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SGL44-01 Room:101B Time:May 23 15:30-15:45

Accretionary age of Pale-Tethys subduction in northern Thailand: Constraints from U-Pb age of detrital zircon

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These Paleo-Tethyan rocks in Thailand characterized by Ocean Plate Stratigraphy were subducted beneath the Indochina Block during the Permian to Triassic (Wakita and Metcalfe, 2005). In the Inthanon Zone of northern Thailand, melanges occur in association with oceanic rocks of Paleo-Tethys origin (Hara et al., 2009). Accretionary age related to the Paleo-Tethys subduction has not been clarified in northern Thailand because of absence of fossils from clastic rocks. For understanding accretionary age, we examined U-Pb ages of detrital zircon of sandstone collected from the Inthanon Zone, by using LA-ICPMS.

Keywords: Paleo-Tethys, melange, zircon, U-Pb age, Thailand

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Publication of Geology of Nago and Yambaru district, northan and central Okinawa main-island

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This abstract is in Geology of Nago and Yambaru district. The geological map occupies the northern and central Okinawa main-island. The district is basemental geologically divided into the Ie, Nakijin, Motobu, and Nago, and Kayo zones. The latter Nago and Kayo zone corresponds to the Crataceous Shimanto zone of Southwest Japan, but the former early Cretaceous Ie and Motobu zone corresponds to e. g., the Jurassic northern Kitakami and related zones of Northeast Japan, not with the Chichibu zone of Southwest Japan. In this district, the Ie zone, and then the Triassic Nakijin zone occupies the highest structural position by the Hedo reverse fault, but it followed lateral tectonic translation from tropical zone. It is a primary characteristic that the hanging wall Anne Unit of the Motobu Complex separated from the footwall of more metamorphosed Nago Complex, by the Kijoka detachment fault. The Motobu complex is devided into the two units by the additional major detachment fault. Exhumation of the metamorphic rocks, consisting mostly of the Nago Complex, especially the Miyagi Unit, exhumed by this later D2 brittle event, which includes also major reverse faulting, assymetric folding, and reversing of strata. Early D1 event is a ductile non-coaxial deformation less than outcrop-scale, but associated with prograde metamorphism. Overthrust nappe of the Nakijin Complex is included in later D2 phase. Also the juxtaposion of the Nago and Kayo complexes is by the Futami reverse fault included in D2, but the Kayo complex is characterized by D1 coaxial deformation including major assymetric folding.

The Valanginian to Hauterivian Ie complex consists of sandstone and mudstone, and includes exotic blocks of red chert, limestone, and basalt. The Carnian Nakijin conplex consists of marl and basalt, but includes exotic blocks of Permian calcareous schist at Hedo-misaki. The Valanginian to Hauterivian Motobu Complex includes the Anne and Yanaza Units, bounded by the Yaedake detachment fault. The hangingwall Yaedake Unit is distributed in the Motobu Peninsula, and consists of sandstone and mudstone as a matrix, and includes exotic blocks of Tyriassic chert, Permian limestone, and basalt. The Anne Unit consists of an alternated psammitic and pelitic schist, but includes exotoc blocks of mafic, calcarenous, and siliceous schists. The Albian Nago Complex includes the Miyagi, Inogama, and Oku Units, but only contains trace fossils. The Miyagi Unit occupies the western flank of backbone range, the Inogama Unit lies on the range, also within fenster, and along eastern coast, and the Oku unit occupies the eastern flank, in general. The Miyagi Unit consists of mafic schist below and pelitic schist and then thin alternated psammitic and pelitic schist above. The Inogama Unit consists of thick alternated psammitic and pelitic schist, and conformably overlies the Oku Unit. The Oku Unit consisits of pelitic schist, siliceous schist (silicic tuff), and thin alternated psammitic and pelitic schist. The Eocene Kayo complex consists of alternated sandstone and mudstone, but contains hemipelagic mudstone at Henoko misaki.

The cover sediments are the Upper Miocene and Pliocene Shimajiri Group, and the Pleistocene Ryukyu Group, consisting of the Kunigami, Guga, Nakoshi, and Naha Formations. The Kunigami Formation is a constituent of the higher terrace, the Guga Formation represents a coastal river valley and fan truncates the higher terrace, but partly deposited in a half graven bounded by the Nago fault, the Nakoshi Formation is a marine sediments covered the Guga Formation, and the Naha Formation, deposited on the Nakaoshi Formation, is a reefal but detrital limestone, which formed a kind of two terraces. The Pleistocene is strongly affected by NW-SE trending normal faulting, other than NE-SW trending Nago fault. These active faults are responsible for the opening of the Okinawa trough. The present morphology and sedimentation reflects the active faulting.

Keywords: Okinawa main island, colored geologic map, full colored text book 209p., Geology of Nago and Yambaru district, Nago Museum

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SGL44-03 Room:101B Time:May 23 16:00-16:15

U-Pb ages of detrital zircons from the Ashidani Formation in the Kuzuryu area, the Hida Gaien Belt

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The Hida Gaien Belt lies between the Hida Belt and the Mino Belt, and is sporadically traced from the Oumi area, through the Renge, Hapoone, Asahi-Shiroumadake, Fukuji, Takayama, and Naradani, to the Kuzuryu area. The Hida Gaien Belt in the Kuzuryu region, the sedimentological and chronological study of the Motodo Formation, radiolarian fossil study of Silurian-Devonian, and stratigraphic and chronological study of the Tomedoro and Konogidani formations, the results of recent years are remarkable geological. For these studies, the Ashidani Formation in the Kuzuryu area since 1967, has not been studied at all. In addition, in the Kuzuryu area, the Ashidani Formation is a stratum has been left as the only age-unknown formation because it does not produce fossil. Based on the above situation, the present study, re-examine the Stratigraphy of the Ashidani Formation, and was carried out U-Pb dating of detrital zircons in order to estimate the geological age.

The Ashidani Formation is distributed almost in east-west direction on the north of the Lake Kuzuryu-ko. The formation strikes N50W to E-W, and dips steeply to the south, with some exceptions of north-dipping sites. The Ashidani Formation is subdivided into three parts: the Lower, Middle, and Upper members.

The Lower Member consists mostly of black shale alternating with thin sandstone layers. The Middle Member is a sandstone-rich member and varies in thickness from 100 m to 250 m. Fine- to coarse-grained and grey to green schistose sandstone is characteristic in the Middle Member. The granite gravels are included in the Middle Member. The Upper Member consists mostly of shale rarely intercalating sandstone layers. The upper limit of the member is cut by a fault, and the thickness of the member is 170 m or more. The shale of the Upper Member is generally phyllitic black shale.

Separating the detrital zircons from two samples (A-1, A-2) of green schistose sandstone of the Middle Member, and was carried out SHRIMP U-Pb dating. A-1 sample is sandstone with a weakly schistose structure. A-2 sample is strongly schistose structure, which is sandy schist. The measurement results of detrital zircon ages are 280-220 Ma with both samples, they is largely concentrated in the 280-250 Ma. The Ashidani Formation is limited to the Triassic to Paleogene, because it is intruded into the Neogene andesite.

According to the existing data, has been reported the Yakuno Group of the Maizuru Belt is that there is a peak of detrital zircon ages to 280-210 Ma. The Ashidani Formation is likely correlated with the Yakuno Group, because of detrital zircon ages the Ashidani Formation obtained in this study are included in the range of 280-210 Ma. However, because the sandstone of the Yakuno Group is fine-grained and dark gray to blue-gray sandstone in general, can’t correlate the Ashidani Formation and Yakuno Group promptly. On the other hand, the Ashidani Formation may be able to correlate with the Triassic of the Ultra-Tamba Belt, because the Triassic of the Ultra-Tamba Belt contain the green sandstone. In any case, it is considered the Ashidani Formation is the Triassic, but a detailed determination of the geological age is an issue in the future.

