regular outlines and well defined areas of pay ore; the usual circumstances disclose irregular areas with poor definition, irregular outlines and of very variable character. Some auriferous quartz veins of this country, both east and west, carry the precious metal in pretty sharply defined *pay streaks* which, however, have very irregular outlines, and may leave vey large portions of any rectangular area of the deposit so poor in value as to be *commercially* barren. This is a prominent characteristic of Nova Scotia and Ontario gold veins. The nickeliferous pyrrhotites of the Sudbury region, while usually presenting irregular outlines and consequently indefinite areas, yet compensate by comparatively sharp lines between ore and waste; in this respect they differ markedly from the British Columbia pyrrhotites, which, as a rule, present no defined sharp boundaries either of pay ore or of mineralization, the "walls" being determined (as in the Le Roi Mine) in the assay office by the shrinking of values below the figures of possible profit. This is a necessary consequence of the character of the deposits, which are metasomatic, the replacement of portions of the eruptive country by the pyrrhotite proceeding in completeness from the centre outwards, or from the plane of the shear on both sides. The longitudinal and vertical limits of the pay ore of these deposits are sometimes more sharply defined than the lateral boundary, but, speaking broadly, their boundaries are not physical, but are a matter of values.

Almost without exception ore deposits are not only irregular in form and outline, but are irregular in value as well; the well-known Homestake and Alaska Treadwell deposits occasionally produce specimens of coarse gold, although the general tenor of these properties is remarkably low grade. The same diversity in contents is seen in the amygdaloid and conglomerate copper bearing belts of Michigan, Wisconsin and Isle Royale, as well as in the so-called "mass" copper properties.

By reason of these variations in value, shape and size, the examining engineer must, for each case, decide the boundaries as closely as possible, and plot the same upon his plans and sections.* Having thus plotted the boundaries of payable ore as accurately as possible, the engineer now has to calculate the area of pay ore within each block of positive and probable ore. It should be, and is, unnecessary to say that "possible" ore has no connection with the estimation of tonnage; only ore which is "ready to be broken" can enter into measurements. The possible ore, or future possibilities of a mine must be dealt with separately, and, by preference, should be discussed only at the very end of the engineer's report. The technical ignorance of shareholders or directors may otherwise ascribe blame to the examining engineer of which he is wholly innocent.

The different areas of pay ore having been measured, their conversion into volumes follows. In most cases determination of the third dimension for each area is not difficult, the average of all the widths measured being taken. But there are deposits frequent in those of the "fissure vein" type, where the irregularity in widths observed throughout any extensive area, is so great in magnitude as to vitiate a general averaging of the widths measured. In such an event the engineer must have recourse to the resources of mathematics, and I may refer the reader, on this particular point, to the method of "revolved areas" as one which usually solves the difficulty of obtaining a correct third dimension from which to obtain the volume.

From the volumes which have been correctly calculated, the conversion is made into tonnage. Sometimes this conversion is made by using the weights per cubic foot, or Specific Gravities, which are found in the tables accompanying text books or engineers' reference books. Protest must be entered against this practice; the specific gravities given in such tables are obtained from pure, clean, selected specimens of the individual minerals, and the weights per cubic foot are calculated from such specific gravities. Now, in nature, one does not often meet with such clean, pure ores; there is always an admixture of other minerals; there are also frequently open or barren spaces arising from crevices and vugs; there are extensive density, such as dykes, horses, etc., which vitiate calculations made from such tabulated figures. It is better for the engineer to determine the average specific gravity of the ore himself on each examination, using for the purpose those portions of the assay samples which were rejected when quartering down, or the samples which were used in making sorting tests of the ores. For himself, in examinations requiring great accuracy, and in which large amounts are involved, the writer chooses to determine the specific gravity of each different class of ore, if such be met with in the mine. For an example, the Stanley Mine (in Colorado), is an aggregation of many claims including several veins of different mineralization; the area owned lies on both sides of Clear Creek, and the main vein which carries auriferous copper pyrites on the east end of the property has its chief values in silver-bearing galena on the west end, with mixed values in the centre. In this instance three different specific gravities were taken, one to be used for the vein mass on the east, one for the vein mass in the centre, and one for the vein mass in the west end.

As to the correction to be made for crevices, oxidations, vugs, etc., above referred to, it must be determined for each deposit, according to the observations made by the engineer during his examination.

* See admirable article by E. B. Kirby, *Engineering and Mining Journal*, March, 1895.