with quartz crystals, the crystals being perfect, but looking as tho they had been twisted and mashed.

The district is noted for having produced large and well developed crystals of quartz, both single and grouped. One large group, taken out by the writer was studded with small brilliant pyritohedral crystals of pyrite.

The eastern part of the district yields large numbers of loose crystals found on the surface, some almost as brilliant as the "Herkimers." On the north side of the mountain, in an outcrop of limestone near the diorite, garnet is very abundant. Dodecahedral crystals of brown and green garnet implanted on calcite, associated with specularite (micaceous hematite) occur, and fine showy specimens were obtained. Good specimens of chabazite, epidote, muscovite, and a yellow garnet were taken from the southern contact. Further north and west coarse porphyritic granite appears, and here fine crystals of orthoclase, some twinned (Carlsbad law) were taken out of the rock.

The following minerals were reported from the locality, but were not observed by the writer: diopside, monticellite, ludwigite, phlogopite, magnetite, chalcocite, tetrahedrite, fluorite and pyromorphite.

The district is very favorable for collecting, interesting specimens being obtainable at any time. The country is not only noted for its variety of minerals and rocks, but also for some of the finest scenery in the West. To the south of Clayton Peak Big Cottonwood Canyon forms a large amphitheatre which is covered with timber, and built up with summer homes. Silver Lake lies at its base, while on the opposite side of the peak, but higher up, the beautiful Lackawaxen Lake is situated, making it an ideal spot to spend a summer vacation.

AN ELEMENTARY INTRODUCTION TO CRYSTALLOGRAPHY

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(*Continued from page 83*)

The face 110 is referred to as the unit prism and the face 111 as the unit pyramid. As already indicated they, with the pinacoids, are the most important faces, for they will give the constants of the crystal, the angles between the axes, (thus far all right angles) and the lengths of the axes, (thus far all equal).

We have now described the three most important fundamental crystal forms; four other primary forms are derived from them, and all other isometric crystals are combinations of these seven. Every plane or face of a crystal we have described has cut one or more of the axes, and in every case where a plane has cut an axis it has been only and entirely at its outer end.

The next four forms cut the axes at some other point than the ends (or the center, where the axes cross).

This is indicated by symbols larger than 1, such as 2. The figured 2 indicates that the axis is cut equally in two, and that the plane cuts the axis at the halfway point. 3 or a larger figure would indicate that the axis was cut into that many parts, and that the plane cuts the axis at the dividing point nearest the center.

Let us take the form indicated by the symbol (210); it is called the four-faced-cube. Each face of the cube has on it a pyramid made by four planes, each bounded by one edge of the square face and by two lines extending from two corners to the center.

210 and $2\bar{1}0$ would be the two such faces on the front face of the cube that would be parallel to *c*. These would cut the *a* axis half way from the center and *b* at its ends.

They would not be as flat as the faces of the cube nor as steep as the faces of the dodecahedron. The symbols of these last, 100 and 110, may be multiplied by 2 and written 200 and 220, when it is at once seen that 210, the symbol for a face of the four-faced-cube, has a slant midway between them.

This suggests the second great law of crystallography— that the planes which cut one axis divide it into parts, which, for the different planes, bear simple numerical relations, as twice, three times, a half, a third, two thirds, (2 to 3), three halves, (3 to 2), etc.

All the angles in a zone, if measured not in degrees but in "offsets," as elevations, or as tangents, bear simple ratios or relations to each other (in other words, they are commensurable). This is called the rationality of the indexes, and is the second fundamental law of crystallography.

Each of the four faces of the cube parallel to *c* has two pyramid faces also parallel to *c*, making eight faces in the *c* zone.

I think it is plain that there are also eight independent faces in each of the zones *a* and *b*; in all, twenty-four faces. It would be good practice for a student to write down the symbols of the eight faces in each of these zones, thinking them out. For the *c* zone

on 100	on 010	on $\bar{1}00$	on $0\bar{1}0$
$2\bar{1}0$, 210	120, $\bar{1}20$	$\bar{2}10$, $\bar{2}\bar{1}0$	$\bar{1}\bar{2}0$, $1\bar{2}0$

It is plain that this could be done with very little thinking, indeed, mechanically. On 100 and on $\bar{1}00$ the symbols are the same, except that for faces that are opposite one another the signs are all reversed. To reverse the signs always indicates a face directly opposite a given face.

The faces in the *c* zone, the symbols of which always have 0 in the third place, are called prism faces, except when they are the faces of a cube or pinacoid.

(To be continued)