reflections indicate that the ordinary nepheline cell is only a pseudo cell and that the true cell is considerably larger. Like the pseudo cell, the true cell is also hexagonal. The a-axes of the cells are at an angle of 30°. The dimensions of the true cell are: $a_0=17.4$ Å; $c_0=76$ Å ± 1 or 2%. A rotation photograph about the c-axis shows the presence or absence of the following layer lines:

Layer lines with $l=9n$ ..... strong.
Layer lines with $l=9n\pm 2$ ..... very weak.
Layer lines with $l\neq 9n$ or $9n\pm 2$ ..... absent.

As revealed by the Weissenberg photographs, the rules limiting possible reflections are:

For $(hk\bar{i}l)$ reflections: if $l=9n$ then $l-h$ and $l-k=3n$.
if $l=9n\pm 2$ then there are no restrictions.
For $(000l)$ reflections: $l=18n$.

The extra reflections of the true cell are too weak to allow a determination of the space group to be made with any certainty.

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A CHART SHOWING THE SPHERE OF INFLUENCE OF ATOMS AND IONS IN MINERALS

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A chart showing both the radii and valences of the atoms and ions which enter into minerals can easily be constructed by pressing transparent colored Zip-a-tone circles onto a large size (76″×52″) periodic chart of the elements (Fig. 1). The chart is entirely visual and at a glance one can tell the valence of the ion and its relative size. It has proven to be particularly useful in teaching mineralogy and geology courses dealing with mineral formation. The chart is easily amenable to changes as the colored Zip-a-tone circles are easily replaceable.

The data for the selection of valences found in minerals were taken

from Goldschmidt (1954), Green (1953) and Rankama and Sahama (1950). Only the valences found in minerals were used. Circles representing the radii of elements formed only from radioactive disintegration processes and those of the inert gases are not shown.

Atomic and ionic radii as given by Green (1953) were used for this chart. The values in angstrom units were multiplied by 2×10^8 so as to give the radii in centimeters of the circles. For example, the ionic radius for O^{-2} (1.40 Å) when multiplied by 2×10^8 cm./Å gives a radius of 2.80 cm. This was found to be the best scale for the chart as the large ions

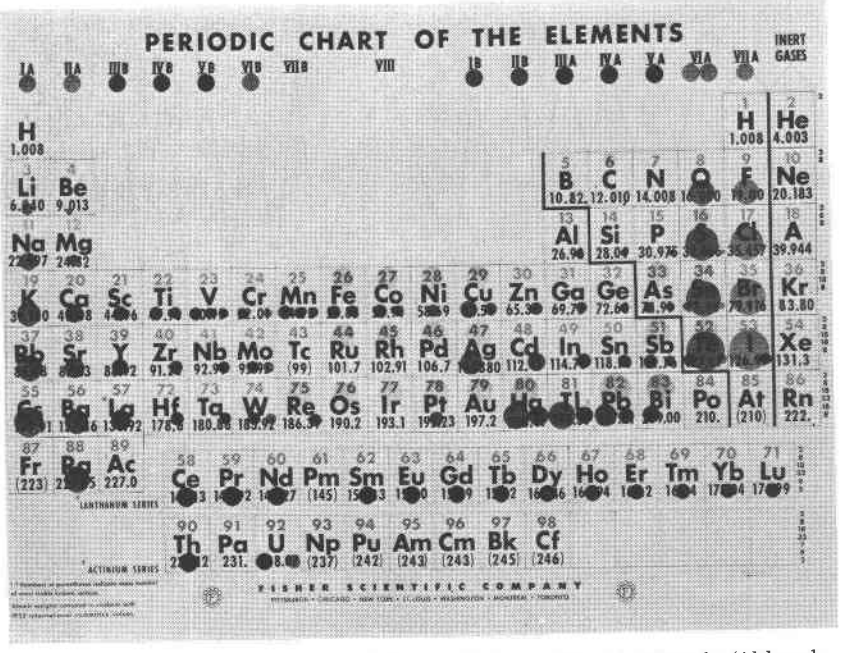

FIG. 1. A chart showing the sphere of influence of atoms and ions in minerals. (Although in the photograph some of the circles appear opaque, they actually are transparent.)

such as Br^{-1} and I^{-1} just fit in their respective squares. Some overlap occurs with the circles in the squares for Hg, Se, Te, and I. Since the value for the ionic radius for H^{+1} is too small to show to scale, its size is exaggerated so that it is visible. It is the only circle on the chart that is not to scale.

Each valence is designated by a specific color, the colors being used in the order in which they appear in the spectrum. A valence of +1 is represented by red circles, +2 by yellow circles, +3 by green circles, +4 by blue circles, +5 by purple circles, and +6 by gray circles. Elements

having a valence of -1 are represented by lighter red circles and those of -2 by lighter yellow circles.

Colored circles showing valence are at the top of the chart just under the sub-group numbers. These have radii of 2 cm. which represents a value of 1 Å, so a rough idea of the size of any radius on the chart can be had by comparison with these unit circles.

Atomic radii are shown by a transparent black and white ruled pattern and are located in the upper part of the square over the atomic number.

Colored circles showing the relative size of the ionic radius or radii for each element, with appropriate color for different valences, are located in the lower part of each square over the value for the atomic weight. If more than one ionic radius of positive valence is given for an element, the radius with the lowest valence is placed to the left. Valences of the same value and so of the same color are aligned so that their centers are in a straight vertical line as for instance Ti^{+4}, Zr^{+4} and Hf^{+4}. The circles representing the positive ionic radii for each period are aligned horizontally so that their centers are on a straight line across the chart.

The Zip-a-tone circles were cut out with a compass with a small piece of sharpened steel in place of the usual pencil point.

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