Uplift and denudation history of the Akaishi Range based on low-temperature thermochronology and thermo-kinematic model

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The Akaisahi Range is a thrust block distributed in the collision zone between the Izu-Bonin and Honshu arcs, as well as the collision zone between the NE and SW Japan arcs. Thus, elucidation of uplift process and mechanism of the Akaishi Range can be a key to understand tectonics in and around arc-arc collision zones. We carried out thermo-kinematic modeling based on thermochronometric ages across the northern Akaishi Range for revealing: 1) relations between uplift of the northern Akaishi Range and activity of the Itoigawa-Shizuoka Tectonic Line fault zone (ISTL-FZ), 2) subsurface geometry and slip rate of ISTL-FZ, and 3) uplift and denudation history of the northern Akaishi Range.
The age data were reported by Sueoka et al. (2012, abst. AGU); apatite fission-track (AFT), zircon (U-Th)/He (ZHe), zircon fission-track (ZFT), and zircon U-Pb ages were obtained. AFT, ZHe, and ZFT ages generally decrease to the east, suggesting a westerly tilted uplift of the range. The youngest AFT and ZHe ages of ~3 Ma agree with onset of the uplift at ~3.3 Ma which was estimated from deposition age of the Akebono Conglomerate (Kano, 2002). The youngest ages were obtained at the western side of the Hakushu and Ho-osan faults (HHFs). Thus, thrusting of HHFs is thought to be the primary factor of the northern Akaishi Range uplift. In contrast, to the east of HHFs, no ages were significantly younger than the granitic formation age at ~16 Ma, then the total denudation since ~16 Ma is 2-3 km or less. The Ichinose and Shimotsuburai faults to the east of HHFs might be formed later than onset of the uplift due to migration of thrust front (Tajikara, 2002).
Thermo-kinematic calculations were conducted to verify if uplift of the northern Akaishi Range is attributable to thrusting of HHFs. We computed theoretical ages resulted from given tectonic scenarios to compare with the observed ages. HHFs were simplified to be a flat-ramp thrust composed of two rectangular fault plains. The calculation results suggest that the age pattern observed can be explained by 5–10 mm/yr reverse slip on HHFs that dip 27–45° west and sole onto detachment at a 20–25 km depth. The bedrock uplift rate was estimated at ~4 mm/yr from the slip rate and dip. The denudation rate was also inferred at ~4 mm/yr assuming a steady-state condition of bedrock uplift and denudation; this assumption seems adequate as the denudation rate is comparable with the shorter-term denudation rates obtained by cosmogenic nuclides methods (Korup et al., 2014) and sediment volumes of catchments (Fujiwara et al., 1999). The estimated fault parameters are also consistent with previously reported data, e.g., reverse slip rate of ISTL-FZ estimated from deformation of fluvial terraces (Ikeda et al., 2009), dip of ISTL-FZ obtained by seismic array observations (Panayotopoulos et al., 2010), and the lower limit of the seismic layer in this region (e.g., Asano et al., 2010). Consequently, uplift of the northern Akaishi Range is attributable to thrusting of HHFs since ~3.3 Ma.
Taking into account the results above, the uplift and denudation style of the northern Akaishi Range is well explained as a simple tilted thrust block model of Sueoka et al. (2012); due to tilted uplift derived from faulting on one side of the mountain, the mountain presents asymmetric topographic cross-sections as well as bedrock uplift and denudation rates increasing toward the fault side. However, considering both the difference in apatite FT age (Yamagiwa, 1998MS) and active fault distribution, the northern and southern Akaishi Range might be different in origin and timing of uplift. The inferred total denudation is larger than several km and likely exceeds 10 km since the onset of the northern Akaishi Range uplift,

suggesting that the low-relief surfaces on the ridges and relatively constant elevations of the summits reflect post-uplift denudation rather than pre-existing low-relief landforms.

Keywords: Akaishi Range, Itoigawa-Shizuoka Tectonic Line fault zone, low-temperature thermochronology, thermo-kinematic modeling, arc-arc collision zone

Geochemical characteristics of Miocene volcanic rocks in “Nagura Basalt formation”

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14 samples of the basaltic volcanic rocks collected from the "Nagura Basalt Formation" were analyzed. "Nagura Basalt Formation" is composed by Miocene basaltic-andesitic tuff and lava, pyroclastic sediments and it is distributed in the northern Tanzawa-Mountains, (hereinafter referred to as Nagura basalt). Nagura basalt was compared with the chemical composition of the Miocene volcanic rocks distributed in the northern Tanzawa-Mountains (Hinate andesite, Oshima basic intrusive), and the Quaternary Izu - Ogasawara arc, Northeast-Japan arc volcanic rocks.

As a result, Nagura basalt is classified as low K, tholeiitic series like the current Izu-Bonin arc and Hinate andesite, Oshima basic intrusive, and it has a different chemical composition from the volcanic rocks of the Northeast Japan arc, and it also found that it has high FeO*/MgO ratio to the volcanic rocks of Izu Bonin arc and Hinate andesite, Oshima basic intrusive.

