INSTITUTE OF SEISMOLOGY
UNIVERSITY OF HELSINKI
REPORT S-67

LITHOSPHERE 2018

TENTH SYMPOSIUM ON STRUCTURE, COMPOSITION AND EVOLUTION OF THE LITHOSPHERE

PROGRAMME AND EXTENDED ABSTRACTS

Edited by

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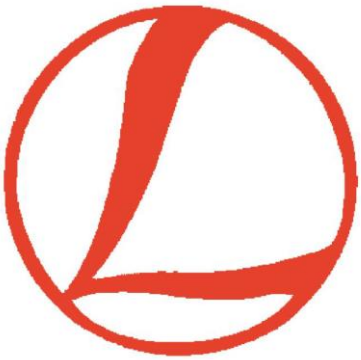

University of Oulu,
November 14-16, 2018

Oulu 2018

Geochronology, geochemistry and structural setting of the Uunimäki gold mineralisation, SW Finland

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The Uunimäki gabbro was studied by zircon U-Pb geochronology which yielded an age of ~1.89 Ga, making it one of the oldest plutonic rocks in the Häme Belt. Geochemical analysis of the gabbro reveals that it lacks several characteristics for typical subduction zone rocks: (i) it does not have a negative Ta-Nb anomaly compared to average NMORB-composition, (ii) it shows a rather unfractionated REE pattern, (iii) it lacks clear enrichment of fluid-mobile elements (e.g. Ba, Rb, Th, Pb). Structurally, the Uunimäki gabbro is located at the intersection of several regional features: (i) steep NE-plunging folds, (ii) a ENE-WSW-trending deformation zone immediately to the north and (iii) a large N-S-trending deformation zone to the west. The gabbro itself has been deformed under both brittle and ductile conditions by primarily NW-SE-trending faults and shears.

Keywords: geochronology, geochemistry, structural geology, orogenic gold

1. Introduction

A two-year joint project between the Geological Survey of Finland (GTK) and the University of Turku was launched in the spring of 2017. Goals of the project include further structural mapping and interpretation of some previously discovered orogenic gold prospects in SW Finland (see also Kara et al. 2018, Pitkälä et al. 2018, this issue). The Uunimäki mineralisation was first discovered by GTK in 2008, during mapping of Au-critical fault and shear zones in spatially associated with gabbros (Kärkkäinen et al. 2016). The mineralisation was studied during the next decade by field mapping, till geochemistry, ground geophysical surveys and core drilling. The aim of this study is to (i) determine the age of the Uunimäki gabbro, (ii) link the mineralisation to the structural evolution of the western part of the Häme Belt, (iii) compare the hosting lithology of the Uunimäki mineralisation to the nearby Jokisivu and Palokallio gold mineralisations.

2. Geological setting

The Uunimäki mineralisation is located in the NW Häme Belt (Fig. 1) which was formed during the magmatic arc stage of the Svecofennian Orogeny at 1.90-1.87 Ga (Lahtinen et al. 2005). The lithology of the area consists of metavolcanic and metasedimentary rocks intruded by syn- and post-kinematic gabbros, diorites, tonalites, granodiorites, granites and pegmatites (Kähkönen 2005; Mäkitie et al. 2016; Nironen et al. 2016). The area has undergone polyphase deformation, with shear activity occurring post-peak metamorphism (Nironen 1999, Saalmann et al. 2010). In addition to Uunimäki, the western Häme Belt is host to other several orogenic gold occurrences (Eilu et al. 2012).

