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^{40}Ar-^{39}Ar biotite geochronology: new insights into the magmatic evolution of the Proterozoic in the Baltic Sea region

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The Precambrian crust below the Baltic Sea constitutes a southeastern extension of the Fennoscandian Shield, but is mostly covered by Phanerozoic sedimentary rocks. However, the Precambrian crust in this region can be studied in material from numerous drillings and through geophysical data. A shift from the 1.89-1.90 Ga Svecofennian crust in the northern and central parts of Gotland to the 1.77-1.81 Ga Transscandinavian Igneous Belt (TIB) in the southernmost tip of this island was recognized by Sundblad et al. (2003), together with the presence of 1.49 Ga granite at Grötlingbo in the southern part of Gotland. This granite intruded during the 1.55-1.40 Ga Danopolonian orogeny (Bogdanova et al. 2001), which affected the southwestern part of the Fennoscandian Shield.

In this study, nine ^{40}Ar–^{39}Ar biotite age determinations were carried out to constrain the cooling history of the Precambrian crust in the Baltic Sea region. Biotite was collected from drill sites (mostly percussion drillings) from the depths of 162 to 1648 m.

Four biotite age populations have been identified: 1.61 Ga, 1.53 Ga, 1.45-1.31 Ga and 1.04 Ga, which represent post-magmatic cooling and are in agreement with the results presented by Söderlund et al. (2008). Biotite grains from the 1800 Ma Böda Hamn quartz monzodiorite (northernmost tip of Öland) yielded an age of 1610±12 Ma, which is interpreted to date cooling of the rock below the biotite closure temperature of 300 ˚C. The 1530±12 Ma Ar-Ar age of a deformed granitoid east of Gotland probably reflects cooling after the emplacement of the adjacent and voluminous ∼1.58 Ga Riga pluton. The largest Ar-Ar age population (1.45-1.31 Ga; six analyses) may be correlated with the Danopolonian orogeny. The four of these from southern Gotland and adjacent off shore areas could represent cooling associated with the nearby Grötlingbo granite. The other two are enigmatic due to their location (northern Öland and offshore Latvia), yet still may indicate a Danopolonian thermal effect. The Ar-Ar age 1041±10 Ma, obtained for the Petes granitoid in the southern part of Gotland, reflects an even later thermal influence, probably associated with the Sveconorwegian orogeny and/or the emplacement of the Blekinge-Dalarna Dolerite group at ∼1000 Ma.

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