the lack of alumina cannot be accounted for. Any formula corresponding more closely to the analysis will be exceedingly complicated.

The systematical position of the igalikite is extremely doubtful and it is not possible to find any other mineral to which it can be related. Its composition is not so very different from that of the muskovite, but its physical properties by no means agree with those of the mica.

2. Naujakasite from Naujakasik.

Among the minerals collected by G. FLINK on his mineralogical journey in 1897[1]) there is a specimen labelled „Chlorite?" by FLINK. The locality is stated to be Naujakasik, a well-known place the coast of Tunugdliarfik Fjord, belonging to the nepheline-syenite batholite, described by USSING[2]). FLINK and USSING do not mention any chlorite-like mineral from that place, which is otherwise rather rich in minerals originating from the many pegmatite veins from the nepheline-syenite.

The specimen containing the naujakasite was probably found loose on the ground and the connection between it and the nepheline-syenite is not clear; it may perhaps have been transported from some other place. The minerals associated with the naujakasite, the arfvedsonite, and the sodalite, are, no doubt, very common in the pegmatites of that region but the aggregation, as a whole, bears no resemblance to any other known rocks or mineral associations found in the country.

The whole material consists of a single piece of the size of a hand; the weight is almost 350 gr. The habit is not that of any pegmatitic material; it mostly resembles a fine-grained rock which is perfectly uniform throughout the whole mass. It is to be hoped that some future expedition may succeed in finding the original occurrence of this peculiar mass.

The mineral aggregation is very simple; more than half of the mass consists of naujakasite, and almost the whole remainder of arfvedsonite. Among the lightest particles of a specific gravity below 2.460 there are found some single-refracting grains of a refraction of 1.485 from which it might be concluded that they consist of sodalite. There may, perhaps, also be smaller amounts of other minerals, which cannot, however, be determined with certainty.

The largest part of the arfvedsonite occurs as granular masses between the crystals of the naujakasite but it also occurs as regularly formed crystals in the naujakasite. The determination of the arfvedsonite is not quite certain because of the great similarity between that mineral

[1]) Berättelse om en mineralogisk Resa i Syd-Grønland sommaren 1897. Medd. Grønl. 14, p. 221.

[2]) Geology of the Country around Julianehaab, Greenland. Medd. Grønl. 38, 1911, p. 106 ff.

and riebeckite, in some instances, however, a marked obiquity of extinction may be ascertained, which points decidedly towrds the first-named mineral. The absorption colours are the same as hose common to the two minerals. The orientation of the crystals of the arfvedsonite in relation to those of the naujakasite is mostly quite accidental; it will be seen, however, that a relatively large number lie in the cleavage plane of that mineral and that a relative large amount of these are orientated in the direction of the axis of symmetry.

The whole material is in a rather crumbled state and is easily crushed and broken with the fingers only. There is a faint trace of banding or schistosity in the rock, as the majority of the shining cleavage faces of the naujakasite are orientated in almost the same direction; however, a very large number of them are orientated in all possible directions.

The crystals of the naujakasite have very roughly the form of hexagonal plates; the diameter mostly ranges from 1 to 3 millimeters, the thickness, in most instances, is less than 1 millimeter. The boundaries towards the neighbouring individuals of naujakasite or arfvedsonite are mostly very irregular, showing that all the grains must have crystallized at nearly the same time. In some instances, however, the outlines of the shining cleavage faces of the naujakasite may be rather regularly hexagonal. It is quite impossible to find such well developed faces that they can be measured with the goniometer.

The naujakasite in so far resembles the micas that it possesses a very strong cleavage in one direction, parallel to the pseudohexagonal basis; the lustre of the cleavage face is strongly pearly, and to a certain degree also metallic; it is possible, however, that this last property is due to the beginning alteration of the substance. There is no trace of any cleavage in other directions, and the small cleavage plates always have perfectly irregular outlines. The plates are quite brittle and cannot be bent without being broken. The cleavage faces are far from plane but irregularly facetted and folded; in most instances it is found, on closer inspection, that they possess a distinct striation or *folding* in one direction parallel to one of the prismatic faces boundin the crystal, and, as shown by the optical properties, this direction oincides with the monoclinic axis of symmetry.

The colour of the cleavage faces is shining silvery wlte, while seen from other directions the crystals appear dark greyish. Jnder the microscope the small leaves are perfectly colourless and tnsparent, but in many places there occur spots of a faintly transluent, brownish substance, probably an alteration product, and these pas are more or less sharply bounded towards the fresh substance. In ome instances the brown parts are more cloud-like and irregularly dtributed, but

sometimes they are also arranged in very thin lines, the direction of which is parallel to the axis of symmetry.

The hardness is 2—3. The specific gravity of pure, selected pieces was found to be 2.615; the brown substance is lighter, c. 2.46, and all transitions between those values occur.