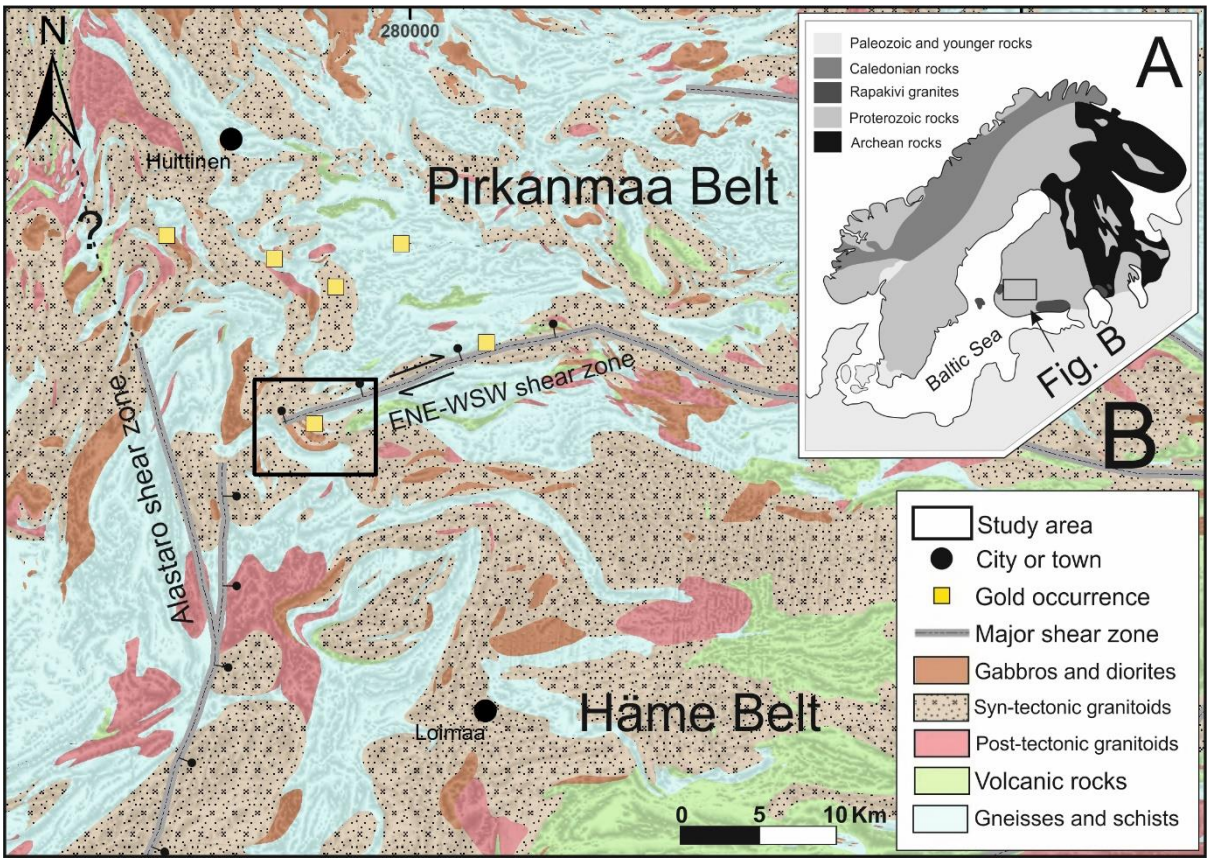

Figure 9. A: Overview of the Fennoscandian Shield modified after Koistinen et al. (2001), B: Lithological and structural map of the Häme Belt with the Uunimäki gold prospect marked by a black rectangle.

3. Petrology and geochemistry

The Uunimäki gabbro is exposed as a 1000 x 700 m large oval-shaped intrusion where the longest axis is NW-SE oriented. The gabbro is mostly medium-grained and equigranular, dark to dark-gray in color. The mineralogy of the gabbro consists of labradorite, amphibole that has been metamorphosed from clinopyroxene, biotite, and accessory ilmenite.

In the TAS-diagram the Uunimäki samples classify as gabbros due to their low SiO_2 and alkali contents. The gabbro shows slight enrichment in Fe_2O_3, Al_2O_3 and TiO_2 and depletion in MgO, K_2O and Ni compared to other gold-hosting mafic intrusive rocks in the area. Trace element concentrations show that the gabbro does not have a negative Nb-Ta anomaly which is typical for subduction zone rocks. The gabbro is only very slightly enriched in LREEs compared to HREEs. Furthermore, due to its low Th-concentration, and comparatively high Zr- and Nb-concentrations, the gabbro has more of an E-MORB affinity than a calc-alkaline volcanic arc affinity (Fig. 2).

