

# On the age and stratigraphic position of the Niskavaara Formation, Posio, North Finland



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Short Communication

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Räsänen & Vaasjoki (2001) stated, that the age of a felsic volcanic rock at Niskavaara located in southwestern tip of the Palaeoproterozoic Kuusamo belt, North Finland, is  $2800 \pm 8$  Ma and consequently, the Niskavaara Formation should be considered as an individual stratigraphic unit belonging to the late Archaean belt extending from Sodankylä via Kuusamo to Puolanka.

We restudied and sampled the Niskavaara area. The hill of Niskavaara itself is poorly exposed and only a few, small outcrops occur at

the lakeside north of it (Fig. 1). At Niskavaara, the rocks dip moderately and face to the south-east. They are subdivided into a schist-dominated lower part and overlying arkosite unit. The lowermost unit of the western part consists of greenish, massive-looking, but thinly laminated, chloritic sericite schists. These are overlain by laminated – thinly bedded and graded bedded heteroliths (Fig. 2). Up-section, structurally similar sericite schists overlie the latter. The dated sample A906 (op. cit.) has been collect-

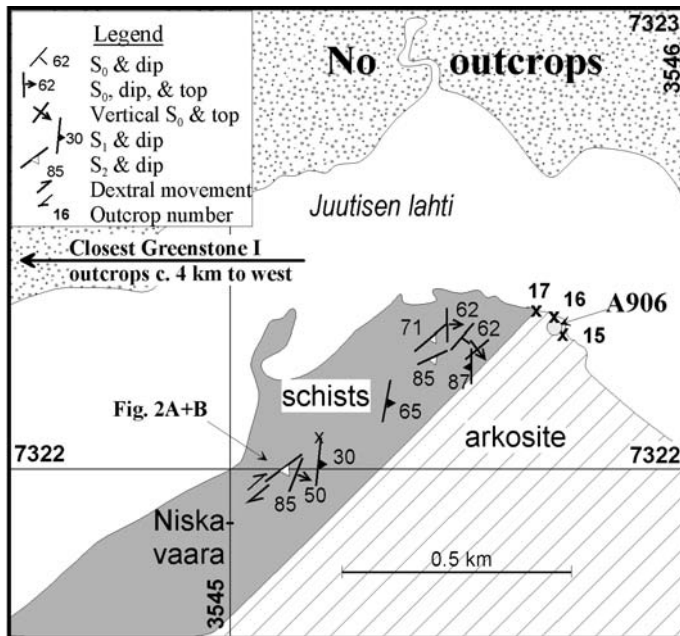


Fig. 1. Geological map of the Niskavaara area (for location see Figs. 1 and 3 in Räsänen & Vaasjoki 2001). Location of outcrops in Fig. 2 and sample A906/Räsänen & Vaasjoki 2001 are shown. Finnish national coordinates are indicated.

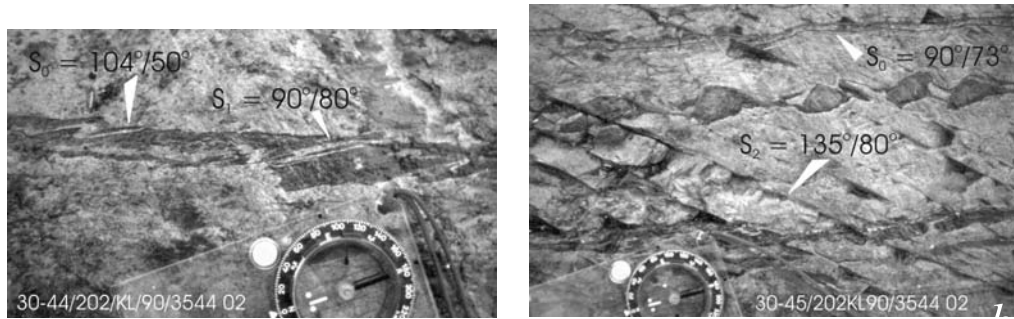


Fig. 2. Photographs of the Niskavaara heterolith showing: a) local foliation  $S_1$ , and b) local foliation  $S_2$  (raw data). The compass is 12.5 cm long and the light needle of its head points to the north.

ed from an outcrop at the lakeshore (Fig. 1), where predominantly foliated arkosites are exposed (Fig. 3a). Räsänen & Vaajoki (2001) described the rock from which the sample A906 derived as a massive, about 10 m thick, acid volcanic unit. However, we were not able to find any acid volcanic rock in the vicinity of the sample location. In order to solve this dilemma, we borrowed the thin section of the sample A906 from the collections of the Geological Survey of Finland. It appeared that the rock is similar to our arkosite samples. It is blastoclastic with rounded quartz, polycrystalline quartz, plutonic plagioclase, and lithic granitoid clasts in a scanty muscovite-chlorite matrix (Fig. 3b). Its zircons are well rounded indicating detrital origin (cf. op. cit., p. 149). With these characteristics the Niskavaara arkosite resembles typical arkosites from the basal parts of the Paleoproterozoic cover of the Archaean granitoid basement in northern Finland.

