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origin of the oöcyte in *Dineutes nigrior* and in *Dytiscus* is in the number of differential mitoses; in *Dineutes nigrior* there are only three (fig. 6) whereas in *Dytiscus* there are four.

As a result the oöcyte of *Dineutes nigrior* is accompanied by only seven nurse cells, that of *Dytiscus* by fifteen. The origin and history of the oöcyte determinant are of considerable interest and importance because of their bearing on the subject of the physical basis of heredity. A more detailed study of our material is now being made and the ovaries of *Dineutes nigrior* and of several other species promise to furnish a means of clearing up the details of differential mitoses in these insects.

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[1] We are indebted to Mr. A. W. Andrews for the identification of this species.

[2] Mr. R. W. Hegner is indebted to the Bache Fund for assistance in preparing the material on which this report is based.

## SOME MINERALS FROM THE FLUORITE-BARITE VEIN NEAR WAGON WHEEL GAP, COLORADO

By Esper S. Larsen and Roger C. Wells

U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C.

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In the summer of 1912 Messrs. W. H. Emmons and E. S. Larsen[1] made a hasty examination of the fluorite-barite vein which passes through the hot springs near Wagon Wheel Gap, Colorado. Since that time this vein has been extensively prospected and a considerable amount of fluorite has been produced. In the summer of 1915, in the course of the reconnaissance geologic study of this region under the direction of Dr. Whitman Cross, Mr. Larsen made another brief visit to the deposit and collected two specimens of material not before recognized in the deposit.

One of these specimens proved to be the unusual mineral gearksutite, and the other was made up of a peculiar kaolinite and a new fluoride-sulphate, *creedite.* It is the purpose of the present paper[2] to describe these minerals.

The vein is entirely in Tertiary volcanic rocks made up of lava flows and tuff beds of rhyolite and quartz latite, with subordinate andesite. It can be followed for perhaps half a mile and is variable in width but is not uncommonly wide enough to make the mining of the fluorite profitable. Much of the vein filling is nearly pure fluorite but locally barite is abundant. The wall rock shows considerable alteration and commonly carries much disseminated pyrite.

*Gearksutite.*—The lower tunnel of the mine, whose portal is about 100 feet east of one of the hot springs, follows the vein and some distance from the portal it passes through a large body of soft, highly altered rock, giving rise to considerable caving. This soft material is a highly altered rhyolite or quartz latite, probably a tuff, which carries very abundant balls, up to several inches across, of snow white, powdery gearksutite. These balls are easily separated from the altered rock and resemble a very fragile chalk or kaolinite. When wet they become plastic and resemble ordinary dough and are without grit.

A microscopic examination shows that the material is homogeneous and is made up of an aggregate of shreds so minute as to be recognized only with a high magnification. It has a mean index of refraction of $1.454 \pm 0.003$ and a moderate birefringence. The specific gravity measured by the pycnometer method is 2.768.

This agrees with the properties of gearksutite from Greenland,[3] which "occurs in white, chalky aggregates of minute fibers or prisms which are optically negative and have a moderate axial angle. X is normal to the fibers and Y makes a large angle with them.

The mineral is probably monoclinic with $X = b$.

$\alpha = 1.448 \pm 0.003$, $\beta = 1.454 \pm 0.003$, $\gamma = 1.456 \pm 0.003$."

A chemical analysis of the material from Wagon Wheel Gap shows its identity with gearksutite. In the following table Analysis 1, by R. C. Wells, is of gearksutite from Wagon Wheel Gap, Colorado. Analysis 2, by G. Lindström, is of gearksutite from Ivigtut, Greenland, and Analysis 3, by Hillebrand, is of that mineral from St. Peters Dome, Colorado. Column 4 gives the theoretical composition,[4] on the basis of the formula $CaF_2.Al(F,OH)_3.H_2O$. with $F:OH = 2:1$.

