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Precambrian basement of Estonia

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The papers in this issue illustrate the present state of research and understandings of Precambrian rocks and their evolution in the Estonian basement. More than 20 years ago – in 1983 – the monograph (in Russian) *Kristallicheskij fundament Èstonii* (The crystalline basement of Estonia) was published. The monograph summarizes comprehensive studies of drill core samples over the period of more than three decades. Although Armin Öpik was the first to propose about half a century ago that the Estonian basement belongs to the Svecofennian orogenic system, the precise position of the Estonian Precambrian rocks within the framework of the Fennoscandian Shield is still open to debate.

Until the late 1980s, geologists believed that the granulitic rocks of the South Estonian complex were Archaean, or at least pre-Svecofennian, in age (e.g. Puura et al. 1983; Gorbatschev & Gaal 1987). This assumption was strongly based on lithological correlations of granulitic facies rocks with those of the Kola series and on an idea, famous among the Soviet geologists, that the regional granulite facies rocks should be older than their lower-grade counterparts. Since reliable isotopic age data were very limited at that time, the field observations and petrography were a major source of information for geological correlations.

In the early 1990s, several short-term international projects on the Estonian Precambrian geology were launched. The results of the Sm-Nd and U-Pb isotopic studies (e.g. Huhma et al. 1991; Petersell & Levchenkov 1994) suggested that the South Estonian granulites were more likely early Proterozoic than Archaean in age. The latest isotopic studies have confirmed the Proterozoic ages of Estonian granulites. The metamorphic conditions of South Estonian granulites were also studied during this period (Hölttä & Klein 1991).

In the mid-1990s, the research activities slowed down somewhat, while, using the geological information on the Estonian basement and adjacent areas, two geo-

logical maps were compiled (Koistinen 1994; Koppelmaa 2002). The latter map at a scale of 1 : 400 000 is based on the results of petrographical, petrophysical, and geochemical investigations of 32 500 m of Estonian drill cores.

The papers of this issue provide an overview of present general geological understandings and also show possible new directions of the future Precambrian studies. Main outlines and a compilation of new data on the Estonian Precambrian are provided in the paper by A. Soesoo, V. Puura, J. Kirs, V. Petersell, M. Niin, and T. All. The authors also give some new age determinations. T. All, V. Puura, and R. Vaher used a new compilation of gravity and seismic data, including deep seismic sounding data, to study the orogenic structure of the basement of Estonia. They modelled the structure of the crust quantitatively for two NNE–SSW trending profiles across the main – southwestern and northeastern structural zones. Lateral variability of the basement structure was revised in the paper using the available geological and geophysical maps, and results of 3D modelling. The metamorphic conditions and the possible age of granulite metamorphism are evaluated by V. Puura, R. Hints, H. Huhma, V. Klein, M. Konsa, R. Kuldkepp, I. Mänttäri, and A. Soesoo. The authors show that the granulitic rocks of South Estonia resemble those of the Pielavesi granulites in Central Finland, while the U-Pb age of monazite (1778 ± 2 Ma) and the Sm-Nd age of garnet (1728 ± 24 Ma) are clearly younger than any comparable ages from granulites in Finland. The anorogenic magmatic rocks within the Estonian basement have been relatively well studied. The paper by J. Kirs, I. Haapala, and O. T. Rämö summarizes the previous studies on the Estonian K-granite rocks and rapakivi-like Riga batholith and provides some new data.

New tools in hard rock geology revolve around the determination of low-abundance elements and isotopes at the millimetre-scale, and understanding the geological processes at different scales (from mineral to crustal scale) and across the scales. We hope that these new views promote Estonian hard rock geology also in the future.

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