Keywords: Ashidani Formation, detrital zircon, Hida Gaien Belt, Kuzuryu area, U-Pb age

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SGL44-04 Room:101B Time:May 23 16:15-16:30

Serpentinite-bearing conglomerate from the Ultra-Tamba Terrane in Kawanishi City: Oeyama ophiolite in Permian forearc?

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The Ultra-Tamba and Akiyoshi Terranes in Southwest Japan are interpreted as a Permian subduction-related accretionary complex. These terranes tectonically underlie the Yakuno ophiolite (Maizuru Terrane) and Oeyama ophiolite, respectively. The Yakuno ophiolite represents Permian crust and mantle of an island arc-marginal basin system along the Eastern margin of East Asia (Ichiyama and Ishiwatari, 2004), and the Oeyama ophiolite does the Early Paleozoic fore-arc lithosphere (Machi and Ishiwatari, 2010). Interpretation was that the Ultra-Tamba and Akiyoshi terranes formed at separate subduction trenches in front of the Maizuru and Oeyama Terranes, respectively.

The Inagawa Complex (Sugamori, 2009) mainly consists of alternating sandstone and mudstone beds and their broken fragments with minor amount of felsic tuff, siliceous mudstone and conglomerate. The felsic tuff and mudstone bear Middle and Late Permian radiolarians, and the complex is interpreted as a Permian subduction-related accretionary complex. The conglomerate of ca. 2 m thick containing serpentinite granules crops out on the floor of the Hitokura Oroji River in Kawanishi City, and is conformably intercalated in mudstone of the Inagawa Complex. The conglomerate contains 5 mm sized granules of felsic tuff, serpentinite and quartzite or mylonite with minor basalt, felsic volcanic rocks, granite, mudstone, sandstone and chert. The chert and mudstone granules contain radiolarian and foraminiferan shells, respectively. The composition of granules suggests that clastics in the conglomerate were derived from Paleozoic sedimentary rocks, ultramafic rocks, metamorphic rocks, granites and arc volcanic rocks.

The serpentinite granules are severely serpentinized, but spinel crystals are well preserved at least in their cores, and exhibit very irregular shapes resembling the so-called ”dancing spinel” that are characteristic to the mantle peridotites of the Oeyama ophiolite. EPMA analyses of spinel cores are done for 5 or 6 points in one serpentinite granule in each of 3 thin sections (TH). Resulted Cr# (=100Cr/(Al+Cr)) data are as follows: TH-1: 50.87+/-0.51, TH-2: 50.33+/-0.22, TH-3: 41.95+/-0.28. The Cr#50-51 spinels are quite common among the western mantle peridotite bodies of the Oeyama ophiolite (Arai, 1980), and the Cr#42 spinels are close to those from the eastern Oeyama body (Cr#35; Kurokawa, 1985). The extremely irregular habit of spinel crystals and their mineral chemistry indicate that they originated in the mantle peridotite of the Oeyama ophiolite.

The clastic grains in the Ultra-Tamba Terrane generally contain abundant felsic tuff. Hayasaka et al. (2010; JGS Meeting abst.) reported that the U-Pb age population of zircon grains from the Ultra-Tamba and Akiyoshi Terranes commonly shows a peak at 270 Ma, corresponding to that of the Yakuno ophiolite rocks (280 Ma) in the Maizuru terrane, and interpreted that the Ultra-Tamba and Akiyoshi Terranes formed by subduction-accretion in front of the Maizuru magmatic arc. However, the conglomerate also includes serpentinites from the Oeyama ophiolite and crystalline schists probably derived from the Sangun-Renge metamorphic belt. These facts remind us of the geological setting such as observed in the NE Japan, Cascades (W USA), and Izu-Bonin-Mariana, where volcanic arcs are accompanied with forearc ophiolite exposures (e.g. Ishiwatari et al. 2006).

The serpentinite granules of the Oeyama ophiolite origin discovered from the Permian accretionary complex of the Ultra-Tamba Terrane indicate that the Oeyama ophiolite was exposed with various Paleozoic sediments, metamorphic rocks and granites in the vicinity of the Maizuru arc, possibly in its forearc area. The island arc-marginal basin system of the Maizuru Terrane may have formed by rifting and spreading of the pre-existing active continental margin as in the case of the Green Tuff volcanism and Japan Sea opening event in Miocene.

Keywords: dancing spinel, island arc-marginal basin system, Sangun-Renge metamorphic belt, Permian accretionary complex, Maizuru (Yakuno) volcanic arc, SE Hyogo Pref. SW Japan

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Tectonostratigraphy of the Omama Complex of the Ashio Belt in the Umeda area, Kiryu City, Gunma Prefecture

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The Jurassic accretionary complex widely distributed in the north of the Kanto Plain is called the Ashio Belt, regarded as the northeastern extension of the Tamba-Mino Belt. Since the mid-1990s, tectonostratigraphic studies have been conducted in the Kuzu area located in the southeastern part of the Ashio Belt (e.g., Kamata, 1996, 1997, 2000); however, the tectonostratigraphic architecture of accretionary complexes in other areas has been unclear. In the Umeda area, Kiryu City, Gunma Prefecture, a Jurassic accretionary complex comprises the Omama and Kurohone-Kiryu complexes (Kamata, 1996). We here describe lithology and geologic structure of the Omama Complex.

In the present study, the Omama Complex is subdivided into two tectonostratigraphic units, Unit A and Unit B. Unit A consists of sheared alternating sandstone and shale and a melange that includes slabs and clasts of chert and a minor amount of limestone and basalt with a muddy matrix. Shale contains probably Middle Jurassic radiolarians. Unit B is a melange containing large blocks of Permian chert and basaltic rocks.

According to Kamata (1997), the Kuzu Complex in the Kuzu area is subdivided into UNIT 1, 2, 3, in structural ascending order. UNIT 1 and 3 are characterized by the tectonic repetition of Triassic chert and Middle to early Late Jurassic clastic sequence, and UNIT 2 is composed of a melange with huge blocks of Permian limestone and basaltic rocks. Based on the lithological characteristics and geologic age, Unit A and B of the Omama Complex can be correlated with UNIT 1 and UNIT 2 of the Kuzu Complex, respectively. In addition, the Middle to early Late Jurassic Kuromatagawa Complex in Niigata Prefecture, composed mainly of coherent sequences of alternating sandstone and shale and slubs of basaltic rocks and chert (Hara and Kashiwagi, 2004), can be correlated with the Omama Complex. Considering the lithology, geologic structure, and age of accretion, Middle to early Late Jurassic accretionary complexes (Kuzu, Omama, Kuromatagawa complexes) occur several times throughout the Ashio Belt with large-scale synclines and anticlines.

Keywords: Ashio Belt, Omama Complex, Jurassic Accretionary Complex

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Upper Carboniferous adakitic granite from eastern margin of the Abukuma Mountain and its geological significance

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East block of the Hatagawa fault in the eastern part of the Abukuma Mountains are considered to the southern extension of the south Kitakami belt (Kubo and Yamamoto, 1990). Wariyama granitic body occurs along the east of the Futaba Fault, juxtaposed to the east of the Hatagawa fault, in eastern end of the Abukuma Mountains. The Wariyama granitic rocks are adakitic granites poor in K_2O and Rb, and similar granitic rocks occur as borehole samples from Matsukawaura (Abe and Ishihara, 1985; Kanaya, 1996) and Tomioka, these adakitic granites are considered to be the southern extension of the Lower Cretaceous adakitic granites in Kitakami (Tsuchiya et al., 2007). However, Ohtomo et al. (2008) described monazite, uraninite, and zircon U-Th-Pb age around 300Ma, and Tsutsumi et al. (2010)described zircon U-Pb SHRIMP age of 293.0 +/- 1.8Ma, 300.3 +/- 1.5Ma, and 304.3+/- 1.7Ma from the granitic rock in the borehole sample in Tomioka. From this, geological position of the Wariyama granitic body should be further studied in detail.

