

## Geology and Geochronology of the Acasta Gneiss Complex at ca. 4.0 Ga, Slave Province, Canada

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The Acasta gneisses in the Slave province of northwestern Canada are known as the oldest terrestrial rocks identified so far (Bowring and Williams, 1999). We made a detailed geologic map of the Acasta Gneiss Complex in 2002. The Acasta Gneiss Complex mainly comprises Gray Gneiss, White Gneiss, Layered Gneiss and Foliated Granite, with many aplitic and mafic dikes. The mapped area is subdivided into two units by a northeast-trending fault. The eastern region mainly consists of Gray Gneiss (quartz dioritic gneiss) and White Gneiss (tonalitic to granitic gneiss). Field relationship indicates that the Gray Gneiss occurs as enclaves in the White Gneiss. On the other hand, the western region is mainly composed of Layered Gneiss and Foliated Granite. The Layered Gneiss is characterized by both compositional banding and foliation, and is intruded by granite sheets (Foliated Granite). Mafic dikes intruded into both the granite and gneisses, and were metamorphosed under the epidote-amphibolite to amphibolite facies condition.

The comprehensive investigation on the geologic evidence and the dating of zircon and sphene demonstrates tectonothermal history in the Acasta Gneiss Complex; (1) intrusion of quartz dioritic magma (Gray Gneiss) before 4.0 Ga, (2) emplacement of tonalitic to granitic magma (White Gneiss 1) at 4.0 Ga, (3) emplacement of tonalitic to granitic magma 2 (White Gneiss 2), and gneissic structure of Gray Gneiss and White Gneiss at 3.75 Ga, (4) emplacement of tonalitic to granitic magma 3 (White Gneiss 3) in the eastern region, and intrusion of granitic sheets (Foliated Granite) at ca. 3.6 Ga, (5) fault at the boundary between eastern and western parts, (6) intrusion of mafic dikes, (7) under the epidote-amphibolite to amphibolite facies metamorphism

The oldest terrestrial rocks identified so far are 4.0 Ga tonalitic and granitic gneisses (White Gneiss) in the Acasta Gneiss Complex (Bowring and Williams, 1999). This work indicates that quartz dioritic gneiss (Gray Gneiss) is older than 4.0 Ga. Moreover, the evidence of partial melting of some Gray Gneiss enclaves within the White Gneiss suggest that the early-formed quartz diorite (Gray Gneiss) older than 4.0 Ga was assimilated into the tonalitic magma (White Gneiss) during the emplacement, which is consistent with the enriched isotopic characteristics of the Acasta gneisses (Bowring and Housh, 1995, Bowring and Williams, 1999).