It is inferred that the tectonic environment at the time of the eruption of Nagura basalt was under the compressive crustal condition compared to the Quaternary volcanic rocks of the Izu- Bonin arc and Hinate andesite, Oshima basic intrusive.

Keywords: Basalt, chemical composition, Izu-Bonin arc

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

Geotectonic evolution in and around Toyama Trough, Japan Sea

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This paper re-analyzed the geologic structure and its development along the eastern margin of Japan Sea, involving the southeastern Japan Basin, the eastern Yamato Basin and Toyama Trough, based on the recent data sets of seismic investigations for resource-exploring and earthquake disaster prevention. The obtained results corroborate a two-stage model of the back-arc spreading with large shear zone in a north-south trend along the eastern border of Japan Basin and Yamato Basin. The new findings were as follows:
1) Regional geologic structure became clear, including the present-day active faults and the suspended Miocene faults in the back-arc region of Honshu arc.
2) The N-S striking faults, one of three fault trends observed in the present Toyama Trough, was traced northerly up to the eastern termination of Yamato Basin.
3) The Toyama Trough shear zone had been spread out with being accompanied by left-lateral strike-slip faulting in a NW-SE trend.
4) As for neotectonics in central Japan, the shift to a convergent regime from a divergent one in the Japan Sea was quite revolutionary. Such a conversion was different in style and time: E-W trending thrust/fold structure in the Late Miocene on SWJ side, probably due to the commencement of subduction of Philippine Sea Plate. The NE-SW trending fault/fold structure characterizing NEJ side is further delayed to become conspicuous after 4Ma, probably due to commencement of eastward motion of Amur Plate.
5) The Present strain concentration belt in Honshu extends along the Japan Sea side on NEJ side through inland on SWJ side, intersecting with the Itoigawa-Shizuoka tectonic line. Its manifestation in the late Quaternary period could be called as "revival Honshu arc" as a behavior of coalesce of the two island arcs, NEJ and SWJ, concerning the interaction of the subducting Pacific Plate with the hanging two plates.

Keywords: Japan Sea, Toyama Trough, Amur Plate, neotectonics, tectonic inversion

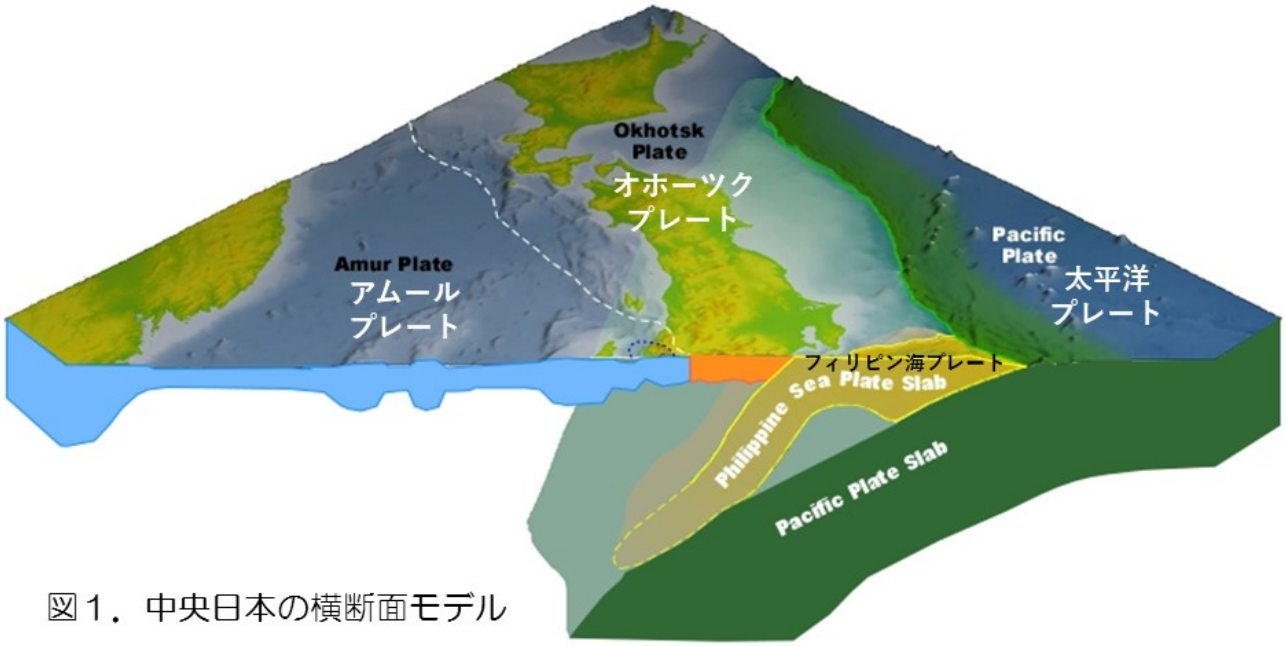

図１．中央日本の横断面モデル

Stratigraphy and geological structure of Goto Group in the Narujima Island, Goto Islands, Nagasaki Prefecture, West Japan