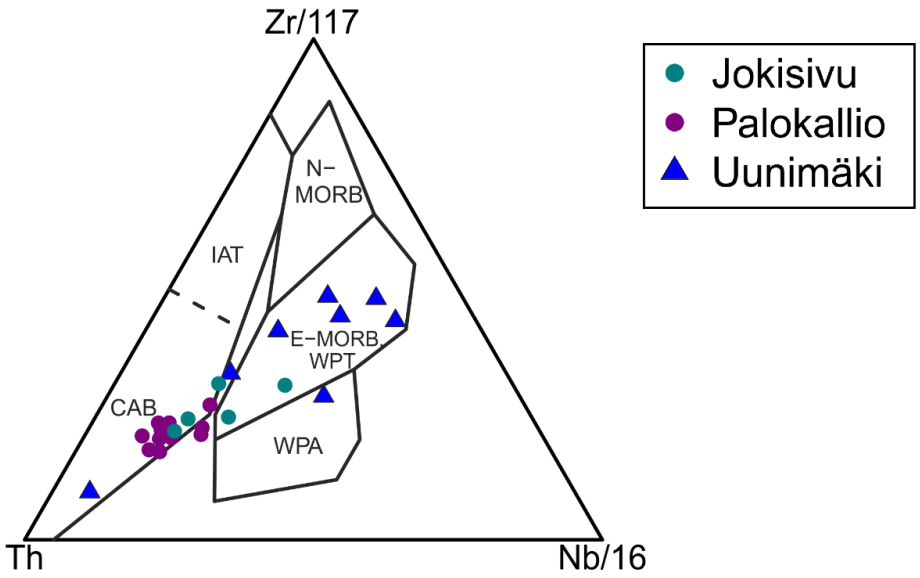

Figure 10. *Samples from the Uunimäki gabbro plotted into the Th-Nb-Zr diagram (Wood et al. 1979). Samples from the Jokisivu and Palokallio gold-hosting diorites shown for comparison.*

4. Geochronology

Zircons from an Uunimäki gabbro sample were separated for age determination. The U-Pb zircon age of the gabbro was determined in the Finnish Geoscience Research Laboratory at GTK, Espoo by laser ablation inductively coupled mass spectrometry (LA-ICP-MS). The analyses yielded a concordia age of ~1.89 Ga.

5. Structural setting

Structural mapping in the field supported by aeromagnetic geophysical maps show that the Uunimäki gabbro is located near the intersection of several regional structures. A zone of steeply NE- to E- plunging folds runs through the western Häme Belt, from Jokisivu through Uunimäki to Oripää. The folded area near Uunimäki has been reworked by two younger deformation zones: the N-S-trending Alastaro shear zone to the west, and the ENE-WSW-trending deformation zone just north of Uunimäki (Fig. 1). The Alastaro shear zone has been interpreted to be mostly a dip-slip-type zone, with the western block having a relative upwards movement. The ENE-WSW-trending shear and fault zone is also mostly dip-slip-type based on the lineation data. Some outcrops along the zone have a significant strike-slip-component as well as shown by the gentler plunging lineations associated with dextral shear sense indicators in the field. Thin sections from samples with steeply plunging lineations indicate a north-block-up sense of shear.

Though most outcrops of the Uunimäki gabbro look relatively ‘healthy’, deformation can be observed as shear bands and larger shear zones are inferred to be in topographic depressions between the individual outcrops. The gabbros close to these valleys usually appear more fractured, are crosscut by quartz veins and appear as a paler-gray in color.

6. Discussion and conclusions

The geochemical and geochronological differences between the Uunimäki gabbro and the other mafic plutonic rocks in the Häme Belt raise some questions. The gabbro does not show geochemical signatures of subduction and it is older than the other compared plutonic rocks. It is possible that the gabbro is from the same source as e.g., the Jokisivu diorite, but is simply more primitive, less fractionated. But the differences in trace element compositions raise the question

whether the gabbro could have been formed in an entirely different geotectonic environment, as the geochemical affinity of the gabbro resembles that of an EMORB rather than that of a subduction-related calc-alkaline rock.

The Uunimäki gold mineralisation fits the criteria of a typical Svecofennian orogenic gold deposit as outlined by Eilu et al. (2003): (i) the relatively small-scale shears that crosscut the Uunimäki gabbro are likely to be second-order structures caused by the nearby regional structures, (ii) the gold mineralisation at Uunimäki is hosted by a mafic intrusive rock, (iii) the host rock has been metamorphosed in amphibolite facies condition, as evidenced by the replacement of clinopyroxene with amphibole.

Acknowledgements
This study was funded by the Geological Survey of Finland.

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