# Evaluation of micro-fabric network within marine sediments based on a rock magnetic technique and its tectonic implications

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Magnetic techniques that use anisotropy of magnetic susceptibility (AMS) act as a proxy of preferred permeable orientation in basin-filling sediments, when it is applied on samples impregnated with a finely-ground magnetic suspension. The unique method for quantifying heterogeneity in rocks is reviewed and its value for reconstruction of the preferred direction of pore fluid flow is reassessed critically. The authors also present results of their experiments, which dealt with secondary fracture networks developed in tight sandstones burying a foreland basin on an arc-arc collision zone in central Hokkaido. Micro-focus three-dimensional density imaging of test pieces of the Miocene Kawabata Formation has shown a substantial variation in pore fabric reflecting inhomogeneous impregnation of magnetic fluid within rocks. Directional analysis of AMS ellipsoid implies tectonic control on rupture development under strong trans-compressive regime.

Keywords: permeability, magnetic susceptibility, anisotropy, sedimentary basin, fracture, tectonics

 

# Tectonics of southern Osaka Plain based on dislocation modeling and subsurface data

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The Osaka basin is surrounded by E-W trending strike slip faults and N-S trending reverse faults. The N-S trending 42-km-long Uemachi faults traverse in the central part of the Osaka city. The Ministry of Education, Culture, Sports, Science and Technology started the project to survey the Uemachi faults from 2009 to 2012 for countermeasures against earthquake disaster.
The various geological, geophysical surveys, such as seismic reflection, micro tremor, gravity surveys and deep boreholes, revealed the complex basement configuration along the Uemachi faults. The survey results revealed not only the detail subsurface structure of the Uemachi fault, but also E-W trend structure. Sugiyama and Imanishi (2015) explained the E-W trending structure caused by deep-seated fluids.
In the south part of the plain, there were difference between the depth of the basement, estimated by gravity analysis and seismic reflection surveys (Osaka Prefecture, 2005; Inoue et al., 2014). This suggests the density of the sediment or the basement of the north and the south part of the plain differs. The difference is considered as the variation of density contrast due to some local distribution of the volcanic rocks. The magnetic anomaly indicates higher value at these points. The density structure was discussed from the gravity anomaly in consideration of the high magnetic anomaly area (Itoh et al., 2012).
Kusumoto et al. (2001) reported that surrounding faults enable to form the similar basement relief without the Uemachi faults model based on a dislocation model. Inoue et al. (2013) performed various parameter studies for dislocation model based on Kusumoto et al. (2001). The model was consisted 11 faults, the Rokko-Awaji, ATL, MTL, Ikoma, Eastern Nara, Osaka-wan, Kongo, the North and South Uemachi faults and, Sakuragawa and Suminoe flextures. The dislocation was calculated based on the Okada et al. (1985). The results show the similar basement displacement pattern to the actual basement configuration.
In this presentation, the dislocation simulation with surrounding faults and other source suggested by Sugiyama and Imanishi (2015) will be performed and the comparison with inversion results of gravity anomaly and dislocation model will be shown.
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Keywords: Osaka Basin, Dislocation model, Potential Data

 

# Outline of basin formation tectonics in the NE and SW Japan Arcs since the opening of the Sea of Japan

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Basin formation tectonics along convergent margins may vary according to the variation in characteristics of plates and their styles of subduction. In this presentation, basin formation tectonics in the NE and SW Japan Arcs since the opening of the Sea of Japan will be compared. Tectonic Stages in both the NE and SW Japan Arcs are roughly divided into the rifting stage and the post-rifting stage. Early rifting sub-stage in the rifting stage commenced at Eocene and was characterized by formation of small rift basins associated with volcanism along the present Sea of Japan coasts in both the NE and SW Japan Arcs. Regional unconformity was formed in both the NE and SW Japan Arcs in Late Oligocene, which suggests a common tectonic setting between the NE and SW Japan Arcs. During the syn-rifting sub-stage in Early Miocene, regional transgression commenced simultaneously in back arc regions of the NE and SW Japan Arcs at 18 Ma. While large rift basins were restricted along the Sea of Japan coast of the SW Japan Arc, deep rift basins were formed in the present backbone range of the NE Japan Arc.
Rifting terminated at 15 Ma in the SW Japan Arc with regional uplift and emergence, which were followed by extraordinary volcanism such as fore-arc volcanism and high-Mg andesite activities in Setouchi region. In contrast, back arc region of the NE Japan Arc subsided to have been deep basins. Rifting associated with subsidence and volcanism had continued in the backbone basins in the NE Japan Arc until 13.5 Ma. This notable difference in tectonics between the NE Japan and SW Japan Arcs was succeeded during the post-rifting stage. While most of the SW Japan Arc remained emerged without intense basin formation by Pliocene, the NE Japan Arc had experienced intermittent uplift and unconformity events and had gradually been emerged since Late Miocene.
Conventional plate reconstruction models commonly assumed that the Pacific Plate had subducted to both the NE and SW Japan Arcs in the early rifting sub-stage and that the young Shikoku Basin in the Philippine Sea Plate replaced the Pacific Plate and subducted to the SW Japan Arc by sometime either during the syn-rifting sub-stage or during the post-rifting stage. Differences in basin formation tectonics between the NE and SW Japan Arcs after the late syn-rifting sub-stage can be attributed to differences in characteristics of subducting plates, in the styles of back arc rifting reflecting complex basin formation processes in the Sea of Japan, and in the styles of drifting of the NE and SW Japan Arcs.

