

ELECTRON-MICROSCOPE INVESTIGATIONS OF LARVIKITE AND TÖNSBERGITE FELDSPARS

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The two monsonitic syenites from the Oslo area, larvikite and tönsbergite, differ mainly in the colour of the feldspar minerals. The blue schiller which is so predominant in the larvikite varieties is normally completely masked by the red colour of the tönsbergite feldspars. The nature of the blue schiller and of the red colour has not been revealed by ordinary microscopic investigations. The blue schiller is mainly seen on the plane (100), and the assumed cryptoperthites are supposed to be oriented parallel to $(\bar{8}01)$. The red colour of the tönsbergite feldspars is supposed to be due to some metasomatic unmixing of the iron content in the feldspar phase (CHR. OFTEDAHL 1948 and I. TH. ROSENQVIST 1951).

For the electron-microscope examination, crystals of the light blue feldspar from Tvedalen, Vestfold, and red feldspars from Stokke quarry, Vestfold, were examined. More than 100 pictures were taken, clarifying to a certain extent the nature of the schiller and of the red colour. The examinations were carried out at the Central Institute for Industrial Research by MRS. ODNY DEBERNARD and MRS. KARI BÅRDSETH under the supervision of cand. real. JOAR MARKALI. I offer them all my sincere thanks for their cooperation.

The pictures were taken from carbon replica made on silver or formvar casts. All specimens were shadowed by Pd or Pt under an angle of 45° . We examined the (001) and (010) planes, partly fresh cleavage planes, planes partly etched with H_2F_2 vapour at room temperature for 1 minute. The perthitic structure is usually non-visible or only slightly visible on the non-etched planes. After etching, however, it appears. Especially for the blue cryptoperthites etching

was necessary. On the red varieties some cryptoperthites could be seen even before etching. As 'perthites' and 'host' have about the same volumes in the alkali feldspars, it is not easy to tell whether the albite or the potash feldspar phase is most strongly attacked by the H_2F_2 . In coarser perthite feldspar the albite is attacked more strongly than the microcline. For this reason I regard it probable that in the cryptoperthites it is also the albite phase which is most strongly attacked.

Pictures parallel to (001) show the perthite strings to be 1–10 microns long, with widths varying around 0.1 micron. On (010) cross section the perthite could be studied. Comparatively short etchmarks corresponding to 0.1×0.3 – 0.5 microns are seen.

The exposures demonstrate that the cryptoperthite of the blue larvikite from Tvedalen is composed of lath-shaped elements, ordered in a zone parallel to the b-axis. This is in accordance with the schiller on (100). The dimensions of the perthite and host domains are on the order of the wave lengths of ultra-violet light. In addition to this regular orientation, a bulging of the perthites along the a-axis is frequently seen (No. 3217 A and 3217 E). On (001) as well as on (010) homogeneous domains (i.e., non-exsolved areas) are sometimes seen.

The tönserbergite feldspars exhibit less regular pictures. On non-etched (001) planes, beautiful polysynthetic sub-microscopic twinning, giving the triclinic feldspar a monoclinic appearance, is sometimes seen (No. 3255 D). In some instances the perthite structure is seen on the non-etched planes (No. 3215 C). In several cases (e.g. 3220 D) it was seen that the tönserbergite feldspar was composed of exsolved and homogeneous domains, the homogeneous domains of the tönserbergite being 100 to 1000 times larger than in the blue feldspars. The cleavage planes along (010) in the red feldspars (as distinct from the blue feldspars) are never so good as to permit a plane replica. By etching, a 'moss-like' structure of dimensions down to 0.01 micron (Nos. 3218 B, 3219 A) is seen. The 'moss-structure' is probably due to fine iron oxide. It is concluded that the iron-oxide unmixing in the tönserbergite variety is oriented as a fibrous 'felt' in planes parallel (010). In this way the cleavage parallel to this plane is enhanced. There does not seem to be any genetic connection between the unmixing of the iron oxide and the unmixing of the perthites.

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REFERENCES

- OFTEDAHL, CHR. 1948. Studies on the Igneous Rock Complex of the Oslo Region. IX. The Feldspars. Det Norske Videnskaps-Akad. i Oslo, I. Mat. Nat. Kl. No. 3, pp. 1-71.
- ROSENGVIST, I. TH. 1951. Investigations in the Crystal Chemistry of Silicates. III. The Relation Haematite-Microcline. Norsk geol. Tidsskr. Bd. 29, pp. 65-76.

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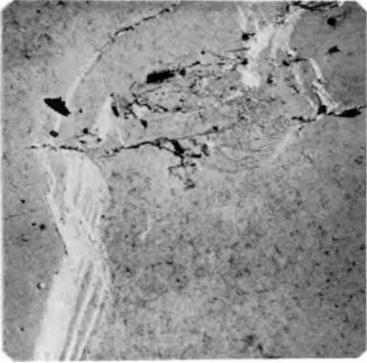
PLATE I

Larvikite, Tvedalen (001)

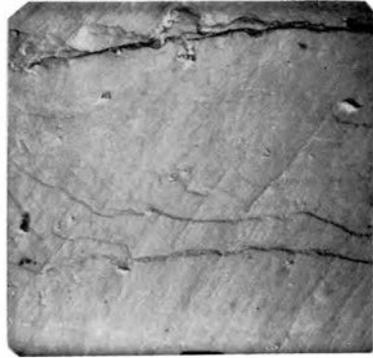
1.	Sample No.	3247 D	Non-etched	3000 ×
2.	—	3210 E	—	3000 ×
3.	—	3210 B	—	9000 ×
4.	—	3216 B	H ₂ F ₂ etched	3000 ×
5.	—	3217 A	—	9000 ×
6.	—	3217 E	—	9000 ×

See also Plate III, 1.