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The Narushima Island, central part of Goto Islands, contains early Middle Miocene Goto Group with several intrusion and 2 type deformations. Goto Group is sediment of expansion time of Japan sea. In the Narushima Island, There may be the evidence of the times change of the lift zone. This study settles a geological feature of the Narushima Island as a stage before finding out the evidence. In this study area strikes NW in the south part and NE in the north part and dips 0-60˚N. Northern area is well preserved drag fold which down to northwest (Type1). Northwest to southeast faults are well exposed 3 places with brecca zone (Type2). The Narushima Island is divided into 4 blocks by NNW-SSE trend extensional strike-slip fault with thick brecciated zone.
Stratigraphy of this sequence is divided 3 formations in ascending order, as follows: A formation (40m thick) is characterized by alternating beds of pyroclastic rock and tuffaceous sandstone. Pyroclastic rock in A formation contains 1-3 cm elongated lapilli oriented with their long axes parallel to bedding. B formation (350m thick) is composed of mudstone-dominant alternating beds of sandstone and mudstone, and subdivided 3 members. Lower Member (90m thick) is characterized by mudstone-dominant alternating beds of sandstone and mudstone, Middle Member (140m thick) by sandstone-dominant alternating beds sandstone and mudstone, and Upper Member (110m thick) by mudstone-dominant alternating beds of sandstone and mudstone. Sandstones of B formation exhibit a variety of depositional structures. Sandstones of Lower Member are normally graded and of Middle Member sometimes show internally climbing ripple lamination and trough and planar cross bedding. Fossils of mud snails occur in Middle Member. C formation (500m + thick) consists of thick sandstone and thin mudstone. Sandstone of C formation exhibits internally thick cross bedding.
It is thought that pyroclastic rocks of A formation are deposited as volcanogenic mud flow sediments, normal graded sandstones of the B formation are turbidity current deposits, and thick sandstones which exhibit cross bedding in the C formation are sediments near estuary. And In B formation, limnetic fossils occur. Therefore this stratigraphic change indicates rifted volcanic event, lake sediment and river-delta sequence at the rift zone of Japan sea. Type 1 deformation may be related by opening face of Japan sea. Northwest to southeast trend Type 2 deformation might be related rifting of north Okinawa Trough.

Secular change in provenance of Early Cretaceous Japan arc: detrital zircon geochronology of fore-arc sandstones

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The orogenic edifice of the Cretaceous Japan arc-trench system is relatively well preserved, particularly with the Ryoke granite belt (magmatic arc) and Sanbagawa blueschist belt (deeper Wadati-Benioff zone). For reconstructing the distributary pattern of terrigenous clastics within the ancient arc-trench system, U-Pb dating of detrital zircon is effective; e.g., the differentiation of fore-arc, intra-arc, and back-arc basins was demonstrated clearly (Nakahata et al., 2015, 2016a, 2016b). This study further investigated detrital zircon chronology of the latest Jurassic-Early Cretaceous sandstones in SW Japan, for constraining the onset of sedimentation in major arc-related basins and their differentiation. The result shows that late Paleozoic to mid-Mesozoic granitoids, particularly early Jurassic one, exposed in the Late Jurassic to Early Cretaceous Japan arc to feed fore-arc basins, although these older granitoids are extremely rare in Japan at present and that continent-derived or recycled Proterozoic clastics, mostly from North and South China blocks, were supplied steadily to the fore-arc domain until the Hauterivian (E. Cretaceous), but were almost totally shut down after the Barremian. This likely reflected the emergence of a major topographic relief within the arc that behaved as a significant barrier to prohibit continental sediment flux to the fore-arc domain. The intensified arc magmatism during the Cretaceous likely emplaced a large volume of new arc-granitoids to form a batholith belt in deeper crust and to uplift older crustal rocks on the surface.

Keywords: Creataceous, arc-trench system, detrital zircon, U-Pb age, SW Japan, provenance

Miocene clockwise rotation of Southwest Japan: a review

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Southwest Japan and Northeast Japan rotated clockwise and counterclockwise, respectively, during Miocene major opening of Japan Sea backarc basins. A kinematic model proposed in the middle of the 1980’s suggests that the differential rotation of the two island arc slivers occurred simultaneously, within only ~1–2 million years, at ~15 Ma, and this view still exerts a strong influence on the geotectonic study of the Japanese islands. I will review paleomagnetic and geochronological data published for Southwest Japan during the last quarter century and try to revise the timing and amount of the clockwise rotation. An important conclusion is that the clockwise rotation occurred between 18 and 16 Ma. The amount of the rotation relative to the tectonically stable part of the Asian continent is estimated to be 41.7 ±5.4°, which is based on the assumption that the main part of Southwest Japan rotated as an essentially rigid block.

