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Ilmo Kukkonen, Toni Veikkolainen, Suvi Heinonen, Fredrik Karell, Elena Kozlovskaya, Arto Luttinen, Kaisa Nikkilä, Vesa Nykänen, Markku Poutanen, Pietari Skyttä, Eija Tanskanen and Timo Tiira

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U-Pb zircon dating of igneous rocks in the Salo area, SW Finland

M. Väisänen[1], J. Kara[1], H. Penttinen[1], Y. Lahaye[2], H. O'Brien[2] and P. Skyttä[1]

[1]Department of Geography and Geology, FI-20014 University of Turku, Finland
[2]Geological Survey of Finland, FI-02150 Espoo, Finland
E-mail: markku.vaisanen@utu.fi

The bedrock of the Salo area in SW Finland is mainly occupied by granitoids. We dated five granitoids and two mafic volcanic rocks with single zircon method. The granitoids fall in two age groups, 1.86–1.85 and 1.83–1.82 Ga. Mafic plutonic rocks occur in both age groups. The volcanic rocks are 1.90 and 1.89 Ga in age. Further, the samples display two periods of metamorphic zircon growth at 1.86 and 1.83 Ga, synchronous with the granitoid magmatism.

Keywords: U-Pb, zircon, granitoids, metamorphism

1. Introduction

The Svecofennian bedrock in the Salo area in SW Finland defines a 30x40 km wide rhomboidal-shaped map area dominated mainly by plutonic rocks intercalated by minor migmatitic paragneisses, mafic volcanic rocks and calcareous gneisses. In the northern part, the granitoids are granites, granodiorites and minor quartz diorites, while the southern part is occupied by the porphyric Perniö granite (Figure 2).

Opposing to the surrounding areas, the Salo area is characterised by gently-dipping structures, including common isoclinal recumbent folds within paragneisses and volcanic rocks. These folds are intruded by subhorisontal sheets of granitoids (Figure 1; Aho et al. 2014).

Figure 1. Subhorisontal supracrustal rocks and granitoids along the E18 motor way road cut in the Salo area.

In this project we performed age determinations on different igneous rocks across the study area. Some previous zircon results are presented in Penttinen et al. (2016) and Penttinen (2019), which are shown in Figure 2. In this contribution we present additional seven zircon age determinations. The analyses were performed in the Finnish Geosciences Research Laboratory at the Geological Survey of Finland, Espoo, using the LA-MC-ICP-MS method, except for the Paimio gabbro and granodiorite samples which were analysed with the LA-SC-ICP-MS method.

