Two Late Mesozoic pulses of silicic volcanism within the North Chukotka area (NE Russia): Magma sources and geodynamic significance

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The Cretaceous Okhotsk-Chukotka volcanic belt (OCVB) is one of the largest Andean-type volcanic provinces of the Earth. Silicic magmatic rocks are the major component of the OCVB, comprising up to 90% vol. of some segments. The lifetime of this belt is still under discussion but all existing models imply the onset of volcanism between 107 Ma and 90 Ma. However, remnants of older (Paleozoic and Mesozoic) subduction-related volcanic provinces overlain by sequences of the OCVB are known.

One such remnant has been discovered within the northern part of the volcanic belt (Tikhomirov *et al*., 2007). This is a 1-1.5 km thick uniform pile of welded rhyolitic tuffs intruded by related granodiorites and overlain by felsic ignimbrites of the OCVB. Zircon U-Pb ages of both tuffs and granodiorites are about 150 Ma (Late Jurassic). The continental crust is inferred to be the main magma source during both Jurassic and Cretaceous events as contemporaneous basalts are absent, and andesites take a minor part (10-15% in vol.). Sr, Nd, Pb, and Hf isotopic characteristics of the Late Jurassic assemblage are very uniform and originate from a relatively depleted source, with εHf_t = +4.4 to +5.0, and εNd_t = -0.5 to -0.1. Isotopic ratios are not correlated with rock chemistry, and therefore considerable contribution from mantle sources are considered unlikely. OCVB rhyolites display a wider range of isotopic composition (εHf_t = -1.6 to +3.8, and εNd_t = -4.1 to -2.1), and appear to result from mixing of at least 3 different end-members within the compositional field of continental crust.

We relate the Late Jurassic magmatic assemblage to a hypothetical continental volcanic arc at the active margin of the Anyui-Angayucham oceanic basin which closed in the Early Cretaceous (Sokolov *et al*., 2002). Absence of apparent tectonic deformation of the volcanic sequence implies that the main Mesozoic compressional event in North Chukotka took place before the Tithonian age.

References

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Melting processes by Rayleigh-Taylor instabilities beneath Continents: Evidence from Cenozoic intraplate volcanism on Zealandia, SW Pacific

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Intraplate volcanism is mainly attributed to upwelling and subsequent partial melting of hot mantle material. However, the origin of these hot mantle material is still a matter of an active debate (e.g. www.mantleplume.org). On the New Zealand micro continent Zealandia (consisting ~ 90 % of submerged continental crust) intraplate volcanism occurs widespread and nearly continuously since the initial separation activity from Gondwana about 100 Ma ago. Voluminous volcanism was associated with the Cretaceous rifting of Zealandia from Gondwana. In contrast, only scattered, low volume eruptives were produced in the Cenozoic. Two volcanic endmembers can be defined in the Cenozoic: 1) diffuse but widespread monogenetic volcanic and dike fields (e.g. Waipiata Volcanic Field, Pukaki Bank, Alpine dike swarm) and 2) shield volcanoes (e.g. Banks Peninsula, Dunedin Volcano, and Chatham Islands).

The geological processes responsible for this intraplate magmatism remain enigmatic. A mantle plume origin appears unlikely as there is no age progression in the erupted lavas in direction of plate motion, although Zealandia drifted ~ 6,000 km to its present position. This combined with the absence of an anomalous hot mantle or large extensional structures requires an alternative process to trigger partial melting beneath Zealandia. It has been proposed that the gravitationally unstable lower lithosphere was subjected to multiple delamination events during the Cenozoic. Using finite element modeling, we will test two alternative mechanisms: Rayleigh-Taylor type delamination of a dense layer at the base of the lithosphere and edge driven convection. The concept of an anomalously dense lower lithosphere is supported by the geological history of Zealandia. Located at the NW margin of Gondwana it was exposed to subduction for hundreds of million of years. Influx of subducting plate derived fluids and melts may have re-fertilized and thereby densified the lower lithosphere making it gravitationally unstable with respect to the underlying asthenospheric mantle. In addition, the relatively small lateral dimensions of Zealandia might make it particularly vulnerable to erosion by edge driven convection. We will present the conditions under which these two processes are viable explanations for the intraplate volcanism in Zealandia.