The fact that the dated rock is an arkosite instead of an acid volcanic rock means that the  $2800 \pm 8$  Ma age gives only the maximum depositional age for the arkosite, but it does not prove that the Niskavaara Formation is Archaean. Consequently, this age is not relevant for determining a lithostratigraphic position of the Niskavaara Formation. Thus, geologic field relations supported by single-grain zircon dating remain the only tools for assessing a lithostratigraphic position. Unfortunately, the area is very poorly exposed and, above this, it is located just east of the Hirvaskoski shear zone. How-

ever, geophysical studies (Airo, 1999) indicate that the mafic metalavas of the Posio greenstone [which has been correlated with Silvennoinen's (1972) Greenstone I in the Kuusamo belt] dips under the Niskavaara formation. Inconveniently, geological mapping cannot verify whether or not this is a primary stratigraphic relationship, as a 3–4 km wide unexposed zone lies between these two units. However, younging of the Niskavaara formation to the east supports this interpretation. The implied stratigraphic order from the west to the east would be as follows: Posio greenstone – chlorite schist – heterolith – sericite schist – arkosite. This succession is essentially similar to the Greenstone I (upper part is tuffitic) – sericite quartzite formation (lower part is arkosic) in the Kuusamo belt (Silvennoinen, 1972). Silvennoinen (op. cit.) considered the tuffite schist above the Greenstone I as its weathering product. Similarly, the sericite rich schists of the Niskavaara Formation could also represent water-laid weathering products of the Posio greenstone, a correlative of the Greenstone I.

Deformation features of the Niskavaara Formation do not reveal any Archaean deformation, but local  $S_1$  and  $S_2$  foliations on rather well-preserved and moderately metamorphosed (garnet grade) heteroliths can be correlated with the regional  $D_3$  and  $D_4$  structures of the Paleoproterozoic shear zone network in northern Finland (Kärki et al., 1993).

We conclude that reliable proofs for an Archaean age of the Niskavaara formation are lack-

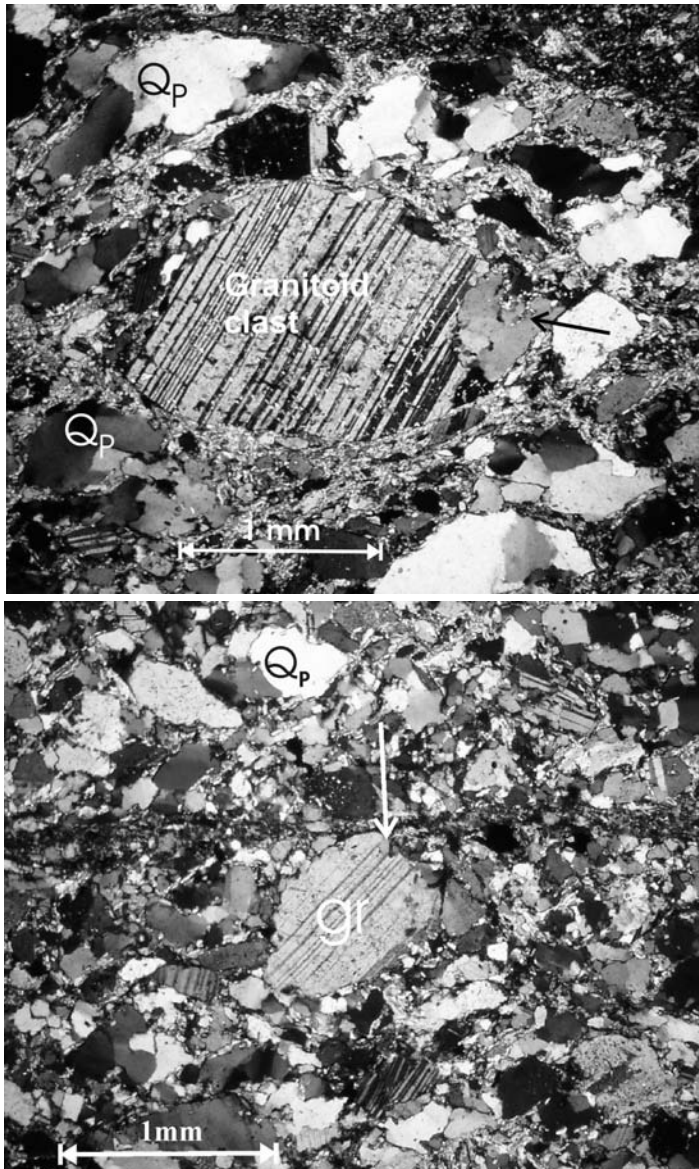


Fig. 3. Microphotographs (crossed polars) of arkosites at Niskavaara: a) Blastoclastic arkosite from outcrop 15 in Fig. 1 with a well-rounded granitoid clast consisting of plagioclase (twinned) and quartz tip (black arrow); b) Sample A906 blastoclastic arkosite with a well-rounded granitoid clast (gr) and polycrystalline quartz clasts (Qp). The former consists of plagioclase (twinned) and minor quartz (arrow). Thin section courtesy Geological Survey of Finland.

ing, and, in the light of our present knowledge, no Archaean belt is indicated.

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