



## **Deep seismic reflection profiling across the northern Fossa Magna, central Japan: opening and closure of back-arc basin**

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The northern Fossa Magna (NFM) is a back-arc rift basin produced in the final stages of the opening of the Sea of Japan. It divides the major structure of Japan into two regions, NE and SW Japan. The Itoigawa-Shizuoka Tectonic Line (ISTL) bounds the western part of the northern Fossa Magna and forms an active fault system that displays one of the largest slip rates in the Japanese islands. The eastern rim is bounded by the western boundary fault of the Nagano basin (WNB), which produced the Zenkoji earthquake of 1847 (M7.4). We carried out deep seismic reflection and refraction/wide-angle reflection profiling across the northern part of NFM in order to delineate structures in the crust, and the deep geometry of the active fault systems. The seismic data were acquired using four vibroseis trucks, explosives (4 locations, 100 kg). We further applied refraction tomography analysis to distinguish between previously undifferentiated syn-rift volcanics and pre-rift Mesozoic rock based on P-wave velocity. The 60-km-long velocity profile suggests 6-km-thick Miocene basin fill beneath in the NFM basin. The thick argillaceous basin fill was strongly deformed by compression since the Pliocene. The shortening deformation is marked by fault-related folds and detachment folds. The middle Miocene over pressured mudstone forms detachments within a basin fill. Geologic reconstruction based on the seismic section suggests that the NFM basin was formed by east dipping normal fault systems. Due to reactivation of normal faults as reverse faults, Miocene major normal faults forms seismogenic source faults. Observed tectonic geomorphological features accords well to the subsurface geologic structures with a flat-and-ramp geometry. The deeper extension of the WNB fault is interpreted as the Miocene normal fault dipping 40 degrees.