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新潟県北部，中新世リフト形成期のファンデルタ堆積物とそのインバージョン期の変形

Fan delta system during Miocene rifting and its deformation under inversion tectonics, northern Niigata, central Japan

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SUMMARY

Surface mapping, sedimentary facies analysis and fault rock analysis on the late Early - early Middle Miocene clastic rocks in northern Niigata, central Japan, have revealed that (1) fan delta systems, rich in deposits of debris flow and its related processes, are prominent along a rift border fault that was active ca. 17-16 Ma; (2) folds as a consequence of reactivation of the rift border fault are segmented by a rift-normal (E-W) fault whose latest activity is right-lateral strike -slip. One of the folds developed possibly with a footwall shortcut fault that uplifted blocks of the basement granitoids which are now the Kushigatayama Range.

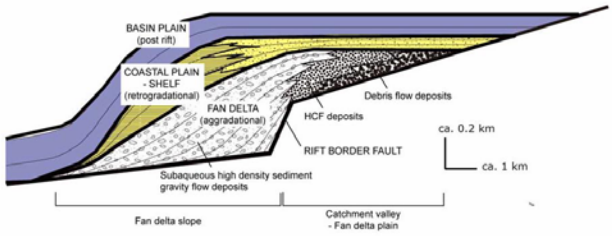

Fig. 1 Model for Miocene fan delta system in Hozakayama - Nakamaruke area, northern Niigata

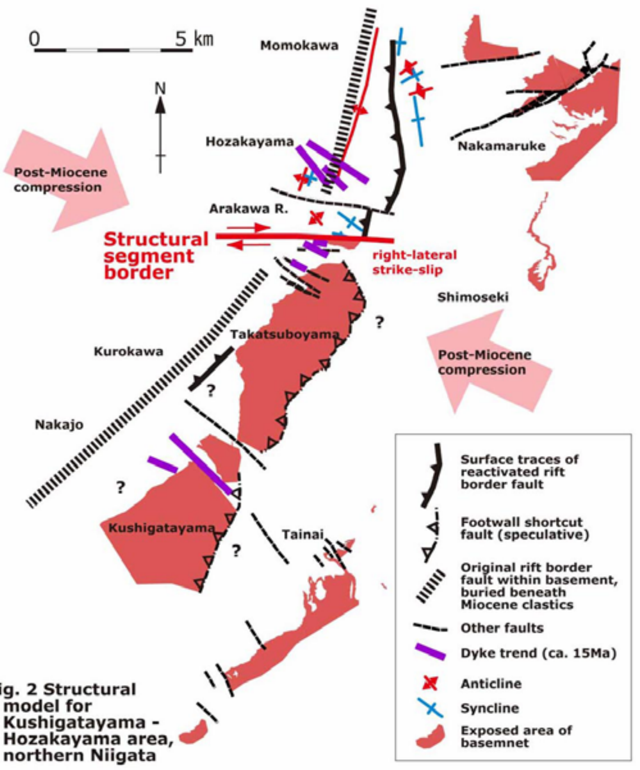

Fig. 2 Structural model for Kushigatayama - Hozakayama area, northern Niigata

STRATIGRAPHY AND AGE

The present study investigated the Kamagui Formation in Shibata, Tainai, Sekikawa and Murakami that consists of conglomerate, sandstone, siltstone and tuff. This formation at the base of the Miocene clastic succession shows considerable lateral variation in lithology and thickness in a short distance. The age range of the formation, even of the gravelly part at its base, falls within 16.9-

14.7 Ma according to dinoflagellate cyst assemblages (Kurita and Ishikawa, 2009; 2010).

FACIES AND DEPOSITIONAL SYSTEMS (Fig. 1)

We recognized eight facies associations (FA). FA1-FA4 are characterized by very poorly-sorted clastic breccia, basically matrix-supported, structureless and with frequent outsized-clasts. They are interpreted as deposits mainly from debris flow, hyperconcentrated flow and their associated sediment gravity flow, forming subaerial catchment valley fill - fan delta plain and subaqueous fan delta front. Other four facies associations consist of deposits from stream flow and suspended load, under the environments of braided river, coastal plain-shelf, estuary and basin plain.

FAULT ROCK ANALYSIS

Analysis of four outcrops of fault rocks that border the Miocene sediments and the basement showed combination of thick cataclasite and gauge. This implies long-term activity whose origin may date back to pre-Miocene. Such case is conspicuous at a E-W trend fault at an outcrop along the Arakawa River, where the latest, post-Miocene kinematics is right-lateral strike-slip.

DEVELOPMENT OF DEPOSITIONAL SYSTEMS

The early phase of the Miocene clastic deposition in this area is the buildup of a series of fan deltas along a major linear geomorphological break which is probably a highly active rift border fault of the N-S trend. Trends of rift-normal (E-W) faults functioned as paths of sediment load from the footwall uplands. The fan deltas are characterized by aggradational stacking of coarse-grained clastics and have a fan area of 52-33 square kilometers each that requires source area in the footwall uplands at least 10-15 km wide. They turned eventually into a retrogradational coastal plain ? shelf system probably in response to decline of the fault activity and acceleration of the basin-wide thermal subsidence. The final phase is the deposition of blanketing deep sea mudstone under a basin plain environment.

POST-MIOCENE DEFORMATION (Fig. 2)

Map-scale geologic structures in the study area is characterized by a N-S trend anticline in the northern part and by an uplifted basement block in the south. Judging from the thickening of the Kamagui Formation in the western flank of the anticline as well as from a N-S trend fault with a zone of high-angle dips of sediments in the eastern flank, the anticline was formed as a consequence of reactivation of the rift border fault under the post-Miocene inversion tectonics (Okamura et al., 1995). In our speculative view, the fault reactivation in the southern part may have incorporated a footwall shortcut fault (Cooper et al., 1989) that should have sliced and uplifted the basement which is now the Kushigatayama Range. These two areas are bordered by the E-W trend, right-lateral strike-slip fault along the Arakawa River which thus would have divided structural segments.

キーワード:ファンデルタ,堆積相解析,インバージョン構造,新潟堆積盆地,中新世

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