Facies architecture, eruption history, and emplacement mechanism of subaqueous lava-carbonate succession in Bogda Mountain, northwest China*

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A subaqueous volcano-sedimentary complex in Bogda Mountains consists of various volcanic facies and coeval carbonates. Lava flows are basalts and grade from fragmented lava clasts and sedimentary rock in the lower part into coherent pillow lava and irregular massive lava bodies in the upper part of the succession. Four different facies are distinguished: (1) hyaloclastite; (2) peperite; (3) pillow lava with interpillow sedimentary rock; and (4) closely packed pillow lavas and huge irregular lava bodies. Hyaloclastites are closely connected with coherent lava flows and show jigsaw-fit texture and stepwise granulation from bigger clasts into smaller ones, indicating in-situ fragmentation and deposition during lava-water interaction, rather than reworking or collapsing of the succession after the eruption. Peperites are formed during the intimate interaction between hot lava flows and unconsolidated, water saturated carbonate rocks, which suggests the coeval volcanic eruption and deposition of carbonates in a shallow marine environment. In the upper part of the succession, the lava flux increases, producing massive, irregular lava bodies indicating an increased eruption frequency, and a thick accumulation of lava flows lacking interbeds. Vesicularity of the lava clasts decreases noticeably as the succession continues, pointing to an increase in ambient pressure as the basin subsided. Vesicularity of basaltic clasts, ambient pressure, and peperitic features indicate eruption depth at between 1500 m to 2500 m. A rhyolite intrusion in the upper part of the succession was dated at 308 Ma by using the LA-ICPMS zircon U–Pb method; it suggests that the subaqueous volcanic eruption and shallow marine carbonate sedimentation took place during the Late Carboniferous. Stratigraphy, facies architecture and vesicularity of the volcano-sedimentary succession in Bogda Mountain suggest that it was formed during subaqueous volcanic eruption in a progressively deepening and subsiding basin. Results of this study are supported by the evidence from previous findings, such as regionally well-documented bimodal volcanic rocks, faulting, and along-strike granitic intrusions in the region, all related to post-collisional extension in the Central Asian Orogenic Belt during the Late Carboniferous.

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