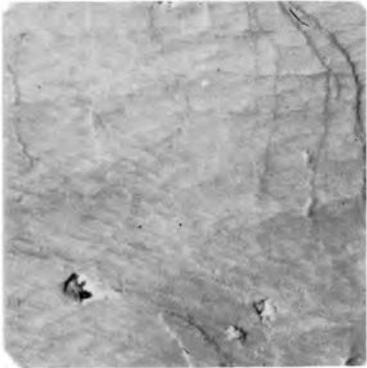
PLATE I



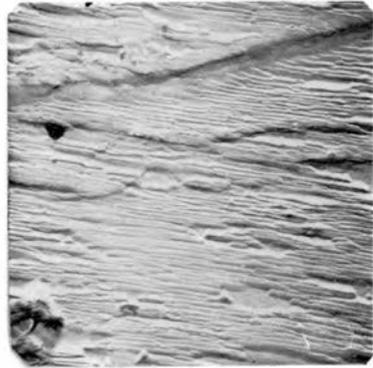
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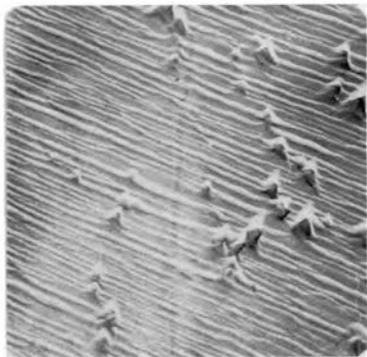
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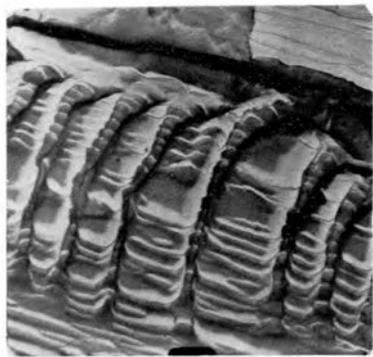
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4



5



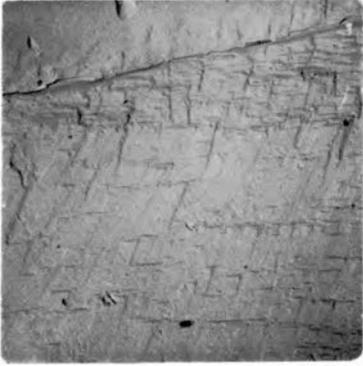
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PLATE II

Larvikite, Tvedalen (010)

1.	Sample No.	3336 A	Non-etched	3000 ×
2.	—	3336 B	—	3000 ×
3.	—	3333 A	H ₂ F ₂ etched	9000 ×
4.	—	3325 E	Non-etched	9000 ×
5.	—	3334 B	H ₂ F ₂ etched	9000 ×
6.	—	3334 C	—	27000 ×

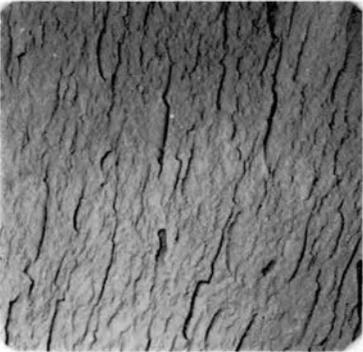
PLATE II



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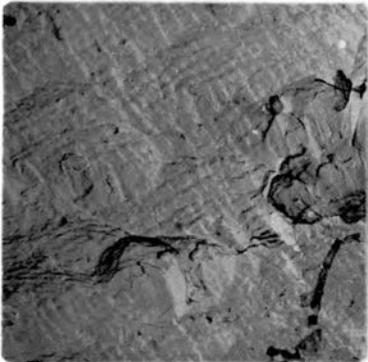
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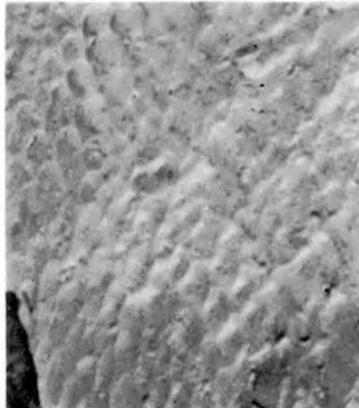
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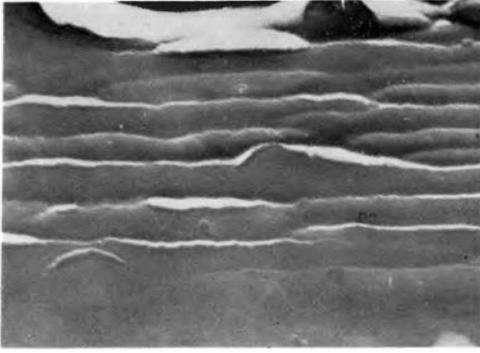
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PLATE III