The Wariyama granitic body occurs along the east of the Futaba Fault, eastern end of the Abukuma Mountains, and exhibits an N–S-trending elongated shape about 0.5 to 1.5 x 15 km (Fujita et al., 1988). The Wariyama granitic rocks composed mainly of strongly foliated biotite-hornblende tonalite, which is characterized by poverty of K-feldsper. Kink and microcracking in plagioclase and subgrains in quartz are generaly shown. Nevertheless the degree of foliation shows remarkable local variation, modal compositions of constituent minerals are homogeneous. U-Pb dating of zircons were carried out using Agilent 7500cx quadrupole inductively coupled plasma mass spectrometer (ICP-MS) with a New Wave Research UP-213 Nd-YAG UV (213 nm) laser ablation system (LA) installed at the Kyushu University (Adachi et al., 2012). Zircon grains from biotite-hornblende tonalite (KAKUDA7) are 0.005–0.03 mm, elongated and euhedral with oscillatory zoning. All data concentrate around ca. 300 Ma, 8 analyses from 8 grains define a concordant age of 302.1 +/- 3.9 Ma (MSWD = 5.7, probability of concordance = 0.017). U-Pb zircon age obtained here is similar to those of the granitic rocks from the Tomioka borehole after Ohtomo et al. (2008) and Tsutsumi et al. (2010). Therefore, granitic rocks distributed to the east of the Futaba fault are considered to be adakitic granites of Upper Carboniferous age.

Kobayashi (2000) divided the Paleozoic granitic rocks in Japan into two groups; Ordovician to Lower Carboniferous granites (450-350Ma) and Permian granitic rocks (280-250Ma). In addition, Isozaki et al. (2011) shows five major granitic activity in the geotectonic history of the Japanese Island; Cambrian to Silurian (520-470Ma, 440-400Ma), Permian (280–250Ma), Triassic to Jurassic (240-210Ma, 190-150Ma), Early Cretaceous (110-90Ma), and Paleogene (60–30Ma). In these granitic rocks, Cambrian to Jurassic rocks are mostly digested by the past tectonic erosion processes in the fore-arc domains (Isozaki et al., 2011). Discovery of the 300Ma adakitic granite of this study indicates that the Permian granitic activity began from 300 Ma by the adakitic activity. The occurrence of the typical adakitic rocks indicates the possibility of ridge subduction and/or young plate subduction around 300Ma in the Japanese Island.

Keywords: zircon geochronology, adakite, Wariyama, Abukuma, Upper Carboniferous

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Geology of the Northeast coast of Kagoshima bay, HUMOTO tuff in particular .

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The Kokubu Group is exposed all along the northern coast of the Kagoshima Bay. The Kokubu Group is a serried of marine sedimentary deposit of Quaternary and is divided into three sedimentary formations which are the Kajiki Formation, the Kamo Formation, and the Hayato Formation. All the three formations are separable by the underwater pyroclastic flow sediments. The area of investigation in this research is the eastern part of Yoshida town which lies along the coastal part in the northwest of Kagoshima Bay. Although the overlying formations such as the Kamo Formation and Hayato Formation are exposed all along the Kagoshima area, the unwelded tuff layers between them which have drastic and variable thickness are exposed only in the investigated area. Among them, in particular the Fumoto Tuff which is weakly sorted and consists of fine ˜ very fine sand with volcanic glass is the most prominent layer. The purpose of this research is to (1) re-examine the stratigraphic relation of the Kokubu Group, and (2) to clarify the depositional environment of the Fumoto tuff. In this research, sampling was carried out systematically with fixed interval from the Fumoto tuff in order to know the heavy mineral fraction and particle size composition. They were then used for comparison with various other tuff deposits in the area in order to identify the pyroclastic flow deposition. By this investigation, we came to the conclusion that the Fumoto tuff overlies the Oda pyroclastic flow deposit. Moreover, the Fumoto tuff was deposited in a basin which becomes lower in altitude from southeast towards northwest in the area. In addition, gradation in grain size indicates that the particle size composition got finer towards the upper part and this can be seen in the research area. The direction of water flow which deposited the middle layers of the Fumoto tuff was from west to east and is indicated by the current ripple mark. In the upper part water driven structures are seen indicating the deposition was fast in the upper layers. Moreover, the presence of a clastic dike along the boundary of Hayato Formation and the Fumoto tuff display that a seismic event occurred after the deposition of Fumoto tuff.

Keywords: Fumoto tuff, Environmental of deposition, Kokubu Formation

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Sandstone unit conformably overlaid by Carboniferous limestone-greenstone successions, Kawakami Area, Akiyoshi Terrane

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The oldest fossil record of the Akiyoshi Terrane, Lower Carboniferous (Visean) was obtained from the upper part of greenstone which has transitional contact with upper limestone. The limestone-greenstone successions have been interpreted as seamounts on an oceanic crust. Precise fieldwork to determine a lowermost boundary of the greenstone has brought discovery of older sandstone formation in three routes. The study area is located western part of Kawakami Town, Takahashi City, Okayama Prefecture where is occupied by Lower Carboniferous to Middle Permian Koyama Group (Yokoyama et al., 1979), Permian Yoshii Group (Sano et al., 1987) and Triassic Nariwa Group which unconformably covers Paleozoic successions (Otoh, 1985). The names of three routes are Hoya, Matsubara and Takase.

The Hoya Route is composed of sandstone unit (120m+), greenstone unit (260m) and limestone unit (300m+) from the bottom to top. The sandstone unit is mainly composed of massive medium- to fine-grained wacke sandstone. Alternation of mudstone and sandstone is intercalated. The greenstone unit conformably overlay the sandstone unit. At the bottom of the greenstone unit, thin (1 to 5 cm) sandstone lenses are associated in basaltic tuff. The greenstone unit mainly comprises basaltic lava and tuff. Two layer of greenish rhyolitic tuff is intercalated in middle part of the unit. Upper part of the unit is characterized by a calcareous basaltic tuff which contains fragments of limestone and crinoid. Limestone lenses are also associated. The contact between greenstone unit and limestone unit is transitional. The Lower Carboniferous fossil assemblage (Endothyra Zone) was obtained from the unit (Yokoyama et al., 1979).

The Matsubara Route is composed of sandstone unit (70m+), greenstone unit (30 m) and the Nariwa Group (30m+) from the bottom to top. There is unconformity between greenstone unit and the Nariwa Group (Otoh, 1985). The sandstone unit comprise massive medium- to fine grained wacke sandstone. The greenstone unit comprises basaltic tuff and lava. The basaltic tuff which contact with the sandstone unit has fractures oblique to the contact plane. However no shear zone and fault rock are observed. The boundary between the sandstone unit and the greenstone unit is considered to be conformable as Otoh (1985) was described in his sketch.

The Takase Route is composed of sandstone unit (30m+), greenstone unit (15m) and limestone unit (35m+) from the bottom to top. The sandstone unit comprises massive fine- to medium-grained sandstone. The greenstone unit comprises basaltic tuff and lava. In the lower most part of the unit, sandstone layer (2m) is intercalated. The upper boundary of the sandstone layer has 2 cm thick fault rock. However there is no shear zone and fault rock are observed at the contact between the sandstone unit and the greenstone unit.

