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Geological Characteristics and Genesis of Subbottom Pinnoite Deposit of Da Qaidam Salt Lake in Qaidam Basin

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Da Qaidam salt lake is known for its both liquid and solid boron resource. Data from previous investigation of the Da Qaidam salt lake provided a comparable framework for this study that focused on investigating the section beneath the bottom of the perennial salt lake, including the timing, distribution pattern, and hydroclimatic and geochemical conditions of the pinnoite deposit. The following are the results and conclusions from the study: (1) The pinnoite deposit commenced from ~1790 a BC, which is determined based on AMS ¹⁴C dating of three organic carbon samples, carefully selected from three black layers rich in organic matter, with reservoir effect calibration and conversion into calendar years. (2) The subbottom borate deposit dominated with pinnoite contains 3-16% B₂O₃ with a zonal deposition pattern offshore with an area of 10 km² along the

eastern shore of the Da Qaidam salt lake. (3) The lean pinnoite formation was constrained by (a) enriched boron content in the brine as a result of earlier evaporative concentration, (b) shallower lake conditions under a more arid climate, (c) dilution and mixing of the brine rich in B₂O₃ and Mg²⁺ with boron-bearing spring water led to dehydration of CO₃²⁻ into OH⁻ and weak alkaline to alkaline brine, (d) while the reaction of B₄O₇²⁻ with OH⁻ produces BO₂⁻, most of Mg²⁺ reacted with BO₂⁻ to produce colloid pinnoite, which were later converted into consolidated pinnoite masses due to subsequent diagenetic compression. The study aims to demonstrate the formational mechanism of the pinnoite strata and to provide contribution to the ore-forming theory of borate deposits in salt lake systems.

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