Keywords: Japan Sea opening, Miocene, paleomagnetism, rotation, Southwest Japan

Release of Seamless Digital Geological Map of Japan (1:200,000) V2

*Makoto Saito[1], Yoshiharu Nishioka[1], Kiyohide Mizuno[1], Kazuhiro Miyazaki[1], Yoshihiro Ishizuka[1], Takashi Kudo[1], Yasuyuki Banno[1], Shinji Takarada[1], Takayuki Uchino[1]

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Wakita et al. released the Seamless Digital Geological Map of Japan (1:200,000) national version at 2006. The legend of the geological map is based on the Geological Map of Japan (1:1,000,000) ver.3 (Geological Survey of Japan, 1992). A number of the legend is 194 at normal version and 386 at detail version.
Authors took control making a new legend by modern geological knowledge and compiling the Seamless Digital Geological Map of Japan (1:200,000) V2 and released it at May 10th (Geology Day in Japan) this year.
This quite newly compiled map is the product of merged 1:200,000 geologic quadrangle maps covering the entire country of Japan based on the new legend.
The new legend is divided into 2500 legends in combination the ages and the kinds of rocks and rock facies.
Because this new legend is structured, the user can make a legend of the briefer division easily.

Keywords: geological map, digital, seamless

The new tectonic division of basin in Eastern Shandong and its ajacent South Yellow Sea, China

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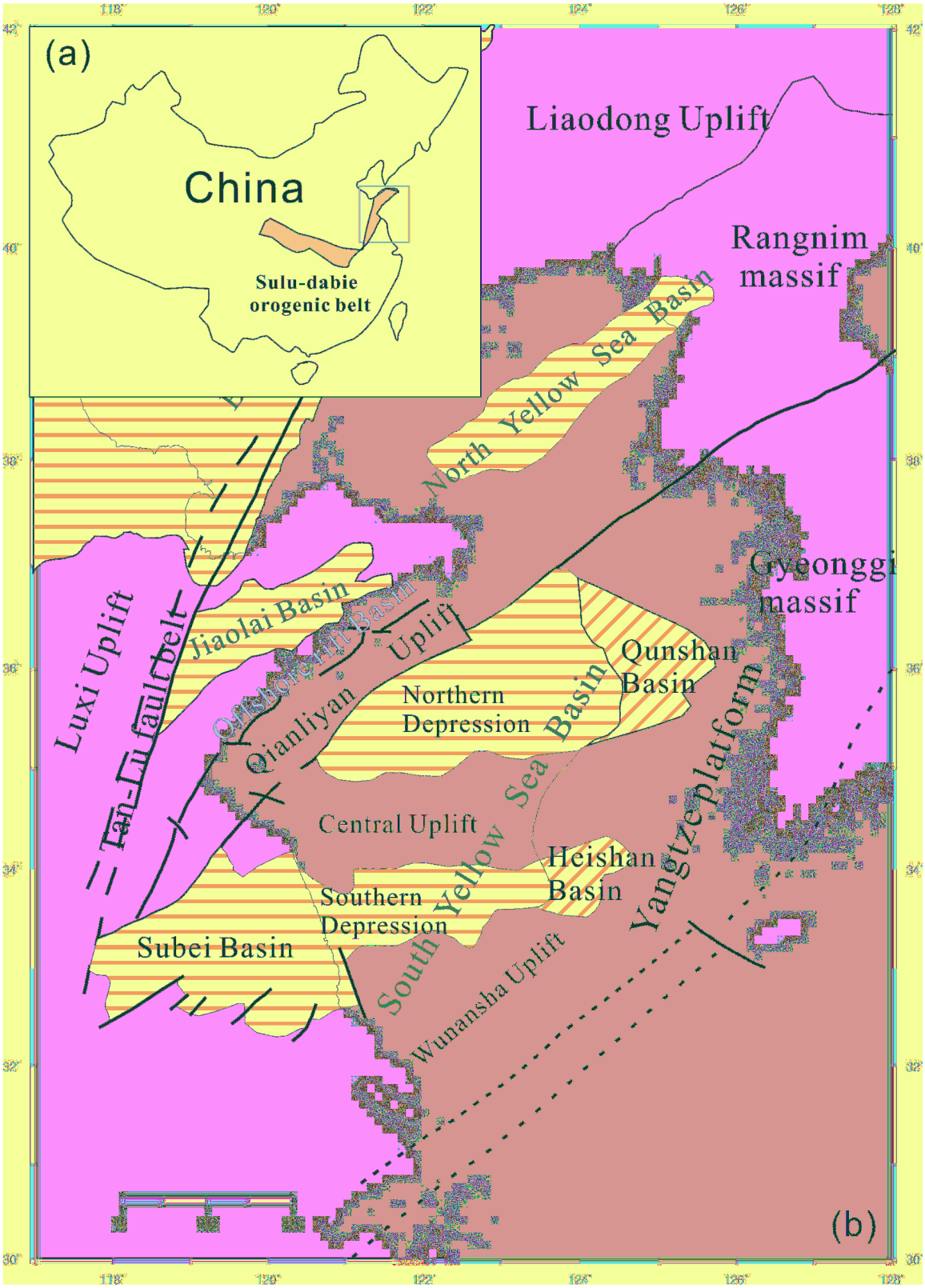
The new discovered Offshore rift basin in Eastern Shandong according to the field inverstigation is one of Mesozoic and Cenozoic rift basin in Eastern North China, which break traditional view for tectonic framework of basin in Eastern Shandong and its ajacent South Yellow Sea. Therefore, the tectonic framework and units of basin in the study area were redivided through the method of wavelet multi-scale decomposition of gravity anomaly, which has important meaning for the study of Mesozoic basin evolution in Eastern North China. In this paper, the method of wavelet multi-scale decomposition is used to separate bouguer gravity anomaly data, extracting first to forth order wavelet transform detail, which reflects gravity anomalies produced by anomalous density bodies varying from surface to Moho. The results showed that the faults in the study area developed, with different tendencies intermeshed and crossed mutually, indicating that there was multi-stage tectonic activity. The distribution of deep faults has a significant effect on the positive and negative gravity anomaly zones corresponding the uplift and depression. With obvious division characteristics of gravity field, the study area is divided into four subregions under boundary of the Tanlu fault zone, Wulian-Qingdao fault and Jimo-Muping fault zone, Qianliyan fault, the southern margin fault of Qianliyan uplift, from north to south, which is Jiaolai Basin, Offshore rift basin, Qianliyan uplift and South yellow sea basin, respectively. Combined with the seismic data, the tectonic units in Offshore rift basin is mostly analyzed. It is a NE-SW trending strip-shaped feature,with alternative depression and uplift. And for the first time, the subsidence center of Offshore rift basin is discovered.