The sandstone modal compositions of the samples from the three Routes are plotted on the same domain in QFR diagram. The sandstone is characterized by containing clasts of potassium feldspar and granite. The rhyolitic tuffs are intercalated in the greenstone unit which conformably overlay the sandstone unit. It is considered that these units are deposited in a marginal area of continent.

Keywords: Akiyoshi Terrane, Carboniferous, sandstone unit

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Observation and analysis of the Median Tectonic Line subsidiary fault in Kada, Wakayama city, southwest Japan

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The Median Tectonic Line (MTL) is the greatest fault, attained to 1,000 km long and more, in southwest Japan. The MTL is actually a fault zone, consisting of two boundary faults and many subsidiary faults in the west Kii Peninsula: One of the two faults is the main boundary fault between the Sambagawa belt (south) and the Cretaceous Izumi Group (north), and the other is a boundary fault between the Sennan belt (south) and the Ryoke main belt (north). The former main boundary fault is called MTL in a narrow sense. The Izumi Group (south) covers unconformably with the Sennan belt (north), or partly contacts with it by a fault. The subsidiary faults are well developed in the Izumi Group and the Sennan belt. The displacement history of the MTL changed from left-lateral strike slip in a very ancient time (late Cretaceous to early Eocene) to right-lateral strike slip in the late Quaternary.

Beneath the Kitan Strait between Kii Peninsula and Awajishima Island, some subsidiary faults of the MTL are presumed. We found one of them at the seashore of Kada Bay, Wakayama City. We made a careful observation and analysis about the subsidiary fault. (1) Its strike and dip are northeast-southwest and almost vertical. (2) Striation on the fault plane is nearly horizontal. (4) Its displacement is a predominant left-lateral strike slip, based on a correlation of the beds. (5) The fault has a fracture zone of 40 m wide. (6) In a fault core, there is not accompanied with a soft fault gauge. And (7) this displacement sense is in harmony with the orientation of sigma1, obtained from an inversion analysis of paleostress. Therefore we revealed the former left-lateral strike slip of the MTL subsidiary fault.

Keywords: Median Tectonic Line, subsidiary fault, left-lateral strike slip, Cretaceous Izumi Group, Kada (Wakayama city)

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Geology of the Hase-Ichinose district in the eastern margin of the Ryoke belt

ONO, Akira[1*]

[1]None

Two particular geological structures are found in the eastern margin of the Inner Zone of Southwest Japan. One of them is the NE-SW trending folds of the Jurassic accretionary complex. Another is the N-S trending Median Tectonic Line (MTL). The trend of folds was initially E-W and it was changed to NE-SW before the volcanic activities of the Nohi rhyolite. While the N-S trending MTL was formed in the Miocene opening of the Sea of Japan [1]. The geological structure near the MTL depends on Miocene tectonics in central Japan. In this point of view the geology of the Hase-Ichinose district is reviewed.

Outline of geology

Gneissose granitoids and mylonites are exposed in the west of the MTL. Mylonites are mainly distributed in the yellow zone (Figure B). Pelitic and psammitic rocks are frequently found in this zone, whereas they are lacking in the west of the yellow zone. Faults are confirmed at the zone boundary. The original rocks of pelitic mylonites are believed to be high-temperature gneissic rocks. Nevertheless, many radiolarian fossils are found in a fine-grained pelitic mylonite which is exposed near the Nakazawa Pass. The srikes and dips of foliations of granitic rocks are N25-40E, >50 in the Mizoguchi area, N35-50 E, >60 in the Ichinose area and N5-20E, >60 in the Kitagawa area of the Ohshika village (Figures A and B).

Small geological bodies which are mainly composed of muscovite-garnet schists are distributed along the MTL in the Awasawa, Nakao and Mizoguchi areas. They are probably Ryoke metamorphic rocks. However, the K-Ar hornblende age of an amphibolite is 55.7Ma. Hence, the metamorphic rocks are tentatively called as the Awasawa metamorphic rocks [1].

Faults near the MTL

Faults are common in the study area. They are frequently accompanied by altered rocks and fault gouges. The strikes of fault planes are N-S and N10-80W. The geology of the Magoi area changes across the N-S trending fault. Pelitic rocks and strongly mylonitized granitic rocks are exposed in the east of the fault, while they are lacking in the west. The strikes of foliations are constant regardless of the fault. Similar geology is detected across the N-S trending fault of the Nakao area (Figure C). In the Awasawa area, several faults are found in the western margin of the yellow zone (Figure B). Metasomatized rocks are found near the faults. The strikes of the faults and foliations are about N35E. In the southern margin of the yellow zone, two faults which are running in N-S directions are developed.

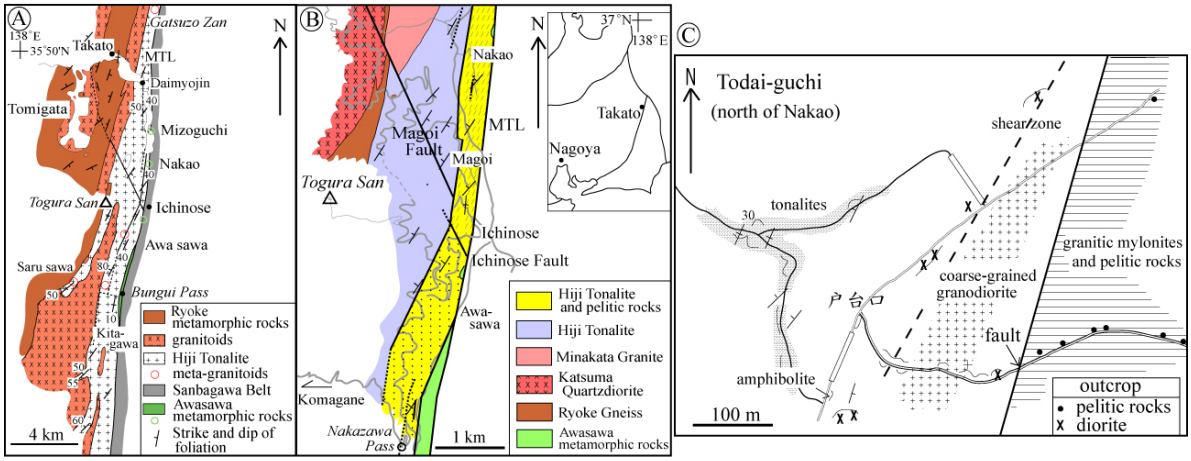
Conclusions

Shear stress that is responsible for the formation of mylonites is believed to increase continuously towards the MTL. However, this assumption is denied by the existence of the Awasawa metamorphic rocks and the N-S trending faults in the Nakao-Magoi area. Moreover the metamorphic zoning of the Kashio mylonite is nearly parallel to the foliation and layering structures [1, 2]. However, the thermal structure is not clear in the north of the Ichinose fault because the initial geological structure was destroyed by many faults. Judging from the strikes of the Ryoke gneiss and mylonites, the geological bodies in the Kitagawa area were rotated in a counterclockwise direction relative to those in the surrounding areas.

[1] Ono, 2002, Jour. Geol. Soc. Japan, no.11, 733-745.
[2] Ono, 2008, Ann. Meet. Geol. Soc. Japan, p.243.

