Oral presentation | S3: Tectonics of East Asia (Special Session)

Sat. Sep 18, 2021 10:00 AM - 12:00 PM JST | Sat. Sep 18, 2021 1:00 AM - 3:00 AM UTC | Zoom
Session 1

S3: Tectonics of East Asia (Special Session)

Chairperson:Kosuke Kimura(KOSEN, Kure College), Kaushik Das(Hiroshima Univ. Sci.)

[Chairperson]
Kosuke Kimura: S3-01 - S3-03
Kaushik Das: S3-04 - S3-06

10:00 AM - 10:15 AM JST | 1:00 AM - 1:15 AM UTC

[S3-01] Zircon U-Pb dating of granitoids in western Nagasaki, southwest Japan

*Yukiyasu Tsutsumi[1], Kenichiro Tani[1] (1. Department of Geology and Paleontology, National Museum of Nature and Science)

10:15 AM - 10:45 AM JST | 1:15 AM - 1:45 AM UTC

[S3-02] Multi-stage metamorphic history of the Oki gneisses in Japan: Implications for Paleoproterozoic metamorphism
and tectonic correlations in northeastern Asia

*Takeshi Imayama[1], Ryoichi Kawabata[1], Takenori Kato[2], Chang Whan Oh[3], Kenji Horie[4], Mami Takehara[4] (1. Okayama Univ. of Sci., 2. Nagoya Univ., 3. Jeonbuk National Univ., 4. NIPR)

10:45 AM - 11:00 AM JST | 1:45 AM - 2:00 AM UTC

[S3-03] **Tonoshiki breccia recording the signature of the closure of Maizuru back-arc basin during Permian-Triassic boundary**

*Larissa NGOMBI MAVOUNGOU[1], Kaushik DAS[1,2], Yasutaka HAYASAKA[1,2], Kenta KAWAGUCHI[3], Jun-ichi ANDO[1,2] (1. Hiroshima Univ. Sci., 2. HIPER, 3. Jeonbuk Nat. Univ., Korea)

11:00 AM - 11:15 AM JST | 2:00 AM - 2:15 AM UTC

[S3-04] Mixing process of oceanic crust of BAB spectrum and continental crust in the Maizuru belt, SW Japan

*Yasutaka Hayasaka[1] (1. Hiroshima Uni. Sci.)

11:15 AM - 11:30 AM JST | 2:15 AM - 2:30 AM UTC

[S3-05] Age variation of granitoids of Tsuwano Complex, SW Japan

*Kosuke Kimura[1], Yasutaka Hayasaka[2], Tomoyuki Shibata[2], Kaushik Das[2], Kenta Kawaguchi[3] (1. KOSEN, Kure College, 2. Hiroshima Univ. Sci., 3. Jeonbuk Nat. Univ.)

11:30 AM - 12:00 PM JST | 2:30 AM - 3:00 AM UTC

[S3-06] The tectonic evolution of the Northeast Asia including Korea and Japan from Permian to Cretaceous

*Chang Whan Oh[1] (1. Jeonbuk National Univ., Republic of Korea)

長崎県西部の花崗岩類のジルコン U-Pb 年代

堤　之恭・谷　健一郎（国立科学博物館）

Zircon U-Pb dating of granitoids in western Nagasaki, southwest Japan

Yukiyasu TSUTSUMI*, Kenichiro TANI (Natl. Mus. Nat. Sci.)

Zircons U-Pb ages were obtained from granitoids in western Nagasaki Prefecture. Considering the ages, it is thought that granitoids in Enoshima Island and Irose Shoal emplaced ~100 Ma whereas Oseto and Otate emplaced in ~97 Ma and Oseto suffered later activity in ~90 Ma. These ages are equivalent of the granitoids in the Ryoke belt. The Oseto granodiorite contacts the Nagasaki Metamorphic Complex which is equivalent of the Sanbagawa belt, across the Yobukonoseto fault system. These data will be important when considering the framework of Kyushu.