Keywords: framework, Gravity Anomaly, Wavelet Multi-Scale Decomposition, Eastern Shandong



Late Paleozoic to Early Mesozoic magmatism in Linxi area, Inner Mongolia: Implications for the tectonic evolution of the Xing'an–Mongolia Orogenic Belt

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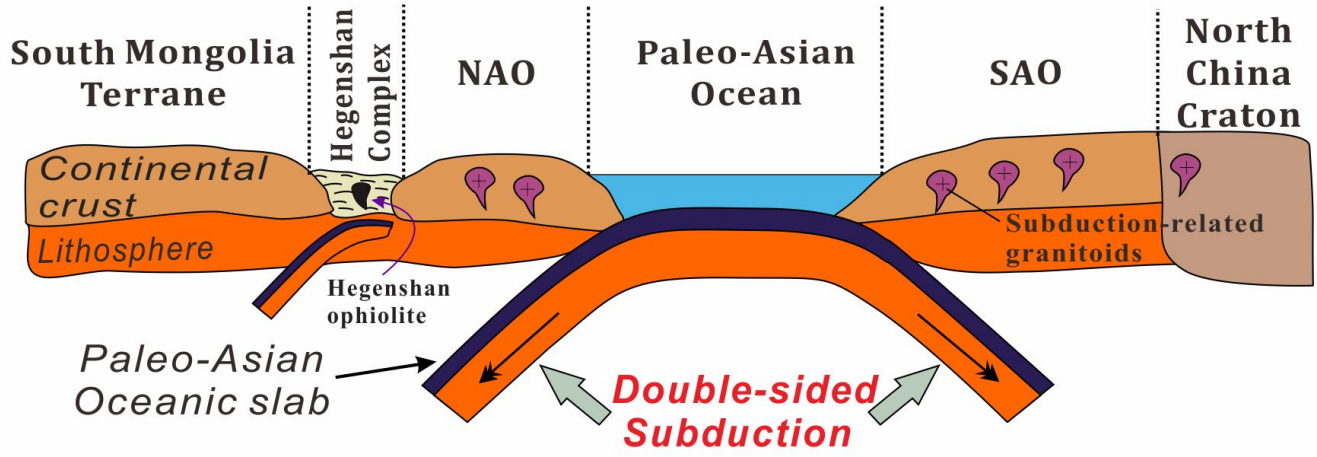
The Central Asian Orogenic Belt (CAOB) is one of the world's largest site of juvenile crustal growth in the Phanerozoic era (Sengor et al., 1993). The southeastern segment of the CAOB is called Xing'an–Mongolia orogenic belt (XMOB, Ren et al., 1980). Numerous fundamental problems are still unsettled, especially when it comes to the tectonic evolution of the XMOB during Late Paleozoic to Early Mesozoic (e.g. Jian et al., 2010; Tong et al., 2015; Xiao et al., 2003; Zhou et al., 2015). The study area (Linxi area, Inner Mongolia), located in the core region of the Solonker–Xra Moron suture (Han et al., 2012; Pei et al., 2017), is undoubtedly the significant region to investigate the tectonic evolution of the XMOB. Here we present new zircon U–Pb ages, whole-rock major and trace element compositions and coupled with Hf isotopes of the representative samples in Linxi area of the XMOB. This work evaluates their petrogenesis and tectonic implications and also provides new constraints on the tectonic evolution of the XMOB.
The representative rock samples analyzed in detail during this study were collected from four plutons in the midwest of the Linxi area, namely the BS, BSFZ, HD and XNG plutons. The BSFZ and XNG plutons consist mainly of granodiorite, granodiorite porphyry and monzogranite, which are belong to I-type granitoids. The BS and HD plutons are mainly composed of granite and monzogranite, which are classified as typical A-type granites. Zircon U–Pb age dating indicates the intrusions were emplaced in two stages: (1) during Late Permian to Early Triassic (the BSFZ and XNG plutons, 252 ±3–246.3 ±3.3 Ma); (2) Late Triassic (the BS and HD plutons, 220.8 ±2.7–211.4 ±2.6 Ma). According to their geochemical characteristics and Hf isotope