Petrography of the metamorphic rocks in the Kabofe and Jaikreek area, Marowijne Greenstone Belt, Suriname

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INTRODUCTION

The Marowijne Greenstone Belt of northeastern Suriname is bounded on both its northern and southern flanks by a narrow belt of high-grade metamorphic rocks, together labeled as Sara's Lust Gneiss. This study aims to investigate whether the southern flank is similar to the northern one, and whether there is a relation with similar high-grade rocks in southwestern Suriname, the Coeroeni Gneiss Belt. The study areas are along the southwestern flank of the Marowijne greenstone belt, bordered by a zone of high-grade metamorphic rocks. According to Kroonenberg, et al. (2016) the southwestern flank predominantly consists of garnet-biotite gneisses, andalusite-cordierite sillimanite schists and ortho- and clinopyroxene gneisses in which the presence of orthopyroxene, if metamorphic, would evidence that metamorphic conditions were up to granulite facies. It is, however, unknown whether orthopyroxene is present as a magmatic or a metamorphic mineral. Nonetheless, according to Goumans (2019) the Sara's Lust Gneisses in the northern flank mainly consist of amphibolite facies metamorphic rocks.

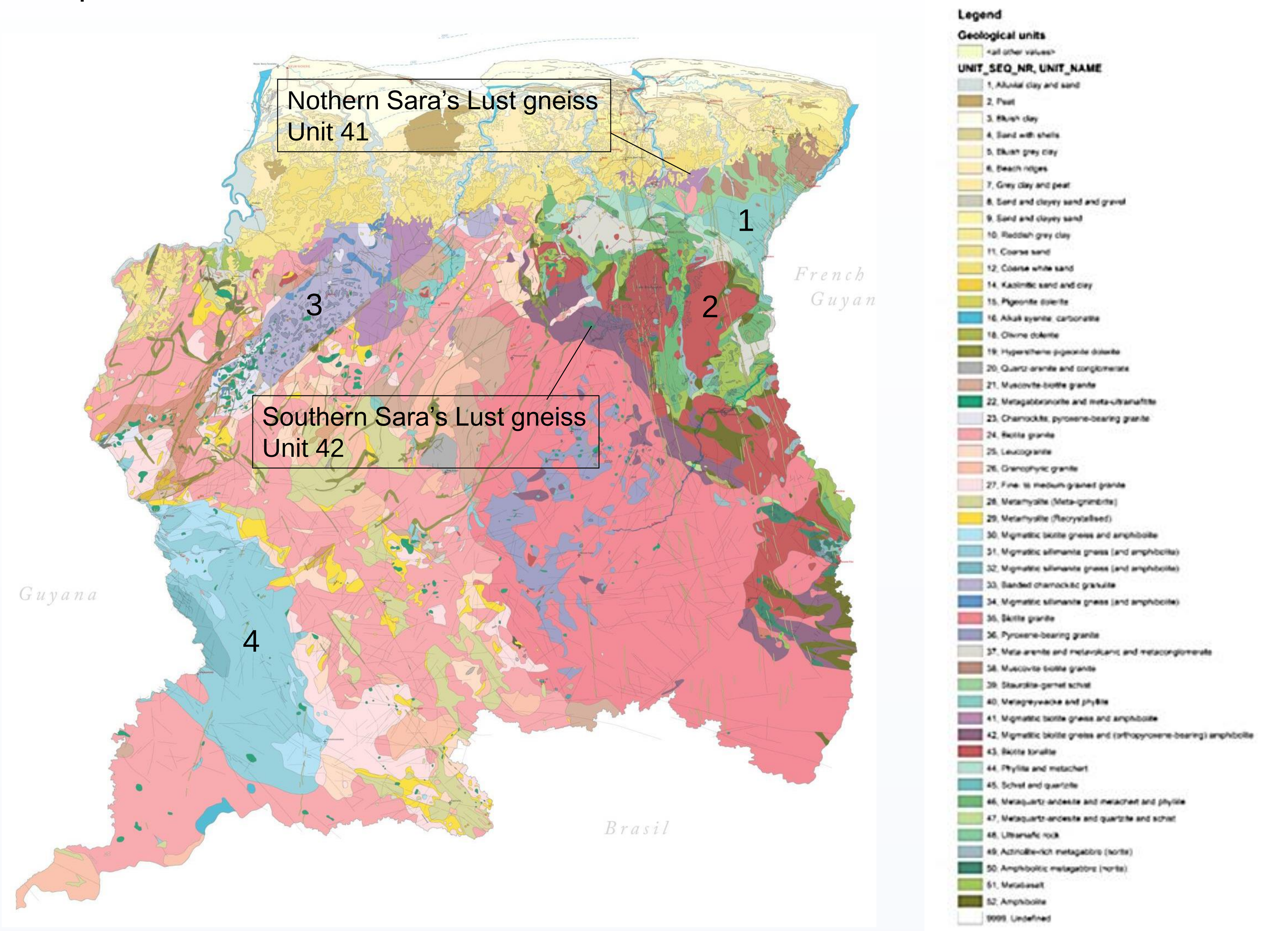