Keywords: basin formation tectonics, NE Japan Arc, SW Japan Arc, rifting stage, post-rifting stage, opening of the Sea of Japan

 

# Forearc and backarc basin-filling stratigraphy as an archive of plate tectonic history

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Basin-filling stratigraphy can be defined as “the study of basin-filling sediments from the standpoints of unconformity events, stress regimes, succession trends and three-dimensional development patterns of depositional systems with consideration of their controlling factors such as plate tectonic conditions.” The basic unit of basin filling stratigraphy can be a tectono-sequence unit, which can be bounded by regional major unconformities, or the turning points of stress regimes, basin evolution stages and succession trends of depositional systems such as upward shallowing and deepening trajectories. This paper presents representative cases of basin-filling stratigraphy for forearc basins and backarc to intraarc basins, which might be reflecting the plate tectonic histories, using examples of the NE and SW Japan convergent margins.
The basin filling stratigraphy of forearc basins is strongly controlled by the morphological variation and volcanic arc setting, both of which influence internal unconformity formation, sediment supply, differences in depositional systems and succession trends. The marine sloped to submerged ridge type is mainly filled with deep marine turbidites or shales. The terraced to shelved, overfilled type commonly shows a transgressive to regressive pattern consisting of turbidite, slope, shelf to shallow marine systems in response to the increase of clastic supply from the adjacent volcanic arc. Internal deformation of basin filling sediments is quite common in case the forearc setting is compressional. The benched type, which has an emergent trench slope break ridge, characteristically shows a regressive succession from marine to fluvial systems, or thick aggradation of bay to coal-bearing fluvial systems. If the forearc setting maintained for a geologically long time, it is estimated that the morphological forearc basin types can be transferred from the submarine sloped, submerged ridge type to the shelved, benched types, as the trench slope break ridge tends to develop along with the accretionary prism development due to plate subduction.
The basin filling stratigraphy of backarc to intraarc basins is commonly characterized by the basin evolution stages, since backarc/intraarc basins are, in most cases, initiated as rift basins, and followed by tectonic inversion into a compressional stress field. The boundary between syn-rift and post rift stages tends to show a regional break-up unconformity, and the inversion stage creates areal uplift-related unconformities. The mass balance between the accommodation space created by subsidence and sedimentation may control the succession trends for the syn-rift, post rift and tectonic inversion stages. The syn-rift to early post rift stage usually shows a transgressive upward-deepening succession trend, whereas the tectonic inversion stage causes an upward-shallowing trend due to increasing sediment supply from the provenance.

Keywords: basin filling stratigraphy, forearc basin, backarc basin, plate tectonics, succession trend, unconformity event

 

# Integrated Research for Quaternary Sedimentary Basin in Southwest Japan from the viewpoint of Deep drilling data and Seismic interpretation

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Research on Quaternary Sedimentary basins in southwest Japan have been developed with accordance of research on paleogeography and tectonic development. Most of distribution area of Quaternary sedimentary basins such as Osaka Bay and Lake Biwa etc. is covered by aquatic or alluvial area, and it is difficult to make clear the stratigraphy and structure of sequence by using the usual geological technique at outcrops. Most adequate methods are drilling and geophysical prospecting such as seismic reflection surveys. I introduce the Quaternary basin formation history in Southwest Japan using the drilling data and geophysical data from Osaka sedimentary basin, Lake Biwa basin, Kyoto basin and Beppu bay basin during 40 years.Osaka sedimentary basin was constructed by the combination of activity of right lateral strike slip movement of Median Tectonic Line and Arima-Takatsuki Tectonic Line, and reverse faults of North-South direction, and has precise subsurface structure in the basin revealed by the distribution of Marine clays deposited under transgression of about 100,000 years cycles. Lake Biwa basin had been influenced by reversed fault activity located at western part of basin and northward migration activity. Kyoto basin was constructed by the activity of two reverse fault activity. Beppu Bay had been influenced by the transcurrent movement of Median Tectonic Line and normal fault activity at the termination of strong strike slip movement.In conclusion, time series of movement of Philippine Sea Plate subduction and activity of Median Tectonic Line at forarc region have played an important role for formation of Quaternary basins in southwest Japan.

Keywords: Quaternary sedimentary basin, Core stratigraphy, Seismic interpretation

 