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.
This research is partly funded by the Comprehensive Research on the Uemachi Fault Zone (from FY2010 to FY2012) by The Ministry of Education, Culture, Sports, Science and Technology (MEXT).

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

Paleomagnetic study of Neogene sediments in strike-slip basins along the Tanakura Fault

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The Tanakura Fault, one of the major tectonic line in Japan, is developed from the Tanagura Town, Fukushima Pref. to the Hitachiohta City, Ibaraki Pref., with a NNW-SSE trending direction. They consist of the Eastern Marginal Fault, the Western Marginal Fault and a shear zone between the faults. The movement of the Tanakura Fault is thought to be related to the Japan Sea opening during the Early to Middle Miocene (e.g., Jolivet and Tamaki, 1992). Geologic studies have revealed that strike-slip basins were developed due to a left lateral movement of the Tanakura Fault (e.g. Amano, 1991). This study aims to refine the chronostratigraphy of geologic sequences of strike-slip basins developed along the Tanakuura Fault, and to reconstruct a tectonic history of the basin based on paleomagnetic analyses.

Samples for paleomagnetic analyses were collected from the Yajika Rhyorite, Kitatage Formation, Kitatage Formation, Osawaguchi Tuff Member and the Nawashiroda Formation in the Yamatsuri, Western Daigo, Eastern Daigo and Yamagata Basin.

As the results of paleomagnetic analyses, the Kitatage Formation, Osawaguchi Tuff Member, Asakawa Formation and Nantaisan Volcanic Breccia exhibit non-rotating reversed polarity supposed to be correlated to the Chron C5Br (ca. 16.04-15.2 Ma). On the other hand, the Nawashiroda Formation exhibits reversed and normal polarities correlated to the Chrons C5Br, C5Bn, C5ADr (ca.15.2~14.6 Ma) , which associated with a clockwise rotation ca. 20°, suggesting that a counterclockwise rotation ca. -20° is needed to be at this area before deposition of the Nawashiroda Formation.

Keywords: The Tanakura Fault, strike-slip basin, Japan Sea opening, Middle Miocene, paleomagnetic study

Paleomagnetism of the Sorachi and Yezo Group in the Ashibetsu area, central Hokkaido, Japan.

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Paleomagnetic study was performed on Upper Jurrasic~Lower Cretaceous Sorachi Group and Yezo Group in Ashibetsu area, central Hokkaido aiming at quantitative estimation of tectonic movements in reference to the northeastern Eurasia. Characteristic remanent magnetization (ChRM), which is carried by various ferromagnetic minerals, was isolated for five sites. To determine their origin, we executed isothermal remanent magnetization (IRM) experiments, and origin of ChRM is categorized into two groups. One of them is positive in reversal test, and enhanced precision parameter after tilt correction implied pre-folding origin. Untilted formation mean direction (D=-12.0°, I=47.7°, α_{95}=12.3°) is characterrized by significantly shallower inclination than the expected value for coeval mother continent, and northward movement since the Cretaceous is determined to be 2100 km (±1500 km). In comparison with previous paleomagnetic studies and tectonic models, central Hokkaido could consist of at least two components and have experienced rapid northward movement driven by plate motion.

Keywords: Paleomagnetism, Hokkaido, Cretaceous

Tectonic Basin Structure in Kansai Area on the point of subsurface structure using borehole database

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Kansai Geo-informatics Research committee started to study about subsurface structure around Kansai Area after the1995 Kobe Earthquake. This committee also carried out the standard borehole survey at the each area and tried to resolve the relation between geological properties and geotechnical properties. The results of this mission were published “Shin-Kansaijiban” series. We are considered each borehole data using geological information such as tephra, microfossils, sedimental environment and so on, and referred to the seismic reflection survey.

The results of this study make clear the tectonic movement of each area. In Osaka area marine clay layers show the tilting toward to the Ikoma Fault. Other area also find these sign of tectonic movement from the subsurface borehole data.

