

*In-situ* U-Pb dating of zircons from the Eoarchean Itsaq Gneiss and supracrustal rocks in the Isua area, southern West Greenland: Reappraisal of geochronology and tectonics of the Isua supracrustal belt

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It is considered that emergence of life and operation of plate tectonics date back to the Eoarchean or Hadean. But, the Archean rocks are preserved only in few blocks; thus it is important to determine the age of the Isua supracrustal belt (ISB) in the Itsaq Gneiss Complex because previous works reported evidence for the plate tectonics and vestige of life from the ISB. Previous works of U-Pb dating of zircons from orthogneisses in the Isua area suggested that northern part of the ISB and an orthogneiss batholith in the northern area have younger ages of *ca.* 3700 Ma whereas the southern part and orthogneiss rocks in the southern area have older ages of *ca.* over 3800 Ma. Nutman et al. (2009) proposed that they were separately formed and subsequently collided and amalgamated with each other around 3690 to 3660 Ma because of the difference in the ages between the northern and southern areas. They also suggested that in this case, the suture zone was located along a chert layer at the center of the belt.

We separated zircons from three northern orthogneisses, five southern orthogneisses and two felsic sedimentary rocks in the ISB, and conducted Cathodoluminescence (CL) observations, U-Pb dating with LA-ICP-MS, and LA-Raman analyses to estimate the influence of metamictization. The CL observations showed that some zircons still preserve magmatic oscillatory zoning in the core, and that zircons from the northern area have relatively darker CL intensity than those from southern area. The zircons from the felsic sedimentary rocks have relatively bright CL intensity, and oscillatory zoning with ambiguous boundaries. The CL observations suggest that influence of secondary thermal events increased from for the zircons in southern orthogneisses through ISB to northern orthogneisses. The LA-Raman analyses can constrain the degree of recrystallization or restoration of mineral structures during later thermal events. The zircons from the northern orthogneisses are more restored than those from the southern orthogneisses. In contrast to the CL observations, the zircons in the ISB suffered the most severely from the later restoration than any others. The combination of the CL and LA-Raman observations indicates especially, the zircons from the ISB had suffered severe secondary thermal events, but the mineralogical structures were partially restored possibly due to thermal events of granitoid intrusions so that their CL images and LA-Raman analyses are inconsistent each other. Because both the mineralogical restoration and destruction resulted in Pb loss, it is considered that the zircons in the ISB underwent more significant Pb loss. The U-Pb ages of the zircons from the northern orthogneisses range from *ca.* 3660 to 3780 Ma whereas the zircons from the southern orthogneisses have ages from *ca.* 3750 to 3850 Ma. The zircons from the ISB range from 3660 to 3750 Ma. The relationship between zircons from the northern orthogneisses and ISB is inconsistent with geological relationship, which the orthogneisses were intruded into the ISB. The geochronological data of zircons should be reconsidered in the points of the mineralogical restoration and destruction; thus the accretionary model for the formation of ISB is still valid.

Keywords: Isua supracrustal belt, U-Pb dating of zircons