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U–Pb evidence for rapid formation of the Nohi Rhyolite, one of the largest caldera-forming volcanic complexes on Earth

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The Nohi Rhyolite in central Japan consists of voluminous late Cretaceous felsic rocks (ignimbrites, lavas, volcaniclastics, intrusives, etc.) that form a caldera-related volcanic complex, and is thought to have an original volume attaining 5000–7000 km³ [1]. This complex contains some large ignimbrite sheets, with the largest one that has an original volume of more than 2200 km³, roughly equivalent to the Fish Canyon Tuff in North America [2] and the Toba Tuff in Sumatra [3]. Repeated caldera-forming eruptions resulted in the emplacement of huge volumes of erupted materials [4]. Previous K-Ar, Ar-Ar, Rb-Sr, fission-track and CHIME (chemical Th-U-total Pb isochron method) age determinations have led to an interpretation that the volcanic activity is divided into two major episodes [1]; the early episode corresponds to lower two units (Nohi-1 and Nohi-2; 85–80 Ma) and the late episode corresponds to upper four units (Nohi-3 to Nohi-6; 75–68 Ma). However, our new zircon U-Pb dates presented here indicate a much shorter duration of volcanic activity (Figure 1). On the basis of the new results, caldera-forming eruptions in the early episode are interpreted to have occurred between 72 and 70 Ma. At present we have only one age determination for the late episode units (we will have more data at the congress), and the result for Nohi-4 shows a date of about 70 Ma. These new results, together with previous data for the late episode, suggest that the Nohi Rhyolite formed within a few million years, probably 4 Myr or less, at around 70 Ma. If this is correct, then we obtain the average magma production rate of caldera-forming eruptions per unit area for the Nohi Rhyolite, which is estimated as $3\text{--}5 \times 10^{-4} \text{ km}^3/\text{yr}\cdot\text{km}^2$. This estimate is one order of magnitude greater than the previous calculation [5] and similar to the rates for the Yellowstone [6] and San Juan [7] volcanic fields in North America.

References:

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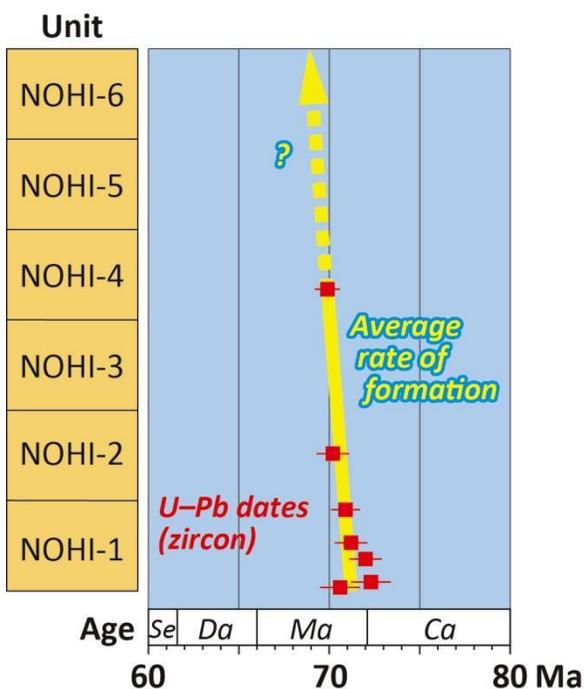


Figure 1: Zircon U-Pb dates of the Nohi Rhyolite (red symbols). Se, Selandian; Da, Danian; Ma,

Maastrichtian; Ca, Campanian.