長崎県の西彼杵半島と五島列島との間は「相の島帯」とよばれ，花崗岩を含む先第三紀基盤岩が伏在している．西彼杵半島西端の大瀬戸花崗閃緑岩と，「大立島背斜」に沿って東から小立島，大立島，色瀬，江島に花崗岩質岩の露出が確認できる．これらの花崗岩質岩についてジルコン年代測定を行った．その結果，江島・色瀬・大立島の花崗岩試料からは年代を得られた．しかし小立島のジルコン年代は明確なピークを成さず，また大瀬戸花崗閃緑岩の年代は分散が大きく，有効な年代とは言い難い（右図）．

年代的には，より西の江島・色瀬が約 100 Ma，大立島が約 97 Ma を示し，この間にギャップが存在すると思われる．また，大瀬戸花崗閃緑岩は約 97 Ma に形成されたものが後（90 Ma 頃？）の熱影響を被っている可能性がある．

これらの年代は北部九州を含む領家花崗岩の年代に対応し，大瀬戸花崗閃緑岩は呼子ノ瀬戸断層系を介して三波川帯に対応する長崎変成岩と接する．この事実は，九州の地体構造を論じる上で意味を持つと考えられる．

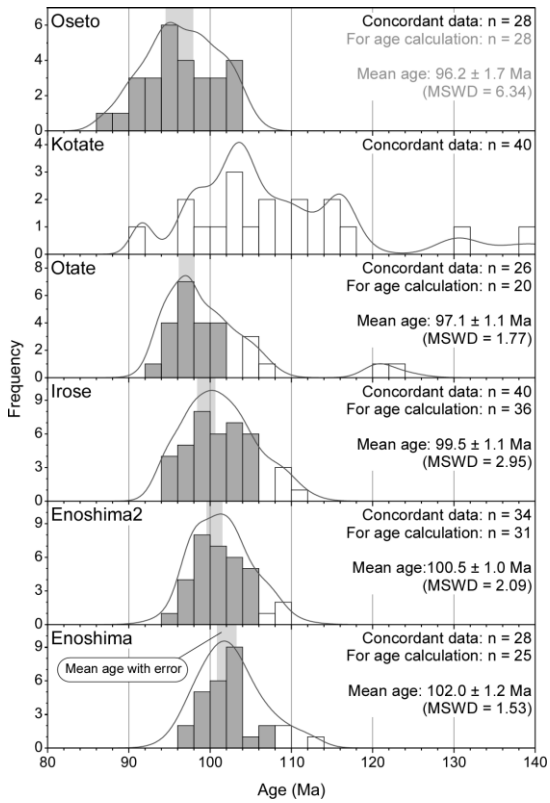

Figure.　Histograms of age data of the samples. Errors of weighted mean ages are 95% conf.

Keywords: zircon, U-Pb age, granitoid, Nagasaki, Ryoke

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日本列島隠岐片麻岩類の複数変成史：古原生代変成作用と北東アジアのテクトニクス

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Multi-stage metamorphic history of the Oki gneisses in Japan: Implications for Paleoproterozoic metamorphism and tectonic correlations in northeastern Asia

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Metamorphic P–T conditions, monazite chemical ages, and zircon U–Pb ages from the gneisses exposed in the Oki belt, Japan, were integrated to unravel the multi-stage metamorphic history of the belt. Microstructural observations combined with obtained P–T conditions and metamorphic ages reveal three distinct stages of metamorphism: M1, M2, and M3. The M1 stage occurred c. 1.85 Ga with high-T granulite-facies metamorphism (793–803°C and 9.8–12.3 kbar and 738–755°C and 9.1–12.0 kbar in the southwestern and southeastern Oki gneisses, respectively). The age of the M1 stage is well recorded in monazites included in large garnet porphyroblasts and low Th/U metamorphic rims in zircons from the Oki gneisses. The M1 metamorphism was overprinted by c. 230 Ma metamorphism (M2), which occurred at granulite-facies conditions (817–829°C and 9.0–10.3 kbar) in the southwestern Oki gneisses and at upper amphibolite-facies conditions (693°C and 5.3 kbar) in the southeastern Oki gneisses. Monazites in small garnets, euhedral zircons, and outermost rims of zircons crystallized during this stage. The final metamorphism occurred as retrograde amphibolite-facies recrystallization (M3) at conditions of 558–638°C and 3.7–4.8 kbar. The inherited cores in zircons yield ages from Paleoarchean to Paleoproterozoic but lack Paleozoic ages. The detrital zircon distribution and the Paleoproterozoic metamorphic event in the Oki belt support the idea that the Oki gneisses are fragments of a Precambrian terrane rather than Paleozoic sediments derived from the terrane. Combined with previous studies, we concluded that the c. 1.85 Ga M1 high-T granulite-facies metamorphism in the Oki belt could be related to that of the Jiao-Liao-Ji belt in the eastern North China block via the northern Gyeonggi and Nangrim Massifs on the Korean Peninsula, whereas the c. 250–230 Ma M2 stage could be associated with collision between the North and South China blocks. The Oki belt geologically corresponds to the northern Gyeonggi Massif in South Korea due to their similar Paleoproterozoic and Triassic tectonothermal events.