*Analyses of gearksutite*

| | 1* | 2 | 3 | 4 |
|---|---|---|---|---|
| Al | 15.11 | 15.37 | 15.20 | 15.1 |
| Fe | tr. | 0.30 | | |
| Ca | 22.41 | 21.02 | 22.30 | 22.4 |
| Mg | tr. | 0.16 | | |
| Na | 0.04 | 1.06 | 0.10 | |
| K | 0.07 | 0.23 | 0.04 | |
| Cl | | 0.20 | | |
| F | 41.00 | 41.81 | 42.07 | 42.9 |
| O | 5.09 | 4.82 | 4.83 | 4.5 |
| $H_2O-$ | 0.44 | | | |
| $H_2O+$ | 15.20 | 15.03 | 15.46 | 15.1 |
| | 99.36 | 100.00 | 100.00 | 100.0 |

* $SiO_2$ none, $Al_2O_3$ 28.49, $Fe_2O_3$ tr., CaO 31.37, MgO tr., $Na_2O$ .05, $K_2O$ .08, F 41.00, $H_2O-$ .44, $H_2O+$ 15.20, less O for F 17.27, total 99.36.

Although the direct determination of fluorine, in which the fluorine was weighed as $CaF_2$, yielded 41.0 per cent in Analysis 1, no great accuracy is claimed for this determination. The agreement of the other constituents in the three analyses, however, shows the practical identity of the minerals, the chief difference being that a small amount of Ca is replaced by Na in the Greenland mineral. All four analyses agree very well with the formula $CaF_2Al\ (F,OH)_3.H_2O$. with F:OH = 2:1.

Heretofore gearksutite has been described only as an alteration product of cryolite, but at Wagon Wheel Gap no cryolite has been recognized and the gearksutite is believed to have been formed by a metasomatic alteration of the rhyolitic wall rock much as kaolinite or sericite is formed. Indeed, on the first visit to the deposits the gearksutite was mistaken for kaolinite. It seems probable that the gearksutite was developed in the wall rock by the ascending hot solutions which deposited the fluorite in the vein.

*Creedite, a New Mineral.*—A specimen collected from the dump of one of the upper workings of the fluorite mine proved to be made up in large part of a new mineral. The name 'Creedite' is proposed for this mineral from its occurrence near the center of the Creede quadrangle of the United States Geological Survey.

Creedite makes up about two-thirds of the specimen and is in white to colorless grains and poorly developed crystals up to 5 millimeters across, imbedded in a dull white kaolinite, with a very little barite. The kaolinite is believed to be derived from the alteration of some unknown mineral.

Creedite is nearly colorless, has a hardness of about $3\frac{1}{2}$, intumesces before the blow pipe, showing the calcium flame, and finally fuses to a white enamel. It is somewhat slowly but completely soluble in acid. Its specific gravity as measured on the powder by the pycnometer method is 2.730.

Most of the grains show no good crystal development, but a few are stout prismatic crystals with an acute rhombic cross section. One crystal showed curved and striated pyramidal faces. The faces are dull, curved, and imperfect, and not suitable for accurate measurements. The angle between the prism faces measured under the microscope on the cross section of a prism gave 68° and is believed to be accurate to within about 1°. However, a measurement on a second prism with distinctly curved faces gave only 59°. The mineral has a perfect cleavage parallel to the elongation of the prisms and bisecting the obtuse angle of the prismatic faces.

Creedite has distinctive optical properties and was first recognized by them. Extinction angles can not be measured accurately on account of the imperfect development of the crystals. However, cleavage fragments show sensibly parallel extinction and the emergence of an optic axis very nearly normal to the cleavage plane. Prismatic sections normal to the cleavage (bisecting the acute angle of the faces) show extinction angles of about 41° ($Z \wedge$ elongation), the emergence of **Y**, sensibly normal, and irregular twinning. Crystals lying on the crystal face show extinction angles ($Z \wedge c$) of $42\frac{1}{2}° \pm 1°$. The mineral is therefore believed to be monoclinic with the faces (110), perfect cleavage (100), $Y = b$, and $Z \wedge c = 41°$; (100) is a twinning plane.

The mineral is optically negative. The axial angle as measured on the axial angle apparatus is:

$$2V_{li} = 64° 30' \pm 10', \quad 2V_{na} = 64° 22' \pm 10', \quad 2V_{Tl}, 64° 20' \pm 10'.$$

Other less satisfactory sections gave

$$2V_{na} = 64° 18' \pm 20' \quad \text{and} \quad 2V_{na} = 64° 50' \pm 30'.$$

The dispersion was perceptible only on one optic axis.

The indices of refraction were measured by the immersion method by matching in a liquid and immediately measuring the index of refraction of the liquid at the same temperature; the probable error should be less than $\pm$ 0.001. All of the grains give the same value showing that the mineral is homogeneous.

$$\alpha = 1.461, \quad \beta = 1.478, \quad \gamma = 1.485.$$

The axial angle computed from the indices of refraction is 65° which agrees very well with the measured values.

