Volcano-tectonic interactions during rapid plate-boundary evolution in the Kyushu region, SW Japan.

Sue H Mahony[1], Laura M Wallace[2], Masaya Miyoshi[3], Pilar Villamor[4], R. Steve J Sparks[1], Toshiaki Hasenaka[5]

[1]University of Bristol, UK, [2]University of Texas at Austin, U.S.A., [3]University of Fukui, Japan, [4]GNS Science, New Zealand, [5]Kumamoto University, Japan

E-mail: Sue.Mahony@bristol.ac.uk

Evolution of the local plate tectonic and volcanic system relationship at Kyushu Island is defined by major changes in tectonics and volcanic style at approximately 15, 10, 6, and 2 Ma.

Plate reconstructions suggest that prior to 15 Ma, the Pacific plate subduction dominated Kyushu tectonics. From 15 to 6 Ma, the evolving relative plate motions shifted the triple junction between the Pacific plate, Philippine Sea plate, and southwest Japan northwards, so that the Philippine Sea plate was subducted beneath Kyushu. From 17 to 10 Ma felsic plutons were formed and high magnesian andesites erupted. This was followed from 10 to 6 Ma by dominantly effusive volcanism and a hiatus in subduction related volcanism. We suggest that this change in volcanic style from 10 to 6 Ma is due to shallow subduction of the young Shikoku Basin lithosphere.

By 6 to 5 Ma, changes in the Philippine Sea plate motion led to more rapid, nearly trench-normal, subduction of the Eocene west Philippine Basin crust beneath Kyushu. This model is supported by an increase in arc-like geochemistry of lavas since approximately 6.5 Ma. Subduction of fluid-rich features such as the Kyushu-Palau ridge introduced large volumes of fluids into the Kyushu arc system, leading to voluminous volcanism across Kyushu, focused particularly in areas where the ridge subduction occurs in tandem with local extensional tectonics, such as the Beppu-Shimabara graben and the Kagoshima graben. These grabens have been the location of 9 caldera forming volcanoes in the last one million years.

Key issues, such as the timing of Izu arc collision with central Japan and the history of motion of the Philippine Sea plate, have been reassessed, resulting in a model that favours Izu arc-central Japan collision at ca. 8 to 6 Ma, rather than the more widely accepted date of ca. 15 Ma.

Only by understanding the long-term interactions between these physical processes can we begin to forecast locations of future volcanic and tectonic activity on a shorter time scale. The ability to forecast on timescales of up to 1 million years is necessary, for example when dealing with the disposal of nuclear waste.