Keywords: Hase-Ichinose, gneissose granitoid, meta-granitoid, mylonite, Awasawa metamorphic rocks, fault

SGL44-P04 Room:Convention Hall Time:May 23 17:30-18:30



Japan Geoscience Union Meeting 2012
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SGL44-P05 Room:Convention Hall Time:May 23 17:30-18:30

Structural geology of Jushi-Kuroya Fault and the neighboring area, eastern margin of Chichibu basin

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Jushi-Kuroya fault is part of the N-S trending fault system which shifts Median Tectonic Line in the northern Kanto Mountain. At the Chichibu basin, it is the boundary between the Sanbagawa Belt (east) and Chichibumachi group (west) at Miocene. WNW-ESE trending fold are developed in the northern Kanto Mountains, however the Sanbagawa Belt at study area in eastern margin of Chichibu basin is developed the folds of N-S trend along fault, and there are different from surrounding folds. The faulting has more than three stages, but the age of stage 1 is unknown, stage 2 (15Ma) is right-lateral strike-slip (Takahashi, 1992), stage 3 (0.4Ma) is dip-slip (Honma, 2000).

At the Sanbagawa Belt, the attitude of crystalline schist ware surveyed the relationship between the distance from the fault and the change in strike and dip. The Sanbagawa Belt was divided into the northern part the middle part and the southern part by the changing to attitude. The northern part and middle part are distributed over the north side from E-W fault. Moreover, composition, grain size, roundness, sphericity, and attitude of conglomerates and mode measurement of sandstone were measured for restoration of the hinterland exposed by fault activity at Miocene.

The geological surveys for the Chichibumachi Formation in Chichibu basin is carried out, the folds were difference between the northern part and the southern part of the E-W fault. Therefore, at latest fault activation (0.4Ma), Jushi-Kuroya fault moved mainly in the northern area, and the southern area had not moved, or had moved a little. In the existing studies, the E-W fault had cut the N-S fault, but the N-S fault had cut the E-W fault. Consequently, The E-W fault shifted at same time or thereafter, when strike-slip movement (15Ma) of Jushi-Kuroya fault and the fault moved as dip-slip (0.4Ma) after that.

The Pre-Neogene distributes the Chichibu Terrane slightly to the east from the fault, but most of the Sanbagawa Belt at the present. However, at Miocene, according to the distribution of conglomerate in the Chichibumachi Formation, the Chichibu Terrane had distributed widely than at the present, granitic rocks had exposed to a small part, and Sanbagawa Belt stretched widely.

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Ddeformed conglomerates of the Shiozawa Formation of the Ashigara Group

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1.Introduction

In the South Fossa Magna, central Japan, the block on the Philippine Sea Plate has multiply collided subducting plates (Amano,1986,1991). The Ashigara Group formed as a trough filling after the collision of the Tanzawa block. Subsequently, collision of the Izu block occurred. The Ashigara Group deformed at high strain rates. The group has a folded structure, and the dip of the bedding planes on the limb is steep.

2. Ddeformed conglomerates of the Shiozawa Formation

The conglomerates of the Shiozawa Formation of the Ashigara Group exhibit remarkable deformation. In particular, the granitic pebbles elongated. Although the conglomerates are of Pleistocene age and considerably new sediments, the heavily deformed sediments appear to be old and to have deformed deep in the crust.

The deformed pebbles are characterized by P-R1 cataclasites, and they elongate along the P foliation and slip on R1 shear planes. They show cataclastic flow structures under the microscope. The fragments are fine and follow the flow direction. The content of clay minerals in the deformed pebbles is low. There was no strong hydrothermal alteration to accelerate deformation. The pebbles are deformed by fracturing, which mechanically reduces the grain size.

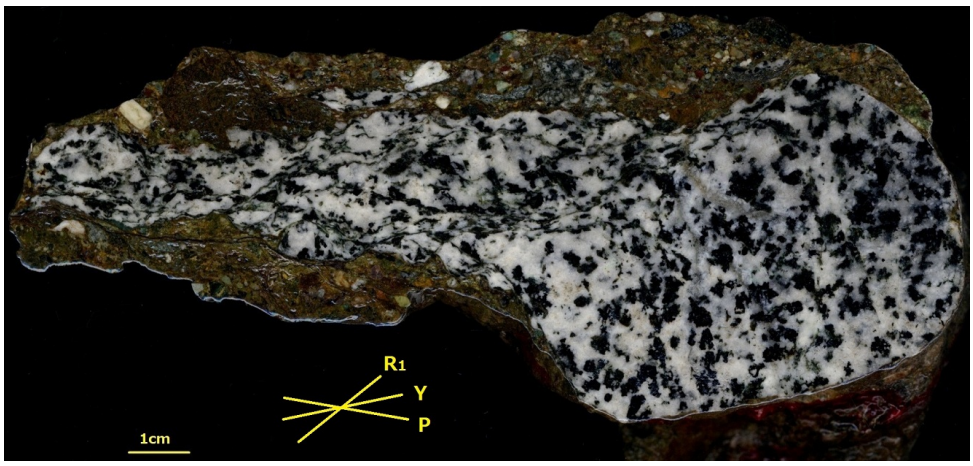
Accordingly, it is assumed that the P-R1 cataclasites formed deep in the crust. This fact contradicts the generally accepted theory that the Ashigara Group is shallow.

3.Various deformation bands of the Shiozawa Formation

There are many deformation bands formed at different depths in the Shiozawa Formation. We have classified them into four types based on differences in the deformation style.

Type A and B have deformed pebbles, which are P-R1 cataclasites. The width of Type A is several meters, whereas Type B is several tens of centimeters. The deformed pebbles concentrate in deformation bands. Type C is characterized by P-R1 cataclasite and fault gouge. Type D has no P-R1 cataclasite structures; it is characterized by planar faults. The pebble shape does not show elongation. Type-D was subdivided into D1, D2, and D3 according to the color of the fault gouge.

Keywords: Ashigara Group, Ddeformed conglomerate



Japan Geoscience Union Meeting 2012
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SGL44-P07 Room:Convention Hall Time:May 23 17:30-18:30

Stratigraphy and tectonic setting of clastic rocks in Jurassic accretionary complex of Cape Shiriya, northern Japan.

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[Introduction]
The Jurassic accretionary complex of Cape Shiriya in northern Japan contains conglomerates and lithic sandstones suggestive of mass wasting on inner trench slopes, as well as large limestone bodies of seamount origin. Dominance of mass-wasting setting on inner trench slopes favors a non-accretionary convergent setting similar to the present-day Japan trench. However, geological processes in such settings are not well studied. The author focuses on recycling processes of accreted materials observed in the Cape Shiriya rocks, and made field mapping, and examined clastic composition and their radiolarian ages. The clastic composition of conglomerates suggests two provenances : a limestone-capped seamount being subducted, and a trench landward slope consisting of previously accreted sandstone and siliceous sedimentary rocks. Because siliceous rock clasts could also be supplied from outer trench slope, radiolarian ages of the siliceous rock clasts are examined to confirm their sources.

[Geologic outline]
Chert, sandstone, and mudstone are dominant along the northwest coast of Cape Shiriya. Whereas on the east coast, conglomerates with clasts and blocks of limestone and chert characteristically occur. In the study area, chert was dated as Late Triassic to Late Jurassic, and mudstones as lastest Jurassic to earliest Cretaceous (Oho and Iwamatsu, 1986 ; Matsuoka, 1987 ; Saito, 2010MS).

[Stratigraphy of clastic rocks]
A gradual lithologic transition from chert via siliceous mudstone to pebbly mudstone and alternation of sandstone and mudstone correlative to ocean plate was observed at Iwaya on the northwest coast. This succession extends to the northeast with folds. Thick conglomerate beds graded into sandstone or mudstone comprise a clastic sedimentary succession at Ataka on the east coast. At Shitsukari on the east coast, one can recognize a fault imbricate stack of peculiar sedimentary successtions, in which chert is overlain by conglomerate with sedimentary contacts.