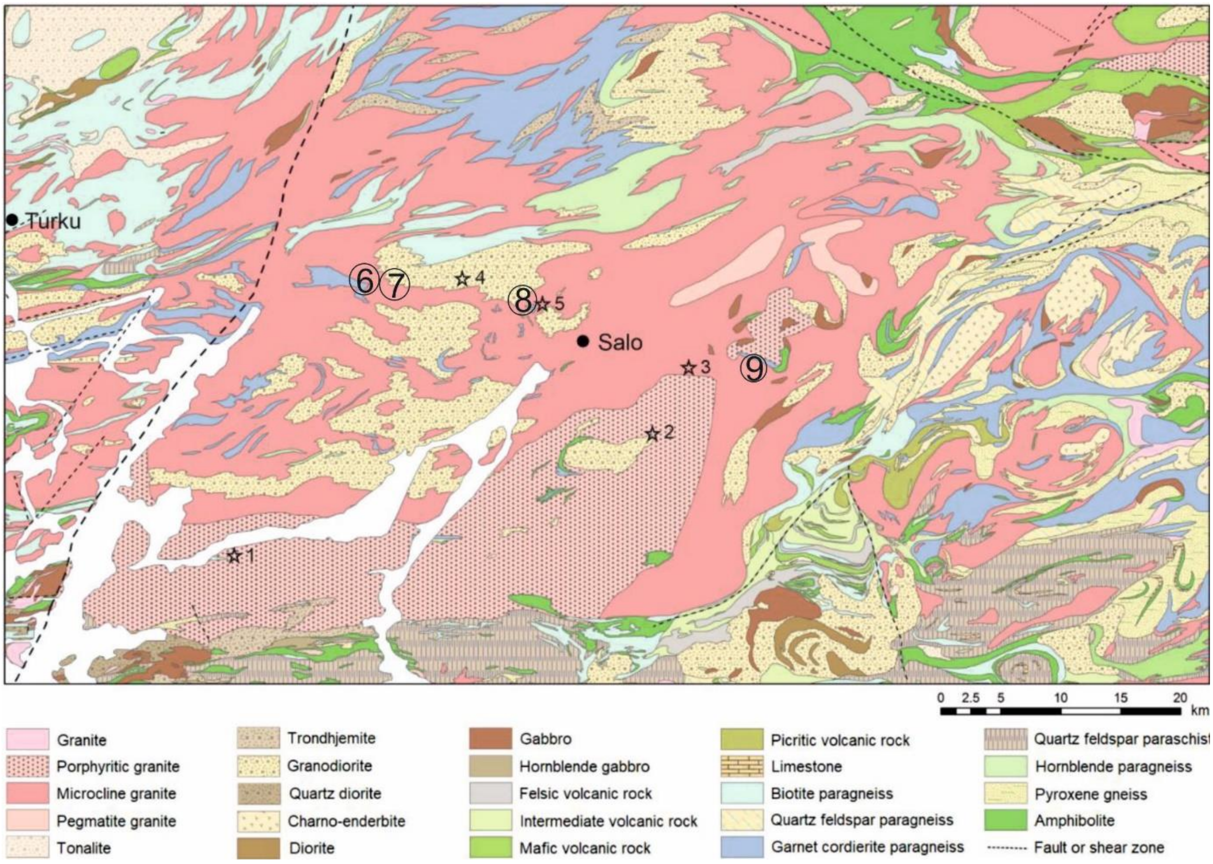

Figure 2. Geological map of the Salo area, modified after Bedrock map of Finland, DigiKP and Penttinen (2019). Sampling locations indicated: 1) Perniö granite, Pungböle (c. 1.84 Ga; Kurhila et al. 2005), 2) Perniö granite, Kistola (c. 1.85 Ga; Kurhila et al. 2010), 3) Muurla granite (1.82 Ga; Penttinen 2019) and Muurla gabbro (c. 1.83; Väisänen et al. 2014), 4) Hiittenmäki granite (c. 1.86 Ga; Penttinen et al. 2016, Penttinen 2019), 5) Hurtinmäki granite (c. 1.85 Ga; Penttinen et al. 2016, Penttinen 2019), 6) Paimio granodiorite and gabbro (this study), 7) Ilttula granite (this study) 8) Hurtinmäki mafic volcanic rock (this study), 9) Kruusila mafic volcanic rock, Kruusila granite and Kruusila pegmatite (this study).

2. Results

Seven U-Pb zircon age determinations are presented. The sampling locations are shown in Figure 2 and the results are summarized in Table 1.

3. Discussion

The oldest igneous rocks in the Salo area are the two dated volcanic rocks from Hurtinmäki and Kruusila, 1.89 and 1.90 Ga, respectively. The latter is the oldest volcanic rock so far discovered in Southern Svecofennia (cf. Kara et al. 2018). The plutonic rocks are of two ages, 1.86–1.85 and 1.83-1.82 Ga. The 1.83-1.82 Ga granites resemble the common migmatising granites in southern Finland (e.g. Ehlers et al. 1993, Skyttä & Mänttäri 2008, Kurhila et al. 2010). However, the Perniö granite in the southern part of the area seems to be slightly older (Figure 2). Previously found 1.86–1.85 Ga magmatism in southern Finland has occurred as minor dykes and sills (Väisänen et al. 2012; Nevalainen et al. 2014; Kara et al. 2020). Therefore, the Salo area rather resembles the Ljusdal batholith in central Sweden where 1.86 Ga granitoids are common (Högdahl et al. 2008).

Table 1. Overview of the age results of this study.

Sample name	ID/Figure 2	Rock type	Setting	Age (Ga)
Paimio	6	Granodiorite	Plutonic	1.86 Ga
Paimio	6	Gabbro	Rounded enclaves in granodiorite	1.86 (core), 1.83 (rim)
Ilttula	7	Granite	Dyke along fold axial surface	1.81
Hurtinmäki	8	Intermed.-mafic volcano-sedim. rock	banded	from 2.1 to 1.91 (inherited) 1.89 major cluster 1.86 & 1.83 younger populations
Kruusila	9	Mafic volcanic rock	layered	1.92 (inherited); 1.90 major group 1.86 & 1.83 younger populations
Kruusila	9	Granite	Subhorisontal sheet	1.82
Kruusila	9	Pegmatite	Steeply crosscutting dyke	1.82

A conspicuous feature is the lack of evidence for the 1.88 Ma magmatism in the area, which is after all the main crustal growth period in the Svecofennian orogen (e.g. Korsman et al. 1999). The rhomboidal shape of the Salo area resembles a pull-apart basin evoking a question whether the area originally formed by extension of older Svecofennian orogeny (see the orogenic collapse model of Lahtinen et al. 2005 and the retreating subduction zone model of Hermansson et al. 2008).

Two younger ages (1.86 and 1.83 Ga) found in the older rocks are interpreted to be metamorphic. The 1.86 Ga metamorphic age has not previously been found but it is very logical regarding the amount of 1.86 Ga granitoids in the area. The 1.83-1.82 Ga metamorphic age is comparable to other lateorogenic ages elsewhere in southern Finland (Väisänen et al. 2002, Mouri et al. 2005). Both 1.86 and 1.82 Ga metamorphic events also have corresponding magmatic events. Both thermal pulses also contain mafic magmatism, exemplified by the Paimio gabbro (this study) and the Muurla gabbro (Väisänen et al. 2014). The connection of mafic magmatism and metamorphism suggests that the mafic magmatism together with radioactive decay (Kukkonen and Lauri 2009) is a possible heat source for high heat flow needed for melting.

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