Larvikite, Tvedalen (001)

1. Sample No. 3217 C H_2F_2 etched 27000 \times
Tönsbergite, Stokke (001)
2. Sample No. 3215 C Non-etched 9000 \times
3. — 3255 D — 9000 \times
4. — 3255 C — 9000 \times
5. — 3220 D H_2F_2 etched 3000 \times

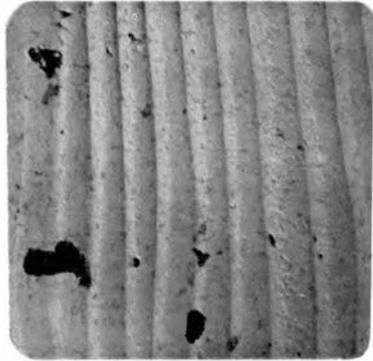
See also Plate IV, 1.



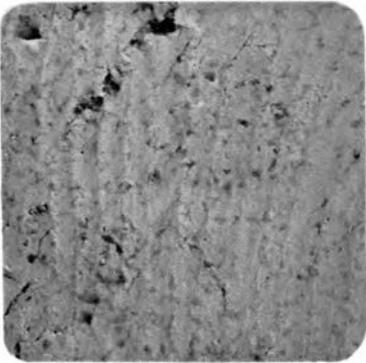
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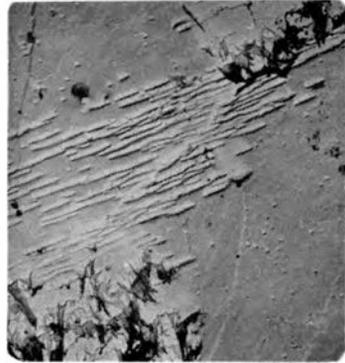
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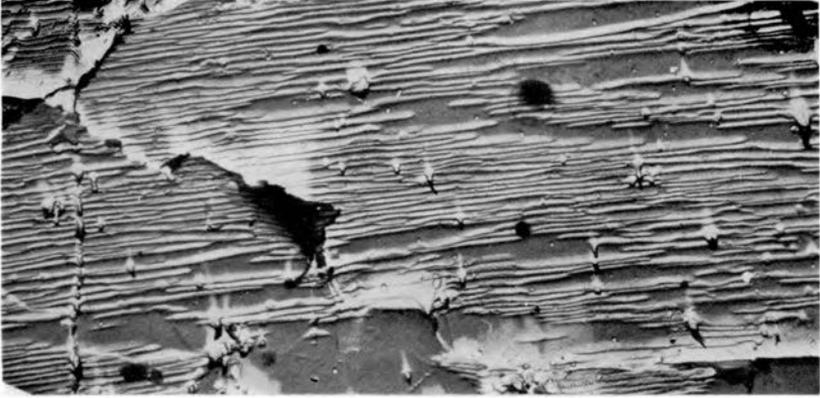


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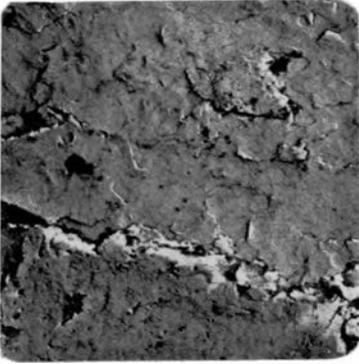
PLATE IV

Tönsbergite, Stokke

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|----|------------|--------|--------------------------------------|--------------|
| 1. | Sample No. | 3220 A | H ₂ F ₂ etched | 9000 × (001) |
| 2. | — | 3253 C | Non-etched | 9000 × (010) |
| 3. | — | 3253 A | — | 9000 × (010) |
| 4. | — | 3218 B | H ₂ F ₂ etched | 9000 × (010) |
| 5. | — | 3219 A | — | 9000 × (010) |



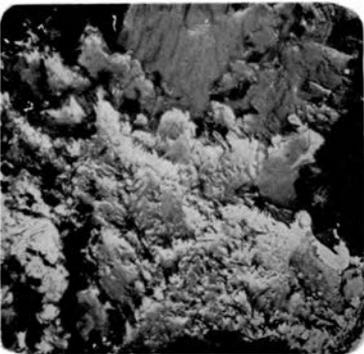
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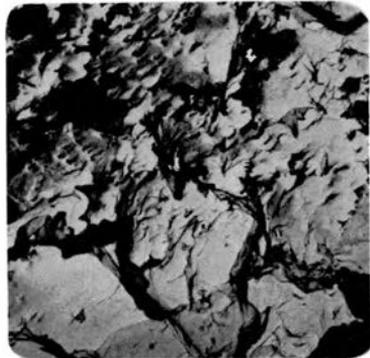
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3



4



5