Figure 1- Geological map of Suriname, produced by TNO (2018). Sara's Lust Gneisses in purple, the Marowijne Greenstone Belt includes the Paramaka Formation in several shades of green and the Armina Formation in turquoise (1), the Kabel Tonalite in dark red (2), the Bakhuis Granulite Belt in violet (3), the Cauarane-Coeroeni Gneiss Belt in blue (4).

RESEARCH APPROACH

This research will help understand and define, whether the rocks observed in the study areas, match the characteristics of the Sara's Lust rocks. This will make it easier to create a more detailed geological map in that area.

RESULTS

For each thin section, petrographic observations were obtained regarding the mineral composition and textures. As a result, five different rock types; amphibolite, gneiss, dolerite, felsic igneous rock, and pegmatite were classified. Gneisses come in five different varieties: sillimanite gneiss, biotite gneiss, garnet-muscovite-biotite gneiss, garnet-biotite gneiss, and hornblende-biotite gneiss. Amphibolite has a mafic supracrustal protolith. Sillimanite gneiss, garnet-muscovite-biotite gneiss, and garnet-biotite gneiss have a pelitic supracrustal protolith. Hornblende-biotite gneiss and biotite gneiss have a quartzofeldspathic supracrustal protolith.

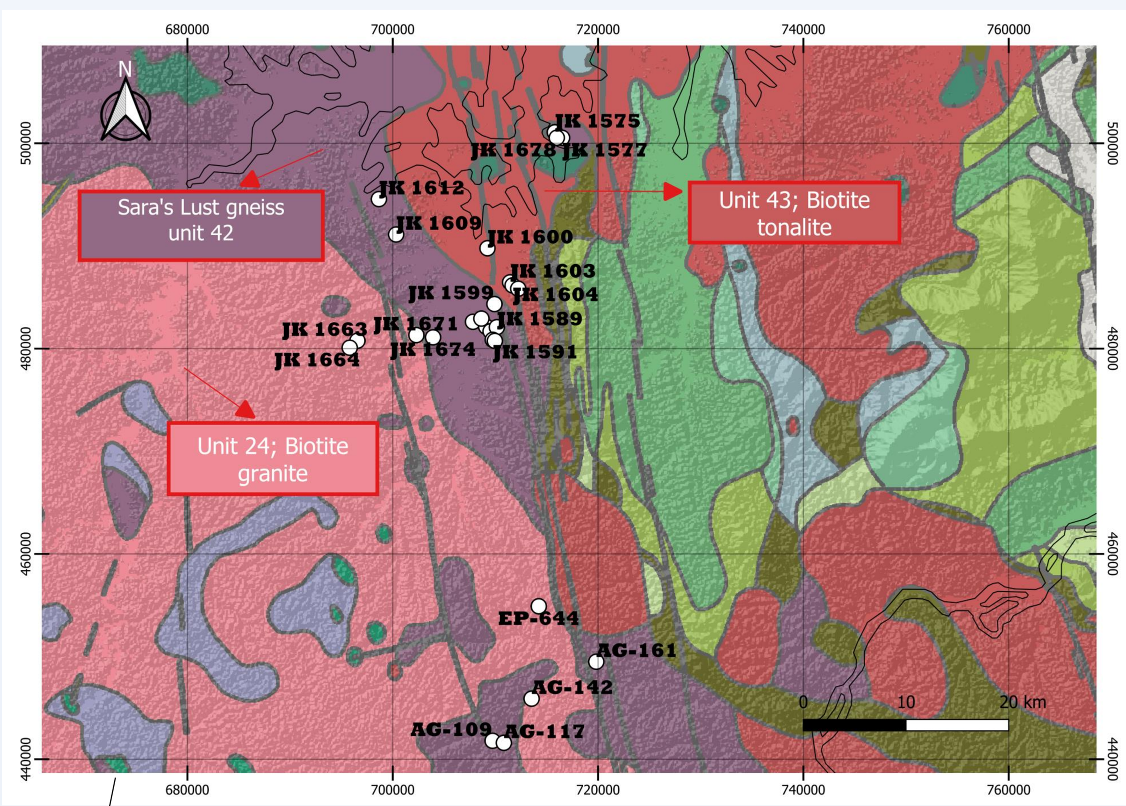

Figure 2 - The geological map of Suriname (2018) zoomed in to the Sara's Lust Gneisses showing the sample locations.