compositions, as well as Nd isotope published recently in this region, we argue that the investigated granitoids share the similar magma sources which were derived from the partial melting of juvenile lower crust materials. It is notable that the BS and HD A-type granites experienced higher degree of magmatic differentiation compared to the BSFZ and XNG I-type granitoids.
Crustal growth and tectonic evolution of orogenic belts could be deciphered by the accompanied magmatism (Wu et al., 2011). In order to get a more comprehensive understanding of magmatism, here we integrated 95 recently-published single-zircon U–Pb ages of granitoids in adjacent areas. According to these precise geochronological data, four main periods of granitic magmatic activity can be distinguished in this area: Late Carboniferous (330–300 Ma), Early Permian (290–270 Ma), Late Permian–Late Triassic (260–220 Ma) and Late Jurassic-Early Cretaceous (150–110 Ma). The occurrence of the youngest age group is triggered by the Pacific plate subduction (e.g., Ouyang et al., 2013; Wilde, 2015). Other age groups are most likely controlled by the subduction–collision processes driven by the closure of the Paleo-Asian Ocean (e.g., Eizenhöfer et al., 2014; Li et al., 2016). There is a broad consensus that the final closure of the Paleo-Asian Ocean took place along the Solonker–Xra Moron suture zone, which was marked by melanges, blueschists and the Solonker–Sonidyouqi–Kedanshan–Xingshuwa ophiolite belts.
Based on these new data and previous studies, we predict three stages of tectonic evolution during the Late Paleozoic–Early Mesozoic in the XMOB: (1) Late Carboniferous–Early Permian (330–270 Ma): double-sided subduction of the Paleo-Asian Ocean; (2) Middle Permian–Middle Triassic (270–237 Ma): the closure of the Paleo-Asian Ocean and subsequent continent–continent collision between the North China Craton and the South Mongolia Terrane. (3) Late Triassic (237–211 Ma): post-collisional extension.

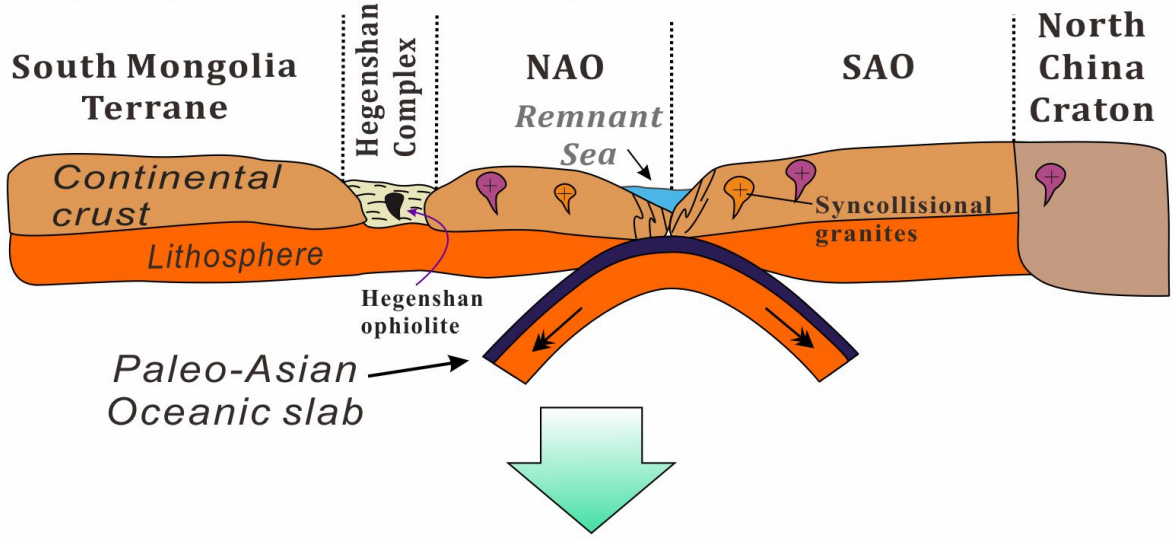
Keywords: tectonic evolution, CAOB, U–Pb–Hf isotopes, magmatism, Linxi

