A characteristic feature of niocalite appears to be its twinning and in the search for a crystal suitable for single crystal *x*-ray determinations, no untwinned crystal has so far been found. The twinning takes place about a twinning axis which coincides with the acute bisectrix X which is presumably also a crystallographic direction. If the mineral is monoclinic, as it appears to be, this would be the *b*-axis. Other properties of niocalite are:

OPTICAL PROPERTIES:
Biaxial negative
$-2V=56°$
$\alpha=1.700$; $\beta=1.721$; $\gamma=1.730$
Birefringence $\gamma-\alpha=0.030$
Specific gravity: 3.32
Hardness: approximately 6 (Mohs scale).

There is a distinct similarity between the optical and physical properties of niocalite and wöhlerite. The latter, however, has a much higher sodium and zirconium content than niocalite.

A NEW TECHNIQUE FOR MICROMETRIC ANALYSIS OF THIN-SECTIONS*

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The method of thin-section analysis described in this note is based on the fact that, if a microscope objective is uncentered, a circular succession of grain images will pass through the intersection of the cross-hairs when the stage is rotated. In effect, the rotation axis of the thin-section has been shifted from a point at the center of the field to a point near or beyond the edge of the field. The method may be used for either Rosiwal or point count analyses.

Comparison with Linear Rosiwal Method

To compare the results obtained from a circular analysis with those obtained from a conventional Rosiwal analysis, a large "synthetic thin-section" was constructed on paper. This "thin-section" consisted of seven constituents. The position of each grain was determined by using a random number table. These numbers corresponded to grid points on the thin-section. Shapes and sizes of grains were varied to approximate those of minerals actually seen in thin-sections of rocks possessing hypautomorphic-granular texture. After the thin-section was completed, the planimetric percentages of the constituents were determined by measuring the areas of all the grains with a planimeter.

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A conventional Rosiwal analysis was performed by running five linear traverses along the length and five along the width of the "section." Next, twelve circular traverses were run. Table 1 shows the results of the two Rosiwal analyses compared with the planimetric percentages. The twelve circular traverses, because of the radius chosen, correspond to 75.36 linear units. The ten linear traverses correspond to 160.15 linear units.

In order to be sure that the personal factor did not exert too great an influence on the construction of the synthetic thin-section with respect to grain orientation, a similar pair of analyses was run on a thin-section of granodiorite from St. Cloud, Minnesota. The objective was uncentered about one millimeter for the circular traverses. The amount of uncentering was measured with a stage micrometer. The point of rotation was shifted just beyond the edge of the field. Twelve circular traverses, corresponding to approximately 38 mm. of linear transverse, were run on the thin-section. The centers of adjacent traverses were approximately three millimeters apart. The conventional linear traverses (five along the length and five along the width) corresponded to approximately 121 mm. The results of the two analyses are given in Table 2.

Table 1. Synthetic Thin-Section

Constituent	Planimetric %	Rosiwal		Point Count	
		Linear	Circular	Grid	Circular
A	18.2	17.6	17.5	18.6	17.7
B	15.1	15.7	15.0	15.2	15.2
C	1.4	1.0	1.3	1.4	1.9
D	1.0	1.3	1.1	0.6	0.3
E	0.9	0.5	0.7	1.6	0.5
F	0.5	0.6	0.6	0.8	0.6
G	62.9	63.4	63.8	61.8	63.8
Total	100.0	100.1	100.0	100.0	100.0

Twenty other linear Rosiwal analyses were run on the synthetic thin-section to determine the standard deviation from the mean for Constituent "A." The analyses were performed with each set of traverses parallel to each other, but displaced a short distance from the preceding set. The values obtained from the twenty analyses formed a Gaussian distribution. The standard deviation for Constituent "A" was 3.0%. This means that about 68% of the linear Rosiwal analyses would yield values ranging from 15.2% to 21.2% for "A," and the full range of values

TABLE 2. THIN-SECTION OF GRANODIORITE, ST. CLOUD, MINNESOTA

Constituent	Rosiwal		Point Count
	Linear	Circular	Circular
Quartz	15.5	15.3	16.6
Microcline	33.3	33.4	33.9
Plagioclase	35.2	36.6	33.6
Hornblende, Biotite	14.3	13.2	14.1
Magnetite, Sphene, Apatite	1.7	1.5	1.8
Total	100.0	100.0	100.0

would be from about 9.2% to about 27.2%. Thus, the results obtained by the two methods from the true thin-section (Table 2) are compatible.

The primary objection to the use of the circular Rosiwal method lies in the fact that the angle through which the stage rotates in traversing across a grain must be recorded by noting the angular positions before and after the traverse. This difficulty is about the same as that encountered when using an ordinary non-integrating mechanical stage for linear Rosiwal analysis where the linear positions must be recorded before and after traversing each grain.

In using the circular Rosiwal method it is convenient to work to the nearest degree. For this reason, the amount that the objective is uncentered should be selected such that the smallest grain desired subtends an angle of at least one degree.

Comparison with Linear Point Count Method

The circular technique also seems to be applicable to the point counting method. The objective is uncentered as before, and the stage is rotated in angular increments to fix the points to be counted. This method together with a grid-type point count was used on the synthetic thin-section. The points for the circular method were fixed by rotating the stage in five degree increments. The results are shown in Table 1. The grid point count used 897 points; the circular used 864 points. The results of a circular point count on the previously mentioned granodiorite are given in Table 2. The points were spaced five degrees apart on the same twelve circles used for the circular Rosiwal analysis.

An inexpensive circular point counter was constructed by cutting a disc out of 1/16 inch metal and cutting notches in the periphery. The notches were spaced five degrees apart by use of a protractor. The disc was fastened to the stage and a small piece of spring brass was fastened to the stationary part of the stage in such a manner that it engaged the notches as the stage was rotated. The stage is rotated until a click is heard which indicates the point to be counted. Before a circular point count is begun, the position of the stage with respect to the vernier should be noted in order that no more than one complete revolution be made in the same spot. It is convenient to paint a reference mark on the disc to indicate the starting point.

The circular point counter was constructed in about two hours, and only common hand tools such as files, drills, and a hack saw were used.

The methods as outlined here should be of value to those petrographers who do not do enough thin-section analyses to warrant the purchase of an integrating stage, a mechanical stage, or a point counter. For circular Rosiwal analyses, no apparatus is required other than a petrographic microscope. For circular point counts, an easily constructed notched disc may be used. The method should also be useful in petrography classes where the ratio of students to integrating stages and/or point counters is high.

ANOMALOUS FLUORESCENCE IN TORBERNITE FROM RUM JUNGLE, N.T. AUSTRALIA

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Although most, if not all, torbernite is non-fluorescent, reports of torbernite showing anomalous fluorescence appear from time to time. Where such torbernite has been subjected to microscopic examination it has been found to consist of intergrowths of one or more fluorescing minerals, notably autunite, with the torbernite (Meixner, 1939, p. 438), whereas the torbernite in the intergrowths did not fluoresce.

A striking example of torbernite showing such anomalous fluorescence was found recently at Rum Jungle, N.T., in Northern Australia (*C.S.I.R.O. Mineragraphic Report No. 619*). This specimen, which is about 9 in.×6 in., is covered with protuberances 1 to 2 mm. high consisting of stacks and clusters of a platy emerald green mineral, apparently torbernite, but the surface fluoresces a vivid greenish-yellow, except in a single band across the center. This band consists of non-fluorescent, slightly darker green crystals.

These darker green non-fluorescent crystals consist of meta-torbernite.