other it is minutely corrugated by scarcely emergent wrinkles in concretionary groups. In a third specimen the surface is smooth to the naked eye, but under a glass is minutely pustulate with flat disks.

The specific gravity was determined by the balance as 3.84. Mr. Fair submitted a sample to J. P. Maider, city chemist of Spokane, who reported as follows: $FeCO_3$, 93.16; $MnCO_3$, trace; $CaCO_3$, 5.13; $MgCO_3$, 1.83; sum 100.12,% Sp. gr. by picnometer 3.673(?).

The optical properties of this siderite have been studied by Mr. E. S. Larsen of the U. S. Geological Survey, and will be described in a forthcoming number of the Journal of the Washington Academy of Sciences.

AN ELEMENTARY INTRODUCTION TO CRYSTALLOGRAPHY

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(*Continued from page 66*)

The symbol 111 calls for a plane that passes thru the ends of the *a* axis in front, the end of the *b* to the right or E and of *c* above or to the N. $1\bar{1}1$ gives a plane cutting *a* in front, *b* to the left or W, and *c* above or to the N.

$\bar{1}11$ is a plane cutting *a* to the back, *b* to the right, and *c* above, $\bar{1}\bar{1}1$ *a* to the back, *b* to the left and *c* as before, above. These four would cut out a four sided pyramid. Four more which might be written at once by *reversing* the signs on the above, $\bar{1}\bar{1}\bar{1}$, $1\bar{1}\bar{1}$, $\bar{1}1\bar{1}$ and $11\bar{1}$, would give an inverted pyramid with its base to the base of the first. The whole figure will make an octahedron.

If we take the four symbols 110, $\bar{1}10$, $1\bar{1}0$ and $\bar{1}\bar{1}0$ they would indicate a square pillar or prism as the four 100, 010, $\bar{1}00$ and $0\bar{1}0$ did, but that had a face toward us, and this has an edge towards us. The three edges of a cube which meet in a point give us the direction of our three axes; here these four faces indicate that the two axes *a* and *b* are the same length or our pillar (or prism) would be diamond shaped, not square. These four faces are also in a zone parallel to *c*. They are properly called prism faces. They may be thought of as cutting off the corners of the first square pillars, whose face 100 is toward us. If they only cut off say half of the corners and left half we would have eight faces all in the *c* zone, the faces and edges all parallel to *c*.

The first four faces are the faces of a cube or are pinacoids, the last four are prism faces. As the cube has four faces parallel to *b* as well as parallel to *c*, this crystal form has four faces parallel to *b*; they are 101, $\bar{1}01$, $10\bar{1}$ and $\bar{1}0\bar{1}$, and indicate, if taken alone, a horizontal prism.

If the prism is square and not diamond shaped that shows that the lengths of the *a* and *c* axes are equal. If the crystal was drawn out that way it would be said to be elongated parallel to *b*.

These two sets taken together would make a closed form but not a perfect crystal.

There is plainly another set where the 0 is in the first place, 011, $0\bar{1}1$, $01\bar{1}$, and $0\bar{1}\bar{1}$.

They would make a prism parallel to *a*. The three pillars which combine to make a cube have for each pair two faces in common so the cube has only three times two, or six faces. Our last three prisms or pillars made with only one 0 in each symbol if combined would cut out or make a crystal form of three times four, or twelve faces, and for that reason is called the dodecahedron.

The dodecahedron has four faces meeting in a pyramid at each of the six ends of the axes; each face must thus go to the ends of two axes. As I have indicated each of these faces shows that two of the axes in the isometric system of crystals are equal. The octahedron, typified by (111), gives the indication by one of its faces that the three axes are all equal (but not so simply). These, the cube, the octahedron and the dodecahedron are the fundamental forms of the isometric system. There are four more forms in this system; they and all the forms in the other systems are derived from these three fundamental forms. The symbol 100 can only be modified by putting the 1 in each of three places and the 1 with the minus sign in three, making six planes or faces of the cube, the number of the permutations of the symbols being the same as the number of faces for the form it indicates. The same is true for the other crystal forms. The word form is used to indicate such a set of faces or planes. We use the symbol with a bracket to indicate the full set; thus:

(100) stands for all the faces of a cube.

(111) stands for all the faces of an octahedron.

(110) stands for all the faces of a dodecahedron.

The bracket is frequently put in by writers where it should be left out as only one face is intended. These crystal forms are not capable of any variation in the direction of their planes.

PROCEEDINGS OF SOCIETIES

The Philadelphia Mineralogical Society

Wagner Free Institute of Science, April 12, 1917.

President Trudell in the chair. Fifteen members and two visitors were present. Mr. M. L. Jandorf and Dr. Herman Burgin were elected active members. Mr. William C. Knabe was appointed Treasurer to take the place of Mr. Oscar Streland who has resigned the office.

Mr. Oldach reported a trip to the Falls of French Creek Mines which are now in active operation. Fine specimens of pyrite, magnetite, calcite, and heulandite (new) were exhibited. Mr. Benge reported the results of the trip of the Society to Mullica Hill, attended by seven members. Vivianite, beraunite and aragonite (besides eight or nine species of fossils) were obtained, the viv-