(1) Subduction of the PAO (330–270 Ma)

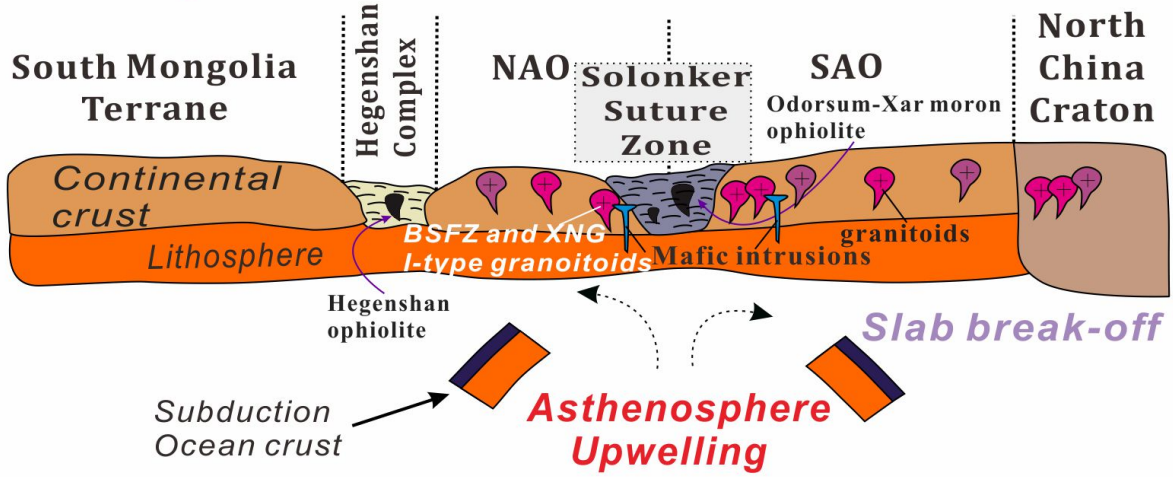


(2) Collisional orogeny (270–237 Ma)

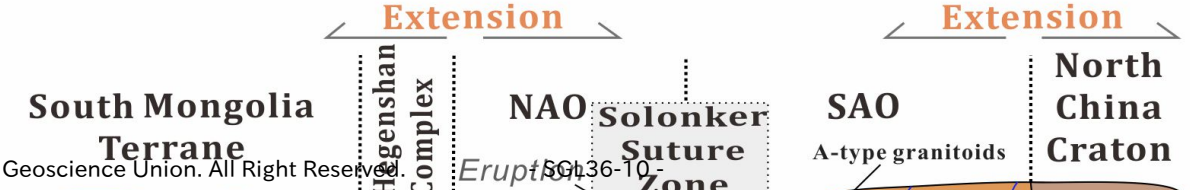
a. Initial collision: 270–260 Ma



b. Subsequent continent–continent collision: 260–237 Ma



(3) Post-collisional extension (237–211 Ma)



INTEGRATED INTERPRETATION OF HIGH SENSITIVITY MARINE MAGNETIC DATA AND MARINE SEISMIC DATA IN IZMIT BAY, TURKEY

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In this study, we have compared high resolution marine magnetometer data and marine seismic data. In this way, we have aimed to create the model map of active tectonic structures in Izmit Bay that located in the east of the Marmara Sea. Izmit Gulf, has attracted the attention of local and international researchers after the earthquake of 17 August 1999. From that time until today, there have been several geological and geophysical studies. Mainly shallow marine seismic studies have been carried out in the region. However, there is no high resolution marine magnetic data history of national or international literature. After the earthquake in Golcuk, the deep seismic reflection data on a total of 64 lines were collected by research vessel MTA Seismic 1 in September, 1999. In this study, only 10 of these lines that NS direction have been used. Air gun was used as the energy source. Seismic lines has 1 ms sampling interval and 1,5 s record length. About 1000 km in length data has been collected with SeaSpy Marine Magnetometer which belongs to Istanbul University Institute of Marine Sciences and Management in Izmit Bay. The collected raw data has been converted to Excel format. Firstly, noise generated by human-induced structure are fixed as observational. Then, the daily change occurring in the magnetic field is corrected. Daily data has been taken on the basis of minutes from Iznik station which belonging to Bogazici University Kandilli Observatory and Earthquake Research Institute. Correction of the measured values has been performed by application that we made. Modeling has been performed by Geosoft Oasis Montaj application by using this data. Two fault map is created by using high resolution marine seismic data and marine magnetic data. These two maps are verifying each other greatly. North Anatolian Fault; passing within 750 m of the Hersek nose at West of Izmit Bay. In middle of Izmit Bay, NAF protect distance from shoreline from offshore of Karamursel to offshore of Degirmendere. In the East of Izmit Bay; NAF passing through Golcuk and Derince and lies on the eastern basin.