[Petrological characteristics of conglomerate and sandstone]
In the Cape Shiriya area, conglomerate is typically angular, massive, and unsorted. Some of the conglomerate beds are graded into lithic sandstone. The conglomerate contains variously sized rubbles and clasts of limestone, chert, sandstone, and mudstone with small amounts of quartz, plagioclase, and potassium feldspar particles. The areas adjacent to large limestone bodies on the east coast, the conglomerate beds are dominated by limestone clasts exceeding 50 modal %, and are characterized by sandy matrixes dominantly of chert clasts. In Ataka, far to the north from the limestone bodies, limestone clasts is restricted no greater than 19 modal %, and conglomerate is rich in clasts of chert, sandstone, and mudstone.
Sandstone is classified into two types : one is characterized by the dominance of quartz and feldspar particles compared with lithic fragments. The other type is rich in clasts of siliceous sedimentary rocks. Sandstone of former type characteristically occurs as isolated thick beds among mudstone. Sandstone of later type occurs as those graded from as thin-beded turbidite alternating with mudstone.

[Radiolarian fossils]
Two alternative explanations are possible for the source of siliceous sedimentary clasts : the inner vs. outer trench slopes. Because the fossil age of siliceous sedimentary rock clasts are expected to differ among two options, the author is examining radiolarian ages of siliceous mudstone and chert underlying conglomerate and siliceous rock clasts. To date, Triassic to Jurassic siliceous rock clasts has been detected. In the study area, siliceous mudstones are uppermost Jurassic to lowermost Cretaceous. However, siliceous rock clasts correlative to this range have not been found.

Keywords: Jurassic accretionary complex, seamount, radiolarian age, conglomerate, Cape Shiriya

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SGL44-P08 Room:Convention Hall Time:May 23 17:30-18:30

Geological age of Sarabetsu and Yuchi Formations in and around Teshio plain, Northern Hokkaido

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The Teshio plain is the largest Cenozoic sedimentary basin in Hokkaido, equal to the Ishikari Low-land. Post-Neogene thick sediments, which show shallowing upward successions deposited on environments ranging from shelf to terrestrial environments, are distributed in and around the Teshio plain. Further, these strata show westward depositional migration in response to the movements of depositional centers. Yuchi and Sarabetsu Formations are Plio-Pleistocene sedimentary layers deposited on shallow sea?terrestrial environments in the latest stage of the sedimentary basin. The geological ages of Yuchi and Sarabetsu Formations are defined on the basis of biostratigraphy (pollen and diatom fossils) and fission track ages. Both the strata in the western part beyond the Horonobe Fault are at least 1 million years younger than the strata in the eastern part, and both show contemporaneous heterotopic facies. However, the geological age of both the strata in the Teshio plain is unclear because thick alluvium covers the surface. We conducted the deep drilling survey at a depth of 1000 m in the study site at the coastal zone of the Teshio plain and the laboratory analysis of the core. From the results of the analysis, it is clear that the geology is composed of alluvium until a depth of 90 m, the Sarabetsu Formation at depths ranging between 90 m and 470 m, and the Yuchi Formation at depths ranging between 470 m and 1004 m. Palynological successions of the Yuchi and Sarabetsu Formation were divided into three pollen zones. Further, the Larix zone, which was formed after 1 Ma, has been confirmed at depths between 90 m and 220 m. Tephra, which is approximately 1.5 Ma, has been discovered at a depth of 930 m. The diatom zone has not been recognized because most diatom fossils are redeposited species; however, the presence of confirmed species is consistent with other analytical results. From the results of comprehensive geological analysis, the geological age of Yuchi and Sarabetsu Formation is estimated to be ranging from 0.8 to 1.5 Ma in the study site at depths ranging between 90 m and 1000 m. In addition, the fact that both the strata are in a relationship of contemporaneous heterotopic facies until the Teshio plain is widely accepted. Moreover, both the strata in the Teshio plain are at least 0.5 million years younger than the strata in eastern hilly areas.

Keywords: Geological age, Yuchi Formation, Sarabetsu Formation, Teshio plain, Deep all-core drilling, Coastal area

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A preliminary study of the age distribution of detrital zircons in the Paleo-Mesozoic strata of the South Kitakami Belt

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INTRODUCTION U-Pb LA-ICP-MS dating of detrital zircons was carried out of the Paleo-Mesozoic succession in the South Kitakami Belt, Northeast Japan. The analyzed samples were taken from the following eight geologic units: Devonian Ono Formation, Devonian Nakasato Formation, Upper Permian Toyoma Formation, Hosoura Formation of the Lower Jurassic Shizugawa Group, Sodenohama Formation of the Middle Jurassic Hashiura Group, Oginohama and Oshika formations of the Upper Jurassic to Lower Cretaceous Oshika Group, and the Yoshinohama Formation of the Lower Cretaceous Jusanhama Group. The South Kitakami Belt retains continual succession of shallow-marine to terrestrial strata of Ordovician to Early Cretaceous times, and is very important in analyzing the long-term tectonic and environmental history of the Japanese Islands. This abstract mainly notes the analytical results of the Toyoma and Ayukawa formations.

OUTLINE OF GEOLOGY A Middle to Late Permian succession is exposed along the coast from Cape Iwaizaki to Motoyoshi Town, Kesennuma City, Miyagi Prefecture, in the eastern half of the Shizugawa-Hashiura row. The sandstone sample of the Toyoma Formation was collected from the uppermost part of the formation exposed along the Maehama coast of Motoyoshi Town. The Lower Triassic Inai Group rests upon the Toyoma Group. On the other hand, in the tip of the Oshika Peninsula, a generally southeast facing Upper Jurassic to Lower Cretaceous sequence, with some folds, is exposed. The sandstone sample of the Ayukawa Formation was collected from the Domeki Sandstone Member exposed on the Ayukawa coast, Ayukawa Town, Ishinomaki City, Miyagi Prefecture. The Lower Cretaceous Yamadori Formation, consisting of andesitic volcanic and pyroclastic rocks, rests upon the Ayukawa Formation.

RESULTS The U-Pb dating of the zircons was carried out with the LA-ICP-MS equipped in the Earthquake Research Institute of the University of Tokyo. The Toyoma sandstone contains abundant 250-Ma zircons with the youngest age of 244.2+/-3.3 Ma. The sample also contains zircons of 900 Ma and 400 Ma, but Mesoproterozoic or older zircons are absent. The Ayukawa sandstone contains abundant 130-Ma zircons with the youngest age of 125.9+/-6.3 Ma, and some 400-Ma and Paleoproterozoic zircons. Middle Jurassic to Lower Cretaceous sandstones (Sodenohama, Oginohama, and Yoshinohama formations) do not contain 160 Ma or younger zircons and the youngest age of detrital zircons in each sample is younger than the age inferred from index fossils.

DISCUSSION Although Paleoproterozoic rocks are widely exposed in the North China Block, the Toyoma Formation does not contain Paleoproterozoic zircons but contains 900-Ma zircons probably marking the formation of the South China Block. However further study is needed to search for 900-Ma igneous rock bodies from, for example, the Ogcheon Belt of Korea or Central Asian Orogenic Belt. Although the Permian-Triassic boundary in the Motoyoshi section was usually drawn between the Toyoma Formation and Inai Group, this study indicates a possibility that the Permian-Triassic boundary is in the upper part of the Toyoma Formation. The 130-Ma age of zircons, abundantly contained in the Ayukawa Formation, is the age of metamorphic core complexes sporadically distributed in the North China Block and Central Asian Orogenic Belt, the age of igneous rocks commonly distributed along the eastern coast of the South China Block. We have to look for another signature of North China or South China Block. 158-110 Ma (= magmatic hiatus in Korea; Sagong et al., 2005) zircons are absent in other Middle Jurassic to Lower Cretaceous sandstones. The fact indicates that detrital materials from Korea or North China Block largely contributed to the deposition of these sandstones.

