

SCG090-05

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熱水性石英中の流体包有物から読み取る初期地球の海水中CO₂濃度

CO₂ concentration of fluid inclusions in hydrothermal quartz: evidence for Archean CO₂-rich seawater

渋谷 岳造^{1*}, 上野 雄一郎², 小宮 剛³, 吉田 尚弘², 丸山 茂徳², 高井 研¹

Takazo Shibuya^{1*}, Yuichiro Ueno², Tsuyoshi Komiya³, Naohiro Yoshida², Shigenori Maruyama², Ken Takai¹

¹海洋研究開発機構 プレカンブリアンラボ, ²東京工業大学, ³東京大学

¹Precambrian Ecosystem Lab, JAMSTEC, ²TITECH, ³University of Tokyo

CO₂ is a key element to understanding the Precambrian surface environment because of its greenhouse effect in atmosphere and influence on seawater chemistry. The purpose of this study is to estimate CO₂ concentration of ancient seawater from fluid inclusions in quartz formed in subseafloor hydrothermal system. The crushing extraction system was established to measure CO₂ concentration of fluid inclusions entrapped by hydrothermally precipitated quartz, and was applied to natural samples from the 3.0 Ga Pongola area and the 2.2 Ga the Ongeluk area, Kaapvaal Craton, South Africa. The quartz deposits occur in drain cavity and interpillow space of pillow lavas, and in vesicle of sheet flow, the size of which ranges from several to 15 cm across. The precipitates in the drain cavity are smooth oval tube in shape and oriented parallel to the pillow tube, and never cut pillow rim. The quartz precipitate in the interpillow is shaped by primary structure of the pore surrounded by pillows and also never cut the pillow rims. Some quartz crystals show a point symmetrical structure that grew from surface to center of the cavity, and form banded growth plain defined by repeated changes of grain size. Because hydrothermally precipitated quartz has both primary and secondary inclusions, we classified quartz samples into primary-rich and secondary-rich samples based on the detailed microscopic observation. The CO₂ concentration of extracted fluid from the primary-rich samples in the Pongola quartz is approximately 100 times higher than present-day seawater, while primary-rich samples in the Ongeluk area have relatively low CO₂ concentrations up to 20 times the present. These results imply that the CO₂ concentrations of hydrothermal fluid and seawater decreased from 3.0 Ga to 2.2 Ga.