Keywords: Izmit Bay, High Resolution Marine Magnetics, North Anatolian Fault

Late Pleistocene and Holocene stratigraphy of the Gulf of Saros; new Chirp seismic data

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The Gulf of Saros is located at the eastern margin of the North Aegean Trough (NAT), which is a right-stepping horsetail structure developed at the western termination of the North Anatolian Fault (NAF). Its evolution started in the Middle to Late Miocene, under the NW–SE compression caused by the counterclockwise movement of the Thrace and Biga peninsulas along the Thrace Fault Zone. This presentation presents the stratigraphic setting in this active gulf region, depending on the available seismic data sets and as well as new 300 km-line high-resolution shallow chirp data collected at the eastern margin of the gulf. The shear deformations confirmed that the right-lateral North NAT fault zone (NNAT) and left-lateral South NAT fault zone (SNAT) are the most significant structural elements controlling the NW–SE compression deformation. The Neogene sediments overlie the pre-Early Miocene basement on land. The erosion unconformity between these formations forms a characteristic key surface area on all of the marine seismic records, implying a long hiatus from Miocene to Pleistocene, and with some local erosions.

The deposits above the acoustic basement are divided into four distinctive seismic units. The bottommost unit U1d overlies the pre-Early Miocene basement, and accumulated from the onset of coastal transgression until the time of maximum transgression of the coast, with sediments onlap the underlying erosional truncation surface. The unit U1c comprises fluvial sigmoidal reflections with sediments downlap the underlying unit and show highstand - lowstand period. The unit U1b comprises marginal marine and fluvial sediments deposited during the lowstand period. Finally, the topmost unit U1a and its parallel inner reflections represent the last transgression.

Two different depositional characteristics have been defined in the gulf, as they are separated by an actual fault system. On the southern margin, the transgressive deposits of unit U1a lie directly above the pre-Early Miocene basement while fluvial sigmoidal deposits of the unit U1c and marginal marine and fluvial deposits of the unit U1b can be seen on the northern margin, and they form 30-ms (twt) thick sedimentation deposited under the control of northerly riverine inputs during highstand to lowstand periods. The stratigraphic setting in the gulf supports a dextral movement along the NNAT. The unit U1c is widely distributed in the middle of the studied area. Some buried channel geometries of the rivers, which transported the sediments of unit U1c, have been outlined at the northern sector. In addition, some characteristic sand deposits, equivalent with the unit U1d, were defined at the northern sector of the gulf. All these findings show that the northern margin is under the influence of river aggradation whilst the southern margin was an erosional platform during the last glacial maximum.

Keywords: seismic stratigraphy, Chirp seismic, Aegean Sea

A new tectonic model and fault segmentation controlling the evolution of the inner margin of the Gulf of Saros, NE Aegean Sea

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This study is focused on the definition of tectonic elements in the Gulf of Saros, a highly active seismic region within the North Anatolian Fault Zone. The previous reflection seismic studies trying to characterize the structural setting of the gulf were not presenting sufficient and efficient seismic data at the inner part of the gulf, so we studied this part in detail. For this purpose, we have collected more than 350 km-line high-resolution seismic data by a small research vessel at the inner side in May 2016. All of the obtained seismic profiles were interpreted on a workstation using the commercial software packages known as Kogeo and Kingdom. The Ganos fault, that generated the 9 August 1912 earthquake (Mw=7.2) in western Turkey, enters into the Gulf of Saros from the east, cuts the southern margin of the gulf forming a valley which is deepening westward. The deepest part of this valley cuts into the basement surface and divides the gulf into two. The seismic data revealed that the fault was not a single segment or a pair of border faults bordering the valley. According to the seismic images of the fault segments, the emanating earthquake energy will possibly be carried by two different fractures; the Ganos and Saros segments. The Ganos segment controls the northern margin of the valley while the recently defined Saros segment will control the centre of the valley. This segment causes the development of a new active basin and forms the deep canyon structure through the main valley structure. The new fault map defined using the new seismic data confirms a tectonic escape model for the gulf, which was also proposed by some of the previous geophysical researches. The Saros fault, which is a more active one if compared to the Ganos Fault, developed due to southwest movement of the gulf block. Such a kinematical model causes the deepening canyon structure.

Keywords: Gulf of Saros, Ganos fault, NE Aegean Sea