Keywords: Multi-stage metamorphic history, Oki belt, Paleoproterozoic metamorphic event, Triassic tectonic event

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Tonoshiki breccia recording the signature of the closure of Maizuru back-arc basin during Permian-Triassic boundary

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Tonoshiki Formation, a breccia-dominated unit which is made up of different sized extremely angular clasts occurred in Maizuru back-arc basin that closed during Late Permian. One of the dominant types is a breccia dominated by mafic rock clasts derived from the Yakuno ophiolites. Recently, clasts with different features, mostly felsic shallow crustal rocks fragments, have been found in the breccia. These two types of breccia might not only differ in terms of their petrology, but they are likely to also present different geochronological and microstructural characteristics. In this study, we report the depositional timing and some microstructural features for Tonoshiki breccia. The detrital zircon LA-ICP-MS dating of Tonoshiki breccia provide Latest Permian maximum depositional ages of 259 and 251 Ma for the mafic-rock clast-rich type and the felsic-rock block-dominated unit, respectively. These characteristics of Tonoshiki breccia suggest its formation as a result of two phases of tectonic activity-induced debris flow occurring during Late Permian. The optical microscopic observation of 2 specimens of Tonoshiki breccia reveal several microstructural features for both types. The two types of Tonoshiki breccia commonly display internal fracturing within several single clasts (e.g., tonalitic, rhyolitic rock fragments). Moreover, evidence of hydraulic fracturing has been found in both types of the breccia. In contrast, following two different types of veins are prominent for both types. Prehnite-pumpellyite and quartz-filled veins are found in the mafic rock-clast rich unit whereas a network of multi-directional calcite-filled fractures are present in some felsic rock fragments. The examination of a Triassic sandstone sample of the Fukumoto Formation under optical microscope does not reveal any evidence of hydraulic fracturing. This provides a possible constraint for the timing of veins formation in Tonoshiki breccia. The development of veins was triggered by fluid overpressure that possibly occurred during the last evolutional stage of Maizuru back-arc basin represented by the collision with the eastern margin of the East Asian continent, which marks the present Maizuru terrane. The Permo-Triassic transition in Maizuru-back-arc basin is characterized by the deposition of Tonoshiki breccia during two pulses of tectonic activity and is accompanied by hydraulic fractures affecting the breccia. Hydraulic fracturing might represent the tectonic signature related to the closure of the basin.

Keywords: Basin closure, Hydraulic fracturing, Late Permian, Maizuru back-arc basin, Tonoshiki breccia.

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舞鶴帯における背弧盆性海洋地殻と大陸地殻の混合過程

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Mixing process of oceanic crust of BAB spectrum and continental crust in the Maizuru belt, SW Japan

Yasutaka Hayasaka* (Hiroshima Univ.)

