EFFECT OF FLOW VELOCITY ON TEMPERATURE AND CHEMICAL COMPOSITION OF FUMAROLIC GASES

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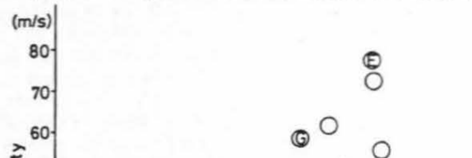
Flow velocity measurements of fumarolic gases using a Pitot tube at the I-crater fumarolic area of My. Usu, Hokkaido, Japan were carried out. At the same time, temperature measurement of gas vents and the sampling of fumarolic gases were also made.

When the flow velocity is low, the outlet temperature is low. However, even when the flow velocity is low, there are fumaroles with high outlet temperature as seen in the figure.



Hence the flow velocity of gas is not the sole factor that controls the outlet temperature. The apparent equilibrium temperature (AET) of the reaction, $3H_2 + SO_2 = H_2S + 2H_2O$, is always higher than the outlet temperature. The relationship between AET - outlet temperature - flow velocity is as follows: 1) when the flow velocity is the same, the difference between AET and outlet temperature is larger for lower temperature fumarolic gases, and 2) when the outlet temperature is the same, AET is lower for fumarolic gases with higher flow velocity. An interpretation for the above two facts is given on the basis of the rate of temperature and pressure drops associated with the flow velocity.

Based on the measured activity ratio of ^{232}Th and ^{238}U in the ejecta, the activity ratio of ^{220}Rn and ^{222}Rn in the magma is estimated to be 0.75. The measured activity ratio at the vent of a fumarole with the flow velocity of 39m/s is less than 0.5. This result indicates that the time elapsed after the gas leaves from the magma top is at least 32.5 seconds. Then, the minimum depth of the magma top is calculated to be 1.3km. Although the above calculation is oversimplified, a continuos measurement of $^{220}Rn/^{222}Rn$ will be one of the candidates which can monitor the fluctuation of the depth of magma top.

ACCRETED ISLAND ARCS AND CROSS-CUTTING BATHOLITHIC BELTS OF THE NORTH AMERCIAN CORDILLERA

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The basement framework of the western Cordillera consists in large part of tectonically accreted island arc terranes and cross-cutting batholithic belts. The arc terranes are diverse in terms of magmatic history, tectonic disruption and basement relations, and represent several distinct systems. Terranes of the two oldest systems occur in inner and outer belt positions. The inner belt runs from central Alaska to the northern Sierra Nevada. It was in its major developmental phases by the Devonian, and was constructed on imbricated North American continental rise strata outboard of a passive margin. The outer belt includes the Alexander Terrane (AT) of SE Alaska and younger amalgamated arc terranes of the Alaska Peninsula and Queen Charlotte-Vancouver Islands. The AT contains a tremendous volume of primitive arc volcanic and plutonic material formed between ~550 and 410 Ma. This early Paleozoic arc was rifted during the Devonian, and appears to have drifted for a substantial part of the late Paleozoic as a Panthalassa oceanic plateau. It was amalgamated to additional arc terranes in the late Paleozoic to early Mesozoic and then accreted to North America during an active arc phase in the Early Cretaceous. In Alaska to northern Washington latitudes the AT system bounds major fragments of an east-Pacific fringing arc system of mid-Paleozoic to mid-Jurassic age (McCloud arc), as well as belts of collapsed open ocean and marginal basin terranes. This arc-ocean basin mosaic was accreted against the inner continental rise system in several stages ending in the Middle Jurassic. In Oregon and California remnants of the major arc systems present to the north are missing or are highly fragmented. In this region the analogous belt of accretionary terranes is composed of composite ophiolites which record a late Paleozoic to early Mesozoic boundary transform system with superposed forearc igneous complexes, and a Middle and Late Jurassic interarc basin system with local vestiges of an outer fringing arc. The AT system and perhaps parts of the McCloud system migrated along the outer edge of the composite ophiolite belt, although detailed kinematic histories are poorly known.

The Cordilleran-wide belt of accreted arcs and ophiolites began major collapse against North America in the Middle Jurassic with final accretion occurring in the Early Cretaceous. The Middle Jurassic Omineca crystalline belt of British Columbia represents a plutonic-metamorphic welt formed along the inner suture of the McCloud system. The southern extension of this belt widens southward into the Nevada-California region where it diverges from the suture trend and cuts into every pre-Late Jurassic accretionary terrane of the region as well as Proterozoic North America. The Cretaceous Sierra Nevada batholith cuts obliquely across the Jurassic plutonic belt and lies along the suture produced by the boundary transform. Interarc basin ophiolite which formed along the transform system constitutes basement for the Cretaceous Great Valley forearc basin. To the north the Idaho batholith and Coast Plutonic belt formed along the suture between the McCloud system and the AT system. Major phases of magmatism commenced here in the mid-Cretaceous and ceased in the Eocene. The Sierran-Idaho-Coast batholithic belt represents a continent edge magmatic arc developed above an east-dipping subduction zone which established itself beneath the hanging wall of the accreted island arc and ophiolite terranes. Subduction zone magmas preferentially intruded major crustal sutures, and in the process transformed the sutures and the juxtaposed ensimatic terranes into new North American sialic crust.