neogene borates (Turkey, USA) we interpret the borate succession due to precipitation at variable pH values (Palmer and Helvacı 1995, Oi et al. 1989). Because of the identical $\delta^{11}\text{B}$ values of each borate sequence from Sijes, similarly composed thermal brines are likely. Taking the Antuco data into account we calculate an original $\delta^{11}\text{B}$ of -12 ‰ for the Sijes brines. The difference to the value (-16 ‰), calculated according to Oi et al. (1989), is small and can be explained by lower temperature and pH as well different chemical composition in the required fluid. In Tincalayu we measured the boron isotopes from different minerals with the same boron atomic coordination. |