舞鶴帯の構成：舞鶴帯は模式地の舞鶴–大江地域において北帯，中帯，南帯に三分される．北帯は圧砕花崗岩類を主とし，変斑れい岩–ドレライトや少量の泥質片麻岩を伴い，南帯は変斑れい岩–ドレライト主体で，圧砕花崗岩を伴う火成岩複合岩体からなる．その間に存在する中帯には主としてペルム系舞鶴層群と，これを不整合に覆うトリアス系夜久野層群，難破江層群が分布し，変斑れい岩や圧砕花崗岩などのレンズ状小岩体がテクトニックに「貫入」している．舞鶴帯を構成する変斑れい岩–ドレライトや圧砕花崗岩類などは，一括して夜久野岩類と呼ばれている．

夜久野岩類の起源と年代：南帯の夜久野岩類は，前期石炭紀の約 340 Ma に形成された海洋プレート内にペルム紀前・中期の 290-270 Ma に形成・成長した海洋内島弧地殻起源である（早坂ほか，1996）が， 石炭紀の海洋地殻の大部分は背弧盆起源である（Suda et al., 2014）．北帯は模式地の舞鶴–大江地域で断層によって東部の舞鶴花崗岩（Ca. 280-240 Ma）と西部の桑飼岩体（Ca. 440-400 Ma, 290 Ma）に分けられる（池田・早坂，1994; Fujii et al., 2008; Tsutsumi et al., 2014）．これらを近隣の大陸地殻と比較すると，桑飼岩体はロシア沿海州のハンカ地塊に，舞鶴花崗岩は飛騨帯のペルム紀–ジュラ紀花崗岩類と共に，北朝鮮北東端の咸北帯の豆満江複合岩体に対比される．桑飼複合岩体の西方延長は岡山県久米地域の取首山岩体（Ca. 490-300 Ma; 原田ほか，2015）である．中帯の夜久野岩類は，大部分 290-270 Ma の背弧盆起源の変斑れい岩（小出，1986）や花崗岩類からなるが，津和野地域には新太古代–古原生代，およびシルル・デボン紀の花崗岩類やメタコーツァイトなどからなる大陸クラトン起源の津和野コンプレックスが伴われる．(木村ほか，2019; Kimura et al., 2021).

海洋地殻と大陸地殻の混合プロセス：中帯の西方延長である福山市北部の山野層群などに厚さ 50 m 以上の半遠洋性赤色珪質粘土岩が伴われることから，中帯の起源となった背弧盆は現在の四国海盆ほどの広さになって海洋性の地殻を伴っていたと推定される．そこに大陸クラトンの断片が伴われるのは，日本海のように，大陸縁内で形成・拡大する際に大和堆のような大陸地殻の断片を取り残した背弧盆が収束したためと考えられる．その後舞鶴帯は幅の広い右横ずれ運動によってメランジュ化した．

Keywords: Maizuru belt, Yakuno complex, Tsuwano complex, closure of back-arc basin

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舞鶴帯津和野コンプレックス花崗岩質岩の年代の多様性

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Age variation of granitoids of Tsuwano Complex, SW Japan

Kosuke Kimura* (KOSEN, Kure College), Yasutaka Hayasaka, Tomoyuki Shibata, Kaushik Das (Hiroshima Univ.), and Kenta Kawaguchi (Jeonbuk National Univ.)

島根県津和野地域の舞鶴帯から見出された新太古代–古原生代の花崗片麻岩，花崗岩類やメタコーツァイトなどからなる津和野コンプレックス(木村ほか, 2019; Kimura et al., 2021)のうち, 特に花崗岩類の年代バリエーションをより広く詳細に把握するため，津和野地域西部に露出する戸谷川岩体(新称)の花崗岩質岩 5 試料，部栄岩体の花崗岩質岩 1 試料のジルコン，および戸谷川岩体のメタコーツァイト 1 試料の砕屑性ジルコンの U-Pb 年代を LA-ICP-MS を用いて測定した．

戸谷川岩体は西北西-東南東方向に伸びた長さ約 1 km, 幅約 100 m のレンズ状小岩体であり，戸谷川沿いに露出する．メタドレライトと花崗岩質岩を主体とし，メタコーツァイトを伴う．花崗岩質岩は主に石英，斜長石，カリ長石からなり，いずれも強いカタクラシスを被っているが，火成岩組織を残している．メタコーツァイトは少量のカリ長石を伴う．