Keywords: U-Pb age, detrital zircon, LA-ICP-MS, South Kitakami Belt, Northeast Japan

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Geochronological study of the Tetori Group and Motodo Formation in Ono City, Fukui Prefecture, Hida and Hida Gaien Belts

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INTRODUCTION Although the Tetori Group is very famous in Japan for dinosaur fossils, the scattered distributions of the group as well as the absence of key beds and scarcity of index fossils make it difficult to assign the precise age of each formation and to correlate formations and members between areas of distribution. The Motodo Formation, on the other hand, is composed mainly of red beds, and is different from the Tetori Group in lithology and distribution. However a conglomerate member of the Motodo Formation yields granadiorite clasts having CHIME zircon ages of 201+/-20 Ma and 202+/-30 Ma, indicating that the Motodo Formation is possibly correlated with some part of the Tetori Group (ca. 170-120 Ma).

GEOLOGIC SETTING The Tetori Group in the study area is divided into the Kuzuryu, Itoshiro, and Akaiwa subgroups in ascending order, and is distributed in the Lake-Kuzuryuko, Ishitoshirogawa-River, and Managawa-River areas of the study area. The following formations of the Tetori Group in the study area have been assumed to be of Jurassic from ammonoid fossils: The Kaizara (Bathonian-Callovian) and Yambarazaka (Oxfordian) formations of the Kuzuryu Subgroup in the Lake-Kuzuryuko and Itoshirogawa-River areas, and the Kamihambara Formation (Early Tithonian) in the Lake-Kuzuryuko area. The Tetori Group in the Managawa-River area is subdivided into the Kuzuryu and Itoshiro subgroups by Yamada *et al.* (1989), but the Middle Formation of the ”Kuzuryu Subgroup” likely yields Early Tithonian ammonoid (Sato, T., personal comm. in Yamada and Uemura, 2008). The Motodo Formation belongs to the Hida Gaien Belt and is composed of the Nakajima Tuff Breccia, Wasadani Conglomerate, and Kumokawa Conglomerate members, in ascending order. The Wasadani Conglomerate Member yields granadiorite clasts mentioned above.

SAMPLE AND METHOD LA-ICP-MS, U-Pb zircon dating was carried out of a sandstone sample of the Itsuki Formation, occupying the upper part of the Itoshiro Subgroup in the Itoshirogawa-River area, a lapilli tuff sample of the Upper Formation of the ”Kuzuryu Subgroup” in the Managawa-River area, and a tuff breccia sample of the Nakajima Tuff Breccia Member of the Motodo Formatin

RESULTS The youngest U-Pb zircon age of the sample from the Itsuki Formation was 127.3+/-2.5 Ma (Barremian). The lapilli tuff sample from the Upper Formation of the ”Kuzuryu Subgroup” in the Managawa-River area was dated as 126.3+/-2.8 Ma (Barremian). The Nakajima Tuff Breccia Member of the Motodo Formation was dated as 254.2+/-2.5 Ma (Wuchiapingian, Late Permian).

DISCUSSION From the geochronological data and previous studies listed above, the Middle to Upper Formations of the ”Kuzuryu Subgroup” in the Managawa-River area can be correlated with the Kamihanbara to Itsuki formations of the Itoshiro Subgroup in the Lake-Kuzuryuko area. The Nakajima Tuff Breccia Member of the Motodo Formation is a product of 254.2+/-2.5 Ma (Wuchiapingian, Late Permian) volcanic activity, which is interpreted to have taken place along the island arc where the sedimentary complexes of the Akiyoshi and Ultra-Tanba belts were accreted.

Keywords: U-Pb age, zircon, LA-ICP-MS, Tetori Group, Motodo Formation

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Jurassic zircons from the Yoshiki Formation

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The ’200Ma zircons’ from the Yoshiki Formation central Japan (Manchuk et al., 2011) will be verified at this presentation.

Japan Geoscience Union Meeting 2012
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SGL44-P12 Room:Convention Hall Time:May 23 17:30-18:30

Permian-Jurassic evolution of the arc-trench system of Japan along the eastern margin of continental Asia

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INTRODUCTION Permian-Jurassic arc-trench system forms the backbone of the Japanese Islands. This study added new LA-ICP-MS U-Pb detrital zircon ages from sandstone of accretionary complexes (AC's) in Southwest (SW) Japan to the results of previous studies, and outlined Permian-Jurassic evolution of the arc-trench system of Japan. We studied sandstone samples of the following geologic units: Akiyoshi AC (Ota Group), Ultra-Tamba AC (Kamitaki and Ajima formations), and Mino AC (Kamiaso Formation) in the Inner Zone of SW Japan. In addition, we studied sandstone samples from the Chichibu Composite Belt (Agekura Formation and Ryokami Unit) of the Outer Zone of SW Japan, although the results are omitted from this abstract.

OUTLINE OF GEOLOGY The Akiyoshi AC consists of Early Carboniferous to late Middle Permian pelagic sedimentary rocks, and late Middle Permian to early Late Permian siliciclastic rocks (e.g. Kanmera *et al.*, 1990). The period of deposition of the oceanic-plate stratigraphy (OPS) ranges 90 m.y. The Ultra-Tamba AC on the other hand consists of Middle to Late Permian pelagic sedimentary rocks, and Late Permian to Middle Triassic siliciclastic rocks (e.g. Sugamori, 2008, 2011), indicating that the OPS was deposited in much shorter period than that of the Akiyoshi AC. The Mino AC consists of Late Carboniferous to Middle Jurassic pelagic sedimentary rocks, and Late Triassic to earliest Cretaceous siliciclastic rocks (e.g. Wakita, 1988).

RESULTS All sandstone samples are of lithic or feldspathic sandstone, and those from the Akiyoshi and Ultra-Tamba AC's contain high proportion of volcanic rock fragments, suggesting that the youngest zircon age is close to the age of deposition. The youngest ages are 253.9+/-6.9 Ma for the Ota Group, 238.0+/-3.9 Ma for the Kamitaki Formation, and 248.3+/-5.2 Ma for the Ajima Formation. These samples contain virtually no Precambrian zircons, and 90% or more zircons in each sample are of 300 Ma or younger. On the other hand 54% of zircons in the sandstone sample of the Kamiaso Formation are of Precambrian.

DISCUSSION From the age distribution of the detrital zircons, the sedimentary tectonic setting of the samples except that of the Kamiaso Formation is a forearc basin or trench of an oceanic island arc started to develop at about 300 Ma. The Ultra-Tamba AC is interpreted to have accreted to the Maizuru Oceanic Island Arc (e.g. Hayasaka *et al.*, 1996), the original geologic entity of the Maizuru Belt. The Akiyoshi AC, on the other hand, is now distributed on the continental side of the Maizuru Belt, but we interpret that it was also originally accreted to the Maizuru Arc. The 310-235Ma zircons, abundantly extracted in the present study, have also been reported from pyroclastic to volcaniclastic rocks of the Nishiki and Ota groups of the Akiyoshi Belt, the Maizuru Group of the Maizuru Belt, and the Motodo Formation of the Hida Gaien Belt. The provenance oceanic island arc of the sandstones in the present study, may have supplied the constituent grains of these pyroclastic to volcaniclastic rocks.

From the results and discussion presented above, Permian-Jurassic evolution of the arc-trench system of Japan can be summarized as follows.