The optical properties are very characteristic and by them the mineral is easily distinguished from any kind of mica, to which mineral naujakasite may otherwise show a considerable similarity. The naujakasite is optically biaxial, one axis being nearly normal to the cleavage plane. The hyperbole is only very slightly curved so that it is very difficult to decide whether the sign is positive or negative; generally, however, the negative sign is most pronounced. The axial angle cannot, of course, be very far from 90 degrees, and the other axis, which is very difficult to observe, must lie nearly in the cleavage plane. This orientation shows with certainty that the crystals must belong to the monoclinic system, and they are, so far in accordance with the micaceous minerals in that they are monoclinic and pseudohexagonal. The above mentioned brown, altered substance is isotropic but there are, in this respect, all possible transitions between that and the fresh mineral.

Because of the form of the thin leaves it is almost impossible to determine the refraction in other directions than that normal to the leaves, and as one of the optic axes is orientated nearly normally to the cleavage, we only obtain the value of β. For the freshest material it is found to be 1.537, but the altered material has a much lower refraction, c. 1.516, and in this respect too all possible transitions occur.

Before the blowpipe the naujakasite is easily melted (fusibility about 3) to a glass, which is, for the purest mineral, greyish, whereas small amounts of arfvedsonite produce a black glass. Decomposed by hydrochloric acid with gelatinisation.

The analysis was made by Mr. Chr. Dethlefsen. In order to procure the purest possible material for analysis the powdered mineral was separated into many parts by means of heavy liquids. Generally the heaviest parts contained most of the arfvedsonite, which mineral, however, will also be found in the lighter parts as small crystals included in the naujakasite. The lightest parts are not, however, suitable for analyses, since they consist mostly of the altered mineral, and I have therefore selected some of the middle parts, the naujakasite of which is mostly in the freshest state, but which, besides that, also contains many of the altered parts with included arfvedsonite crystals. A more perfect separation is quite impossible since the material can never be ground down to such small dimensions that the two minerals will not be found in the same pieces.

The result of the analysis is stated below (under I):

	I.	Quot.		Theor.
SiO_2	50.95	0.849		53.64
Al_2O_3	20.63	0.202	0.219	22.79
Fe_2O_3	2.76	0.017		..
FeO	5.25	0.072		5.70
Na_2O	14.51	0.234		15.86
K_2O	0.80	0.008	0.333	..
MnO	0.57	0.008		..
CaO	0.55	0.010		..
MgO	0.10	0.002		..
H_2O (100°)	1.02	..		..
H_2O (ign.)	2.60	0.144		2.01
	99.74			100.00

It might be expected beforehand that a material of th kind would not give any good values, and we shall see, too, that no siple formula corresponding to the analysis can be found. It is not possib to estimate how much of the arfvedsonite is mixed in the naujakasite aalysed, and it is, of course, impossible to subtract the arfvedsonite fromthe analysis, all the more so because the composition of that mineral is rher variable and we cannot determine with certainty whether the mieral inclosed is arfvedsonite or riebeckite. The theoretical values given bove correspond to a composition like the following:

$$H_2O,\ 3(Na_2, Fe)O, 2Al_2O_3, 8SiO_2$$

but, as will be seen, there are rather large differences betven the analysed values and the theoretical ones. If we disregard theron, the formula may be written in a simpler way as:

$$HNa_3Al_2Si_4O_{13}.$$

The systematical position of the naujakasite is quite ucertain, and there is no other mineral with which it is closely related. Astated above, there is a superficial similarity to the micas, but both the tical properties and the composition show that it has nothing to do wh them, and the same is proved by the röntgenographical properties. he röntgenographical examination was kindly undertaken by Professc B. GOSSNER and Dr. O. KRAUSS of Munich with the following result:

Über die Kristallform von Naujakasit. Fürie goniometrische Messung haben sich die Kristalle als ungeeignet eiesen. Nachdem aber einerseits hinreichend grosse Blättchen ausgcht werden konnten u. anderseits die Kenntnis der optischen Eigechaften eine

geometrische Orientierung ermöglichte, erschien der Versuch einer röntgenographischen Untersuchung nicht aussichtslos. Die Vermutung hat sich bestätigt. Es stehen uns ein recht befriedigendes Laue-Diagramm u. vor allem zwei Drehspektrogramme von wider Erwarten guter Beschaffenheit zur Ermittlung geometrischer Eigenschaften der Kristalle zur Verfügung.

Gemäss der Lage der Ebene der optischen Achsen folgt zunächst mit grosser Wahrscheinlichkeit die Zugehörigkeit zum monoklinen System u. zugleich die Lage der Symmetrieebene. In der Blättchenebene, die mit (001) zu bezeichnen ist, bestimt sich in der Richtung senkrecht zur Spur der Ebene der optischen Achsen die b-Achse = [010]. Eine zweite Richtung, senkrecht zu dieser in der Ebene des Blättchens, ergibt die a-Achse = [100].