戸谷川岩体の花崗岩質岩 2 試料からは 1842 ± 9 Ma と 771 ± 5 Ma の単一年代がそれぞれ得られた．別の 2 試料からは，波動累帯構造を示すリム部から 479 ± 5 Ma の年代 (Th/U < 0.1)が，コアから約 915–845 Ma と約 815–755 Ma の inherited 年代がともに得られた．更に 1 試料からは約 490–400 Ma の年代が得られた．また部栄岩体からは 1760 ± 11 Ma の年代が得られた．一方，メタコーツァイトからは約 2705–2140 Ma (n = 21/102)のコンコーダント年代が得られ，約 2675 Ma に最大のピークを持つ. また約 1850 Ma にも Th/U 比が 0.1 未満のコンコーダントなデータが 1 点認められる．

戸谷川岩体の花崗岩質岩は VAG の特徴を示し, 771 Ma のものは特に高い A/CNK(>1.5) を示す. 一方，部栄岩体のものは A タイプ花崗岩であり，WPG の特徴を示す.

戸谷川岩体にも古原生代の花崗岩類およびメタコーツァイトが分布していることが明らかとなった．戸谷川岩体から得られた 915–755 Ma の年代は, 南中国地塊で最大のピークを形成しているが北中国地塊の南縁にも知られており，韓半島の京畿地塊北部から狼林地塊南部に延長している(Lee et al., 2020). また 1.8–1.75 Ga の A タイプ花崗岩は例えば北中国地塊南縁で知られており(Bai et al., 2021)，コロンビア超大陸の分裂に伴うリフトの活動との関連が指摘されている．今後アジア大陸との精密な対比によって，津和野コンプレックスの起源を制約する．

Keywords: Maizuru Terrane, Tsuwano Complex, Zircon U-Pb age

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The tectonic evolution of the Northeast Asia including Korea and Japan from Permian to Cretaceous

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The Permo-Triassic collision between the North and South China Cratons (NCC and SCC) occurred in the Korean Peninsula (KP). The tectonic model in which the collision was considered to occur along the Hongseong-Odesan collision belt in the Gyeonggi Massif (GM), is most suitable one because it can explain most recent new geological findings and Korea-China correlation. During the collision, the subduction began along the south margin of the SCC. Another Permo-Triassic collision between the NCC and Khangka Block occurred along the Dumangang belt in the northeast KP. Whereas the subduction zone was maintained in the east coast of the northern KP, forming the Paleozoic-Triassic subduction complex which is now the Paleozoic subduction complex in the southwest Japan. During the Permo-Triassic time, the collision and post collision related igneous activities occurred in the northern GM, Nangrim Massif and Kwanmo Massif, whereas the subduction related igneous activities occurred along the southern margin of the KP. During Jurassic before 190 Ma, the subduction related igneous activities occurred in the southern and eastern margins of the KP and the Hida and Oki belts in Japan. After 190-180 Ma, the subduction related igneous activities stopped in Japan and the southeastern and eastern margins of the KP, representing movement of arc front towards west and northwest with decreasing subduction angle. During 180~150 Ma, the igneous activities occurred regionally in the northeast China and inner part of the Korean Peninsula, representing a flat subduction under the Northeast Asia which continued until 145 Ma. After 145 Ma, the Cretaceous igneous activities moved southeastwards from Beijing through Sandong and Liaoning areas to KP until 80 Ma. The Cretaceous igneous activities occurred due to the mantle uplift caused by slab roll-back. The southeastwards movement occurred due to the movement of location where mantle uplift with destruction of flat subducted oceanic slab. On the other hand, the subduction related Cretaceous igneous activities occurred from 128 Ma in Japan, which is not coincide with a southeastwards trend of decreasing age of the Cretaceous igneous activities. These data indicate that the subducted slab below Japan was disconnected from that under the KP at 128 Na due to extension tectonic regime in the Northeast Asia and then began to subduct separately under Japan. The extensional regime was stopped at 80 Ma with stopping of mantle upwelling related igneous activities in the KP and was changed into compressional regime with subduction related igneous activities occurred along the southern margin of the KP and in Japan.

Key words; Permo-Triassic collision, Jurassic flat subduction, Cretaceous slab roll-back, Northeast Asia

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