Rock name	Thin Section #
Amphibolite	AG-109
	AG-117
	JK 1583
	JK 1592
	JK 1674
Sillimanite gneiss	EP-643
	EP-644
Garnet-muscovite-biotite gneiss	AG-142
	AG-161
	JK 1605
Garnet-Biotite gneiss	JK 1589
Hornblende-biotite gneiss	JK 1573
	JK 1612
Biotite gneiss	JK 1582
	JK 1585
	JK 1599
Dolerite	JK 1575
	JK 1603
	JK 1604
Felsic igneous rock	JK 1574
	JK 1579
	JK 1591
	JK 1609
	JK 1663
	JK 1664
Pegmatite	JK 1577
	JK 1671
	JK 1678

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Rock name	Metamorphic facies	Protolith	Temperature
Amphibolite	Amphibolite	Mafic Supracustal rock	
Sillimanite gneiss	Amphibolite	Pelitic Supracrustal rock	between 600° C and 700° C
Garnet-Muscovite-Biotite gneiss	Amphibolite	Pelitic Supracrustal rock	between 400° C and 600° C
Garnet-Biotite gneiss	Amphibolite	Pelitic Supracrustal rock	between 400° C and 700° C
Hornblende-Biotite gneiss	Amphibolite	Quartzofeldspathic Supracrustal rock	between 400° C and 700° C
Biotite gneiss	Amphibolite	Quartzofeldspathic Supracrustal rock	between 300° C and 700° C

CONCLUSION

The metamorphic rocks of the Kabofe and Jaikreek area are characterized by their supracrustal origin, and the amphibolite metamorphic facies. The gneisses of the study area correspond to the Sara's Lust gneisses, based on the mineral composition and the metamorphic facies. The metamorphic grade of the rocks in Kabofe and Jaikreek are intermediate to more high-grade, because most of the rocks indicate temperature greater than 400° C. There are no minerals observed that indicate the granulite facies was reached.

The conclusion was made that these rocks could have undergone regional metamorphism according to the metamorphic facies diagram and parts of the supracrustal rocks also underwent metasomatism, which invaded the protolith. The presence of migmatitic gneisses, makes it easier to understand granite and granitic rocks observed. The granite magma maybe from diatexite migmatites derived from supracrustal rocks of pelitic composition. Biotite remained stable and serves as a tracer for the solid fraction during melt segregation. The migmatites are later intruded with pegmatite dykes or sills. Dolerites are later intruded into the gneisses. The grain size is coarse, meaning it has had enough time to cool and it is not affected by metamorphism.