Material for a chemical analysis was carefully purified by heavy solution (bromoform) and a careful microscopic examination showed only a very little kaolinite present. The analyses by R. C. Wells gave the following results:

*Analysis and molecular ratios of Creedite*

| | | | | | 2. |
|---|---|---|---|---|---|
| Al | 11.58 | 427 | 210 | 2 × 105 | 11.0 |
| Ca | 23.98 | 599 | 295 | 3 × 98 | 24.4 |
| $SO_4$ | 18.32 | 191 | 94 | 1 × 94 | 19.5 |
| O* | 3.97 | 248 | 122 | 1 × 122 | 3.2 |
| $H_2O-$ | 0.72 | | | | |
| $H_2O$ | 11.08 | 615 | 303 | 3 × 101 | 11.0 |
| F* | 30.35 | 1591 | 784 | 8 × 98 | 30.9 |
| | 100.00 | | | | 100.00 |

* Calculated on the basis of a summation of 100%.

This leads to the formula $CaSO_4.2CaF_2.2Al(F,OH)_3.2H_2O$ with F:OH 2:1 and the mineral has the composition of gearksutite with one molecule of $CaSO_4$ added. The composition corresponding to this formula is given in column 2. Creedite is one of the very few minerals described that contain both sulphate and fluoride as essential constituents.

*Isotropic Kaolinite-Like Mineral.*—The creedite is imbedded in a small amount of a kaolinite-like mineral with rather unusual properties, which is believed to have been derived from some unknown mineral. In the hand specimen it is a white powder, in the thin sections it is clear, in large part sensibly isotropic, and can be distinguished from the Canada balsam in which it is imbedded, only by testing its index of refraction. Locally it shows birefringence in wavy streaks, probably due to strain in the soft mineral or to incipient crystallization. It has an index of refraction of 1.557 ± 0.003. When immersed in a liquid with that index of refraction it is at first clouded but the oil rapidly penetrates its pores, the mineral becomes clear, and the grains can be found only by the colored borders formed by the Schroeder van der Kolk test for the index of refraction. The specific gravity of the powder measured by the pycnometer method is 2.548.

A partial analysis by Roger C. Wells gave:

| $SiO_2$ | $Al_2O_3$ | CaO | MgO | F | Ign. | Total |
|---|---|---|---|---|---|---|
| 44.2 | 40.2 | 0.3 | tr. | none | 15.5 | 100.2 |

Imbedded in this mineral and like it derived from some mineral that has disappeared, are spherulites of an undetermined mineral with rather strong birefringence, positive elongation, and a mean index of refraction of about 1.50.

[1] Emmons and Larsen, The hot springs and the mineral deposits of Wagon Wheel Gap, Colorado, *Economic Geology*, 8, 235 (1913).

[2] Published with permission of the Director of the United States Geological Survey.

[3] Unpublished manuscript by Esper S. Larsen.

[4] Dana, *A System of Mineralogy*, sixth edition, p. 181, 1892.

# THE PROCESSES TAKING PLACE IN THE BODY BY WHICH THE NUMBER OF ERYTHROCYTES PER UNIT VOLUME OF BLOOD IS INCREASED IN ACUTE EXPERIMENTAL POLYCYTHAEMIA

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In a previous communication to the PROCEEDINGS[1] I reviewed the work of the past on polycythaemia, and reported a series of experiments carried out in the hope of determining if possible the process by which the number of erythrocytes per unit volume of blood is increased in acute experimental polycythaemia. Since then further experiments have been undertaken, some of which have already been reported.[2] The results of these experiments, and others about to be published, are collected here in a brief summary of this work up to the present time.

This complicated problem may be divided into four main parts:

(1) The causes capable of producing an increase in number of erythrocytes per unit volume of blood.

(2) Localization of these processes.

(3) The manner in which the number of erythrocytes is increased.

(4) The mechanism by which the red corpuscle content of the blood is controlled.

As previously pointed out, the causes of polycythaemia are very numerous, and have received a great deal of attention, but little work has been done concerning the localization and manner in which this increase in number of erythrocytes is brought about.

From experiments previously reported, the present author concluded that the liver is the organ which is responsible for the changes in number of erythrocytes produced by the intravenous injection of epinephrin.[3] This conclusion has been confirmed by the following experiments here summarized.