

Cenozoic volcanism in northern Sikhote Alin, Far East Russia and its implication for the opening of the Japan Sea

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The Sikhote Alin area located side of the Sea of Japan. There are two volcanic belts, which are named ESAVB and WSAVB. The age distribution and the chemical variations in the northern Sikhote-Alin basaltic rocks can provide us with the timing of changing volcanism which related around the opening of Sea of Japan. The 59 results indicate that volcanic activities in the northern Sikhote Alin area occurred in three stages. During 40-25 Ma only in ESAVB, which excelled arc-type basalts. During 25-20 Ma, and was basically inactive stage caused during opening event. During 20-5 Ma, it seems that the volcanic activity in both ESAVB and WSAVB excelled plume-type basalts, and was basically active stage maybe caused intraplate volcanism. The third stage was little longer in only WSAVB (<3 Ma)

K-Ar ages and major/trace element compositions were obtained from 59 fresh lavas from the northern Sikhote Alin, Far East Russia, in order to document the secular variation in volcanism and upper mantle processes during backarc opening. This region is distinct in that it was the home of the NE Japan arc sliver before the opening of the Japan Sea backarc basin. Also, the distribution of lavas from the coastal region to the inner part of the continent is the characteristic feature of this region. Northern Sikhote Alin can be divided into two volcanic belts, that is, the East Sikhote Alin volcanic belt (ESAVB) along the Japan Sea coast, the West Sikhote Alin volcanic belt (WSAVB).

The volcanic activity in the north Sikhote Alin took place during 40-25 Ma and 20-5 Ma, and was separated by a marked hiatus in volcanism during 25-20 Ma, which is synchronous to the period of the major rifting event in the Japan Sea backarc basin. It should be stressed that the volcanic activity during the pre-rifting stage of the Japan Sea occurred in the entire ESAVB along Japan sea, whereas no volcanism in the WSAVB. Such an arc-like distribution of volcanism may suggest the location of a continental arc-trench system in this region before the formation of the backarc basin. On the other hand, the volcanism during 20-5 Ma exhibits "spot-like" distributions both in the WSAVB and ESAVB.

All lavas erupted in the ESAVB during 40-25 Ma have compositions typical of subduction-zone magmas, implying that the ESAVB formed a continental-margin arc before the opening of the Japan Sea. It is further suggested that the backarc rifting is initiated at the volcanic front, not in the backarc region. Thus, the present data clearly demonstrate that the opening of the Japan Sea initiated at least 25-20 Ma, earlier than 15 Ma as suggested previous based on paleomagnetic data. On the contrary, the arc magma chemistry is not confirmed for any lava erupted during 20-5 Ma, indicating that such subduction-related volcanism was terminated due to the opening of the Japan Sea. During 20-5 Ma, intraplate-type lavas with typical hotspot magma compositions typifies the Sikhote Alin volcanism and may be caused by mantle upwelling beneath the Cenozoic intraplate basalt province in the northeast China and Far East Russia.