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Mechanism of Mesozoic Volcanism in Northeastern China: Evidence from New Distribution Maps of Volcanic Rock and Petrogenesis of Acid Rock in Deep Songliao Basin

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Northeastern China is located in the eastern segment of the Central Asian Orogenic belt, which is characterized by widespread Mesozoic volcanic rocks. At present, there are two different opinions concerning the mechanism of volcanism: one proposal is that volcanism was associated with the closure of Mongolia-Okhotsk (MO) Bay, but another suggestion is that the Mesozoic volcanism is controlled by the subduction of Paleo-Pacific plate. However, most studies have mainly focused on the Mesozoic volcanic rocks in Great Xing'an Range(GXR), lack of evidence from Songliao Basin. In order to exactly reveal the mechanism of volcanic rocks in Northeastern China, five new distribution maps of volcanic rocks in Northeast China are drawn and petrogenesis of Mesozoic volcanic rocks in Songliao Basin are obtained.

Based on 1: 50000 geological maps, five distribution maps of volcanic rocks (1:2000000) in Northeastern China are recompiled: Early Jurassic, Middle Jurassic, Late Jurassic, Early Cretaceous, and Late Cretaceous. The Early Jurassic volcanic rocks predominantly occur in the eastern Heilongjiang-Jilin province, with minor in Manzhouli in the western. The Middle Jurassic volcanic rocks are mainly founded in the western Liaoning provinces. The Early-Middle Jurassic volcanic rocks(170-146Ma) belong chemically to sub-alkaline series, implying an active continental margin setting. The Late Jurassic volcanic rocks(146-122Ma) mainly occur in the western GXR area, and the magma derived from enriched lithospheric mantle which is closely associated with the subduction of MO plate. The Early Cretaceous volcanic rocks(122-102Ma), widespread in GXR and Songliao basin, are mainly acid and erupt in extensional setting, probably associated with the lithospheric thinning and asthenospheric mantle upwelling caused by subduction of the Paleo-Pacific plate beneath eastern China.

Constraints on the timing of MO Bay closure and the motion direction of Paleo-Pacific plate, we infer that:(1) In the Early-Middle Jurassic, both MO oceanic plate and Farallon plate subducted beneath Northeastern China from west and east, respectively, which resulted in the volcanism in Manzhouli, eastern Heilongjiang-Jilin and western Liaoning provinces. (2) In the Late Jurassic, volcanic rocks in the western GRX were due to collisional orogeny accompanied the closure of MO Bay, but volcanism in or around Songliao Basin was caused by deviation of Farallon plate. (3) In the early Early Cretaceous, volcanism in the GXR resulted from post-orogenic diffuse extension at the MO suture zone, but volcanoes in Songliao Basin were active related to a backarc setting relative to the subduction of the Kula-Izanagi plate. (4) By the end of the Early Cretaceous, volcanism in Great Xing'an Range gradually decreased, whereas those in Songliao Basin increased accompanied subduction of the Kula-Izanagi plate. (5) In the Late Cretaceous, volcanic rocks were limited to the eastern Lesser Xing'an-Zhangguangcai Ranges affected by right-lateral strike-slip motions in continental margin in process of the oblique subduction of the Kula-Izanagi plate.

Taking all this into account, we can conclude that the Mesozoic volcanism in Northeast China was both controlled by the closure of MO Bay and subduction of Paleo-Pacific plate. Mesozoic volcanic rocks were tectonic overprint that Paleo-Asian oceanic regime transferred to the circum-Pacific.