

Re-examination of the widespread correlation of Middle Pleistocene tephras in Japan: a co-ignimbrite Ks18 tephra in central Japan and the Shimokado pyroclastic flow deposits, south Kyusyu

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Tephra is one of the best indicators of the history of explosive eruptions. Thus, Middle to Late Pleistocene tephrochronology provides information on regional changes of the frequency, magnitude of eruptions and magma discharge rate as a function of time in a long term. So tephra study of explosive eruptions is one of the most positive approaches to volcanic hazard mitigation.

Shimokado pyroclastic flow deposit (SMPF) erupted from a certain caldera in the southern Kyushu during the middle Pleistocene is one of the stratigraphically important key beds in the whole area of the Japanese Islands. Previous study correlated SMPF to Ks18 tephra (vitric ash fall deposit) in the Kasamori Formation of the Kazusa Group at the Boso Peninsula in central Japan. This pyroclastic flow deposit has been called by various names at each local area in southern Kyushu. In addition, correlation and identification of SMPF in southern Kyushu are controversial among previous studies. Furthermore, Ks10 tephra above Ks18, both in the Kasamori Formation, is petrographically similar to SMPF, resulting in complication in widespread correlation of SMPF.

In this study, in order to re-examine the correlation of the Shimokado pyroclastic flow deposit between southern Kyushu and central Japan, we revealed the petrographic and chemical properties of eleven pyroclastic deposits (nine pyroclastic flow deposits and two co-ignimbrite ash fall layers), using the following four different criteria; (1) types of glass shards, (2) mineral assemblages, (3) range and modal values of the refractive indices of glass shards and phenocrysts, (4) chemical compositions of the glass shards, hornblende and orthopyroxene. However, in some cases, by the similar pyroclastic deposits of which differences are not clear in these criteria, we examined the possibility of the correlation of the Shimokado pyroclastic flow deposit, taking into account the stratigraphy and ages of these pyroclastic deposits.

The results are as follows:

1. Four pyroclastic deposits (Kuwanomaru pfl, Mikaeri tuff, Matsuyama tuff, Ks18 afa) are correlated with Shimokado pyroclastic flow deposit. These pyroclastic deposits are mostly rich in fiber and sponge types of glass shards and in agreement with their stratigraphically horizons.
2. Three pyroclastic flow deposits (Fumoto pfl, Futami B pfl, Koseda pfl) are distinguished from Shimokado pyroclastic flow deposit by the refractive indices of glass shards and phenocrysts.
3. Compared with each K₂O wt% in their volcanic glass shards, Hiwaki pyroclastic flow deposit which was correlated with Shimokado pyroclastic flow deposit by previous study is clearly distinguished from Shimokado pyroclastic deposit. Volcanic glass shards in Hiwaki pyroclastic flow deposit indicate higher K₂O ratio.
4. Ks18 and Ks10 which have been indiscernible are easily distinguished by grain size and variation in the chemical compositions of glass shards and hornblende.