1. An old oceanic plate was subducted beneath the Maizuru Oceanic Island Arc initiated at about 300 Ma (Early Permian) and formed the Akiyoshi AC in Late Permian. The Yakuno igneous complex and the basal tuff breccia of the Motodo Formation in the Hida Gaien Belt are traces of igneous arc at that time.
2. A young oceanic plate or marginal sea plate was subducted beneath the Maizuru Arc and formed the Ultra-Tamba AC in Early to Middle Triassic. The granitoids in the Hida Belt and the Korean Peninsula are traces of igneous arc at that time.
3. In Jurassic, the Maizuru Arc changed into a continental arc and an old oceanic plate was subducted beneath it and formed the Mino AC. The granitoids in the Korean Peninsula are a trace of igneous arc at that time.

Keywords: U-Pb age, detrital zircon, LA-ICP-MS, Permian-Jurassic evolution of arc-trench system, eastern margin of continental Asia, Maizuru Oceanic Island Arc

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Contribution of Precambrian clastic materials to the Jurassic accretionary complexes of Japan

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INTRODUCTION Jurassic accretionary prisms are distributed in three geologic belts in Southwest Japan: in the Tanba-Mino, Northern Chichibu, and Southern Chichibu belts from the present-day continental side. There are two contrasting ideas on the origin of this parallel distribution of accretionary prisms. (1) The three Jurassic accretionary prisms form a single tabular geologic unit beneath Paleozoic geologic units and expose along two axes of anticline and the southern limb of the southernmost syncline; and (2) the accretionary prisms were formed along a single subduction zone but have rearranged to the present form by Cretaceous sinistral movements along the Kurosegawa Tectonic Belt and the Median Tectonic Line. This study aims to compare the petrography and the age-distribution of detrital zircons of sandstone samples from the three geologic belts, and to give a constraint to the problem mentioned above.

SAMPLES AND METHOD Sandstone samples were collected from the chert-clastics sequences from the three belts. A Middle Jurassic sandstone sample (11072401) was collected from the Kamiaso Formation of the Tanba?Mino Belt, another Middle Jurassic sample (11031503) from the Nakaoi Unit of the Northern Chichibu Belt, two Middle Jurassic samples (11031403, 11031601) and two Middle to Upper Jurassic samples (11031602, -05) the Togano Unit of the Southern Chichibu Belt. Thin sections of each sample were prepared and their modal compositions were calculated through the standard point-counting method under microscope. On the other hand, 200 zircons were collected for each sample through standard crushing, panning and heavy-liquid techniques. The U-Pb dating of the zircons was carried out with the LA-ICP-MS equipped in the Earthquake Research Institute of the University of Tokyo.

RESULTS The modal analysis indicates that all the samples are of lithic sandstone, but with substantial proportion of quartz and feldspar grains and with virtually no volcanic-rock fragments. The youngest age of detrital zircons in each sample approximately corresponds to the age of underlying mudstone inferred from radiolarian biostratigraphy. The proportion of Precambrian zircons decreases from the Middle Jurassic sandstone of the Mino Belt (54%), through the coeval sandstone of the Northern Chichibu Belt (26%) and Southern Chichibu Belt (16-15%), to the Middle to Upper Jurassic sandstone of the Southern Chichibu Belt (9-8%).

DISCUSSION The proportion of Precambrian zircons in the four Middle Jurassic sandstone samples indicates that the Mino sandstone was deposited in a trench close to the North China Block where Precambrian basement rocks were widely exposed; the Northern Chichibu sandstone may have been deposited in a little farther part of the trench from the North China Block than the Mino sandstone, and the Southern Chichibu sandstone in a much farther part. The interpretation is concordant with model (2) in the first paragraph. The petrography of the sandstones, on the other hand, indicates the deposition in front of a recycled orogenic belt. The petrographical characteristics are discordant with the normal arc-trench system and need further examination.

Keywords: U-Pb age, detrital zircon, LA-ICP-MS, Mino Belt, North chichibu Belt, South chichibu Belt

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Contribution of two arc-trench systems to the formation of proto-Japan

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The Japanese Islands are assumed to have developed for 500 m.y. in a single arc-trench system along the continental margin of East Asia (e.g. Isozaki and Maruyama, 1990). However, our preliminary study of age distribution of detrital zircons in Paleo-Mesozoic sandstones and psammitic schists of Japan, together with previous geological studies, has revealed that the Japanese Islands contain elements of at least two arc-trench systems that initiated by Jurassic Period. Here follow the summary of our data and their implications.

CAMBRIAN?-EARLY PERMIAN ARC-TRENCH SYSTEM In the South Kitakami Belt, arc igneous activity had started by 466 Ma (Middle Ordovician) and Siluro-Devonian sandstone contains high proportion of Precambrian detrital zircons (Shimojo et al., 2010), suggesting that the igneous activity took place in a continental arc. Our new dating results also added evidence for Middle Paleozoic felsic volcanic activity in the South Kitakami Belt; the upper age limits of tuffaceous sandstone samples of the Ono and Nakasato formations are 424.8+/-7.4 Ma and 392.6+/-5.3 Ma, respectively. Previous stratigraphic studies suggest that the arc igneous activity lasted until Early Permian (e.g. Kawamura et al., 1990). Geologic belts and units containing the elements of the arc-trench system in and around this age range can be listed as follows: Cambrian Daioin Granites and the Akazawa Formation in the Hitachi area of the Abukuma Belt (Tagiri et al., 2011), Hida Gaien Belt (e.g. Tsukada, 1997), Kurosegawa Belt, Oeyama Ophiolite (Arai, 1980; Tsujimori et al., 2005), 300 Ma high-P/T metamorphic rocks of the Renge and Nedamo belts (Nishimura, 1998; Uchino et al., 2008), and accretionary complex (AC) of the Nedamo Belt (Uchino et al., 2005). These elements likely formed an arc-trench system in Cambrian to Early Permian times, where the sedimentary complex of the Nedamo Belt and high-P/T metamorphic rocks of the Renge and Nedamo belts accreted to a continental arc that formed pre-Middle Permian igneous rocks in the South Kitakami, Kurosegawa, and Hida Gaien belts. The South Kitakami Belt retains only a little evidence for Middle Permian to earliest Cretaceous igneous activity.

EARLY PERMIAN-EARLIEST CRETACEOUS ARC-TRENCH SYSTEM Zircon data of non-metamorphosed Late Permian to Middle Triassic AC are reported by Morita et al. in this abstract volume. In west Chugoku region, the constituent rocks of the Maizuru or Akiyoshi belt are underlain by the metamorphic rocks of the Suo Belt, and the youngest age of detrital zircons in psammitic schist samples of the Suo Belt gradually becomes younger downward, from 220 Ma to 180 Ma. In east Chugoku to Kinki regions, the Ultra-Tanba AC is underlain by the Late Triassic to earliest Cretaceous Tanba-Mino AC, which also has downward-younging age polarity according to previous studies of radiolarians. On the other hand, we found that the ages of basal tuff breccia of the Motodo Formation (Hida Gaien Belt) and felsic tuff of the Maizuru Group (Maizuru Belt) are 254.2+/-2.5 Ma and 276+/-16 Ma, respectively. Moreover Triassic to Jurassic granitoids have been well known in the Hida Belt and the Korean Peninsula.

Previous studies have already demonstrated that the main part of the Maizuru Belt is composed of rocks and strata of an oceanic island arc-backarc basin system initiated in Early Permian time (e.g. Hayasaka et al., 1996). We tentatively assume that the Permian to earliest Cretaceous elements listed above formed an arc-trench system, which initiated as the Maizuru oceanic arc-trench system in Early Permian and gradually evolved to a continental arc-trench system. Precambrian zircons from continental basements were supplied to the trench from Middle-Late Triassic times. We thus interpret that the arc-trench system that formed the framework of proto-Japan shifted from ”South Kitakami continental arc-trench system” to ”Maizuru oceanic island arc-trench system” in Early Permian.

Keywords: U-Pb age, detrital zircon, LA-ICP-MS, proto-Japan, two arc-trench systems