Late Cenozoic structure and evolution of fold and thrust belts, Off-Joetsu and Northern Fossa Magna, central Japan

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Northern Fossa Magna basin is an active inverted-rift-basin located in the junction between NE and SW Japan arcs. Due to folded thick sediments, the relationship between geological structure and source fault is poorly understood. Thus, we constructed the kinematic model of the formation of the geological structure in this area. By compilation of surface geology, drill hole data, seismic reflection and refraction profiles, gravity anomaly data, we created five geological sections covering the study area and constructed a geological structure model. The structure was examined using balanced cross section analysis. Constructed 3D geological model successfully explains the formation processes of fault-related folds. We identified two major faults, marginal part and central part of the rift basin. The lower crust of the rift basin shows larger P-wave velocity parallel to the rift axis, forming a rift pillow and suggesting the large intrusion of mafic rock during the rifting (Sato, 2013). The estimated main faults correspond to the boundary between continental crust and mafic dominant part. Major faults branch into four faults systems in the basin fill. The thrust systems show a ramp-and-flat geometry, wedge-thrust, pop-up structure and frontal migration of thrusting.
By the thrusting of the east-dipping fault beneath the central uplift zone, the shortening deformation accommodated along the Shiundani and Myoko fault systems. Subsequently, the Nishikubiki fault system has moved associated with frontal migration of thrusting to the NW-direction. Wedge-thrusting has prevailed along the western margin of the central uplifted zone. Total amount of shortening, estimated by balanced geological cross sections, is about 35 km and horizontal rate of shortening since 3.5 Ma is estimated as 10 mm/yr.

Keywords: Fault-related-fold, Northern Fossa Magna, Balanced cross section, Failed rift basin, Kinematic model of the formation of the geological structure