Keywords: borehole, database, tectonic movement, sedimentary environment

Why arc-shaped archipelago was formed ? How concave plate basin was built ? All origin of plate tectonics, was solved by unique hypothesis.

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Origin of plate tectonics, was solved by unique physically meaningful hypothesis.
Even people who stubbornly resist the continental drift theory of Wegener, neither the driving force is unknown, was no people who oppose to adopting a plate tectonics.As the driving force, Mantle Convection Hypothesis of Holms 1929, springing up and coming force to press the plate in the ridge, the power to pull the plate to crawl into the mantle.
Hard plate flowable layer asthenosphere under the lithosphere and assume a rigid a mesosphere under it the plates to move the surface of the earth without parallel deformed like a rigid body,he ashumed.Mantle is springing up from the hot spot, there is the fact that parallel seamount chains has been formed. And it has also been observed that the driving direction is bent. I believe that is happening is mantle convection in the difference of basically any driving force is also density.Problem lithosphere of the same density, can not be proposed first to crawl under the other two mechanical rhythm.In addition, not be able to propose mechanisms and reasons for moving direction was bent.
Multi impact hypothesis, following (A)·a hypothetical two steps (B), as a result (1) - (15).
(A)Protoplanetary CERRA the orbit has been flattened by the Jupiter perturbations, was ruptured in the tension of Jupiter and the sun.
(B)The cross-sectional mantle lobe is for the track that crosses the Earth, caused the sequential Mantle Impact.
Results (1)Injecting a month in the collision to the first of the Pacific Ocean position (12.4km / s, 36.5 deg.), and the trajectory of the month was calculated to be 60RE.
(2)Why? Is formed in almost the same orbital plane moon and the solar system, how the moon was formed only in the mantle? Because collision of the mantle piece.
(3)Meteorite in minute fossil quality achondrites-iron meteorite, which is why a mixed? Cause is Multi Impact.
(4)In the tidal disruption of CERRA, the asteroid belt has been formed energy . Is Kyusetsu is an error that was not accustomed to substantially equal to the planet in the long axis length..
(5)Caused a large species extinction in the collision over a few degrees. It is an inevitable collision mechanism that does not rely on chance.
*(6)By the collision of a plurality of cross-sectional mantle lobes, also 70 p/c of the Earth surface area of the size of the deep sea Yosoko (-5km) has been formed.
*(7)Plate tectonics of the Plate boundary Why was formed in that position? Collision mantle peeling, vacuum melting and cracking.
*(8)Pacific Rim arc-shaped archipelago and back-arc basin, and Darwin raised by the collision loss and isostatic, plate is concave in the mantle reduced pressure.
*(9)Was to elucidate the mystery of the origin and driving force of plate tectonics. Driving force = complement of the moment of inertia eccentric due to the collision.
*(10)To back-arc plate, and Pacific Ocean convex plate each other press in the eccentric moment driving force, starts submarining by isostasy.
*(11)Why form kimberlite pipe in South Africa Premier and Russian Mirunui district? Concentration and continental drift to Hawaii position to the collision and the impact of the counter electrode, and collision on the opposite side of the Drake Passage of Mirunui mine, Antarctica moved

stabilized.
*(12)Why is earth's axis was tilted 23 deg from the revolution surface? Was estimated to collision of CERRA division pieces to the Drake (high latitude) position.
*(13)Why, the core of the Earth eccentricity (about 10 %) happened or? CERRA debris collision, Earth's mantle is missing, isostasy.
(14)Jupiter large red origin of plaques? Form a thermal conductivity difference soliton in the collision of MI mantle piece .cf. Shoemaker Levy comet.
(15)To outer planet is a gas-ice, or Pluto's is why silicate dwarf planet? In CERRA Mantle debris of the swing-by.

Keywords: Formation of the arc-shaped archipelago, Formation of a concave plate basin, Origin of plate tectonics, Multi-Iimpact Hypothesis, The origin of the deep sea floor, Lunar origin