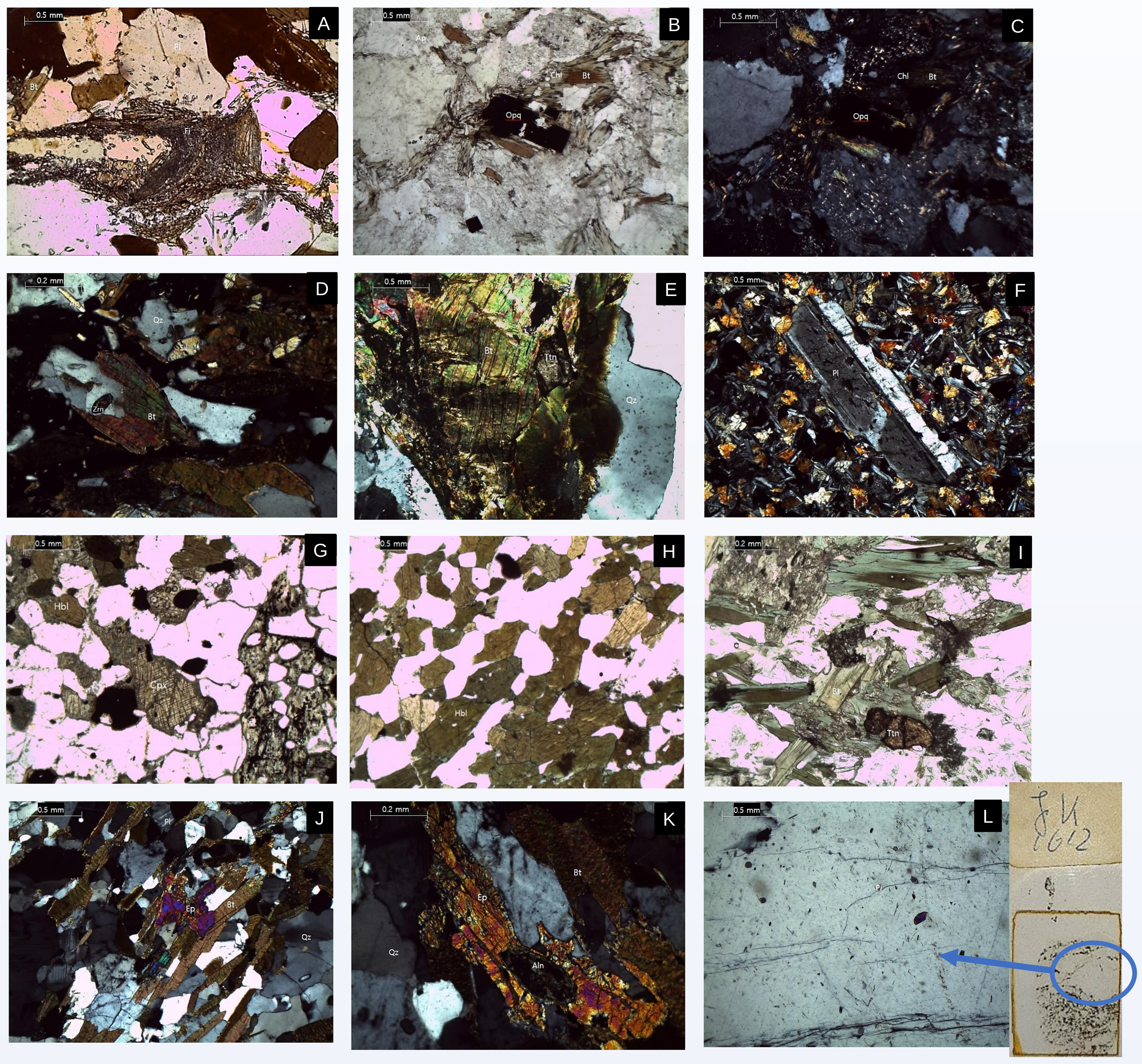

Figure 2- A) EP-643 Sillimanite Gneiss, with fibrolite in Plane Polarized Light. B) AG-142 Garnet muscovite biotite Gneiss, opaque mineral (Pyrite) is converted to iron oxide in PPL. C) opaque mineral (Pyrite) is converted to iron oxide in XPL. D) EP644 Sillimanite gneiss, zircon crystal in XPL. E) JK1585 Biotite gneiss, titanite inclusion in strongly deformed biotite crystal XPL. F) JK1604 Dolerite, plagioclase phenocryst in XPL. G) AG-109 Amphibolite, On the Right Clinopyroxene galtered into tremolite in PPL. H) AG-117 Amphibolite, Hornblende crystals with preferred orientation in PPL. I) JK1573 Hornblende-biotite gneiss, with titanite crystal included in chloritized biotite PPL. J) JK1612 (Migmatite) Hornblende-biotite gneiss, Biotite crystals show preferred orientation. Epidote included between biotite crystals PPL. K) Allanite included in Epidote XPL. L) Plagioclase leucosome in XPL

RECOMMENDATIONS

This study proves that the gneissic rocks from Kabofe and Jaikreek area correspond petrographically with the Sara's Lust Gneisses.

- To get a better understanding, field mapping in the area would be necessary, which can constrain field relationships between several rock types.
- Studying only thin sections has limitations, such as missing transition between rock types and structural observation.
- To understand the geochemistry of the garnets, a trace element analyses can be done for further research. Due to the zircons which are present in thin section EP-644, AG-161, JK1589, JK1582, JK1609, JK1663, JK1664, JK1671 and JK1678 geochronology and trace element analyses can be done.
- Collecting samples of the area for age dating to further constrain geochronology of the Sara's lust rocks in the southwestern flank. For further studies conducting a P-T-t analysis would also be recommended.

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