

Tracing provenance of pumice in upper Holocene deposits of Taiwan

MEI-FEI CHU¹, NENG-TI YU², JIUN-YEE YEN³, I-CHIN YEN⁴

¹ Institute of Oceanography, National Taiwan University, Taiwan;
mfchu@ntu.edu.tw

² Center for General Education, National Tsing Hua University,
Taiwan; ntyu@mx.nthu.edu.tw

³ Department of Natural Resources and Environmental Studies,
National Dong Hwa University, Taiwan;
jyyen@gms.ndhu.edu.tw

⁴ YIC Geological Office, Taiwan; ichin.yen@gmail.com

Tsunami, commonly induced by an earthquake and/or siliceous volcanic activity, is an inevitable natural hazard to Taiwan that is located in the western circum-Pacific seismic zone, and between the Ryukyu arc-trench system in the north and the Luzon arc in the south. As a consequence, pumices in upper Holocene deposits (<2000 yrs.) are widely discovered on coastal plains around Taiwan. In this study, their bulk compositions of immobile trace elements, i.e. Ti, Y, Zr, Nb, Yb and Th, are specifically determined to identify their provenances as essential constraints on the associated tsunami events as well as on the tsunami risk assessment in Taiwan.

Pumice samples can be certainly divided by color into two groups, namely black- and white-types. So far, both types are found in N-, W- and E-Taiwan, but only white pumices show on the S-coast. According to the major-elemental concentrations, black type shows peculiar alkaline characteristics (SiO₂: 55 ~ 65 wt.%; Na₂O+K₂O: mainly >9 wt.%; K₂O/Na₂O: 0.65 ~ 0.96). However, our immobile elemental data demonstrate both pumice types belong to the subalkali series that implies strong alteration and/or unique mineral assemblages in black pumices. The comparison of our pumice data with published geochemical databases of the volcanic rocks in the Tatun volcanos, Ryukyu arc, Okinawa trough, and Luzon arc, further suggests (1) black pumices characterized by high Nb/HREE (e.g. Nb/Y >0.2) are possibly from the Okinawa trough or the Luzon arc, and (2) those white pumices with high Zr/Ti (>0.08) are ubiquitous around Taiwan and are from the Okinawa trough. In addition, although (3) the other white pumices, showing relatively lower Zr/Ti (<0.05) and Nb/Y (<0.07), are not found in S Taiwan yet, their immobile elemental abundances are significantly different from volcanics in the Tatun volcanos, Ryukyu arc and Okinawa trough. However, their provenance counterpart cannot be identified due to the deficiency of corresponding volcanic geochemical data in the Luzon arc.