Das Kristallblättchen, mit seiner Ebene senkrecht zum einfallenden Strahl gestellt, ergab zunächst das in Fig. 1 wiedergegebene Laue-Diagram. Man erkennt darin die Spur der Symmetrieebene, parallel der Ebene der optischen Achsen, während senkrecht dazu sich die Richtung [010] bestimmt. Es weist also auch das Laue-Diagram mit seiner Symmetrie, vor allem in seiner Orientierung gegenüber den auf optischen Wege erkennbaren Hauptrichtungen des Kristalles, deutlich auf die Zugehörigkeit zum monoklinen System hin.

Nachdem die beiden Richtungen [010] u. [100] in der Ebene des Blättchens somit nicht bloss auf Grund der optischen, sondern auch der röntgenographischen Untersuchung festgelegt waren, führte der Versuch, Drehspektrogramme für diese Richtung als Drehungsachsen zu erhalten, bald zu einem befriedigenden Ergebnis.

Fig. 2 ist das Drehspektrogramm mit [010] als Drehungsachse, wobei (001) als Grundfläche für die Schwenkung des Kristalles eingestellt war. Aus Schichtlinienabständen ergibt sich b = 7,9 Å.

Fig. 3 ist das Drehspektrogramm mit [100] als Drehungsachse u. (001) als Grundfläche. Aus Schichtlinienabständen folgt a = 15,06 Å.

Die beiden Drehspektrogramme zeigen auf der Nullschichtlinie in grösserer Anzahl die Reflexe von (001), welche es ermöglichen, den Netzebenenabstand $d_{(001)}$ zu ermitteln. Es ist $d_{(001)}$ = 9,58 Å. Mit Rücksicht auf den Habitus der Kristalle ist man aber berechtigt anzunehmen, dass man in d = 19,16 Å den Abstand zweier nächster identischer Ebenen vor sich hat. Es fallen somit die ungeraden Ordnungen aus u. die beobachteten Reflexe sind 004, 006(st), 008, 0.0.10, 0.0.12(st), 0.0.14, 0.0.16(st).

Nicht möglich war es, den Winkel β zu ermitteln. Es fehlt somit auch die Kenntnis des genauen Wertes der Kante c des Elementarparallelepipedes, welcher sich mit Hilfe von d u. β berechnen würde. Es ist wahrscheinlich, dass β nicht allzuweit von 90° abweicht. Für letztere Neigung β = 90° ist c = 19,16 Å; zu β = 100° würde der Wert c = 19,8 Å

gehören. Ein mittlerer Wert c $\sim$ 19,5 Å dürfte von der wahren Längige der Kante nicht allzu weit sich unterscheiden.

Die Kanten des monoklinen Elementarparallelepipedes sind alslso gegeben in

$$a = 15{,}06\,Å \qquad b = 7{,}98\,Å \qquad c \sim 19{,}5\,Å$$

bei einer mutmasslich von 90° nur mässig abweichenden Neigung β.

Die c-Achse kommt dem entsprechenden Werte von Muskovit, mit c $\sim$ 20,0 Å, nahe. Die beiden andern Konstanten sind beim Glimmer a = 5,2 Å u. b = 8,94 Å. Es zeigen hierin die beiden Silikate einen wesentlichen Unterschied. Die äussere Ähnlichkeit des Naujakasites mit dem Glimmer wiederholt sich also nicht in den Dimensionen des Elementarkörpers.

Dessen Inhalt lässt sich durch das Produkt z × M kennzeichnen, wobei z die Anzahl der Moleküle mit dem Molekulargewicht M bedeutet. Es ist z × M = 3627 für β = 90° u. c = 19,16 Å; das Produkt erhält natürlich für c = 19,8 Å und β = 100° einen ganz ähnlichen Wert. Der wahre Wert dürfte davon sich nur wenig unterscheiden. Angesichts der Tatsache, dass eine befriedigende Analyse nicht vorliegt, bietet der Versuch einer weiteren Auswertung des Ergebnisses mit dem Ziele einer Ermittlung von z u. M wenig Aussicht auf Erfolg.

Aus den Gitterkonstanten leitet sich für den Naujakasit das Achsenverhältnis

$$a : b : c = 1{,}887 : 1 : 2{,}44 \quad (= 15{,}06 : 7{,}98 : 19{,}5)$$

ab, mit nicht näher bekannten, aber mutmasslich von 90° sich nur mässig unterscheidenden Winkel β. Die Parameter a u. b sind mit der üblichen Genauigkeit bestimmt, c dagegen nur mit jenem Grad der Annäherung, der in dem Mangel der Kenntnis von β bedingt ist.