is reproduced by Smith in his article, abovementioned, and in the "Rara Arithmetica."

Some time ago in discussing before the American Mathematical Society the "Quadripartitum" of John of Meurs, written about A.D. 1325, I called attention to the fact that this writer also should be included among those who by use of an analogy with the sexagesimal fractions made a near approach to decimal fractions.[12] In the passage in question, which occurs in the twenty-second chapter of the second book, dealing with the extraction of square root, zeros in pairs are annexed to the number whose approximate root is desired. In extracting the square root of 2, six ciphers are annexed to the 2 and the square root of 2000000 is obtained as 1414. At first this is changed to sexagesimal fractions and by successive multiplication of remainders by 60 the root is obtained as 1° (gradus), 24 minutes, 50 seconds, and 24 thirds, or 1 24/60 50/3600 24/216000. The manuscript proceeds, as follows: "Et si vis posses dicere ab inicio cum habuisti hanc radicem 1414 quod unitas que est in quarto loco est sicut integrum et 4 que sunt in tercio loco sunt decima pars integri, et unitas que est in secundo loco est decima decium, et 4 que sunt in primo loco sunt decima decime decime sic 1·4·1·4. Et nota quod istam radicem preinuentam 1414 potes multum bene ponita unitate in loco integrum tres differentias remanentes multiplicare per 10, 20, 30, 40, 50, 60, 70, 80, 90 et semper a producto demptis figuris que excedunt numerum medietatis circulorum, residuas multiplica per illum articulum per quem alias extendisti et hoc facto tociens quod non remaneant nisi tres circuli qui sunt medietas circulorum. Habebis radicem secundum proporcionem integri ad articulum per quem fueris operatus." The statement here that in the 1414 (regarded as the square root of 2, evidently) that the first unit (fourth as counted from the right or ordinary unit's place) is to be regarded as an integer, the following 4 as tenth parts of an integer, the following unit as the tenth part of a tenth, and the final (first, counting in the ordinary way from the right) 4 as tenth parts of the tenth part of one tenth borders closely on the idea of decimal fractions. However, John of Meurs, like so many others who made initial steps in this direction, carried the idea no further.

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[12] I am using photographic copies of pages of the Vienna MS. 4770; the passage in question is found on folio 224 verso; the manuscript was probably written in the early part of the fifteenth century, containing also Robert of Chester's translation of the algebra of Al Khowarizmi, recently published in the University of Michigan Humanistic Series.

## THE SHORTAGE OF PLATINUM

ACCORDING to a bulletin issued by the U. S. Geological Survey most people are apt to think of platinum as preeminently adapted to settings for precious stones, but the metal is in fact indispensable to many essential industries. Platinum dishes and utensils are absolutely needed in all chemical laboratories, and upon these laboratories all great industries are dependent for guidance. Alloys have been devised for use in the ignition systems of internal-combustion engines, but no substitute for platinum has been found for certain delicate parts of these systems. Platinum and allied rare metals are widely employed in instruments of precision required for making physical tests of materials of all kinds. Probably platinum is now most valuable for its use in the contact process of making concentrated sulphuric acid, which is essential to a great number of industries that are vitally important at all times, and particularly in time of war.

The United States alone annually uses about 165,000 ounces of fine platinum and produces less than 1,000 ounces of crude platinum. Realizing the urgent necessity of increasing the country's production of the metals of the platinum group, the United States Geological Survey, Department of the Interior, has planned an investigation in which L. M. Prindle and J. M. Hill, geologist, will visit places in this country where commercial deposits of these metals may be found.

Native platinum, the metal and sperrylite (platinum arsenide) have been found in basic

igneous rocks at several places in the world but not in commercial quantities. The search for platinum in rocks is therefore not likely to obtain an immediate supply of the metal. Persons searching for platinum ores should remember, however, that the assay for platinum is difficult and apparently can not be successfully made by all commercial assayers. Samples of supposed platiniferous ores should therefore be sent only to the most competent assayers. The United States Geological Survey has received several reports of discoveries of rich platinum ore in which, as the reports state, "the platinum could be detected by the ordinary methods of assay." Such statements should be regarded with great caution, for any platinum ore of commercial grade will doubtless yield traces of platinum if tested by the standard methods employed by competent and reliable assayers.

The platinum supplies of the world, except a relatively small quantity, have been obtained from placer deposits, notably from those of Russia, which have produced about 95 per cent. of the world's output. The largest part of the crude placer platinum now produced in the United States is won by dredges working in California at the west base of the Sierra Nevada, in gravels derived from worn-down lodes and concentrated by natural streams. The greater production from this region than from northwestern California and southwestern Oregon and other places would appear to be due to larger operations rather than to greater or richer deposits.

All the known placer deposits that contain platinum are near areas of basic igneous rocks, and it would seem that the first step in any search for new deposits of platiniferous gravels is to look for outcrops of peridotite, pyroxenite, dunite and serpentine. When areas of these rocks have been found the gravels of the streams that rise in them should be washed to see whether they contain platinum. Most of the heavy concentrates found in gravels that carry platinum are rich in chromite and olivine. The character of the rock of which the gravels were formed may give a clue to their source.

Crude platinum as it occurs in placer concentrates is ordinarily a silvery-white metal, the fresh surface of which could be confused only with that of silver, or possibly with that of iron. It can easily be distinguished from these metals, however, by simple tests, as they are soluble in dilute nitric acid, whereas crude platinum can be dissolved only in concentrated aqua regia, a mixture of three parts of hydrochloric (muriatic) acid and one part of nitric acid. In some placer deposits the grains are coated with a dark film and somewhat resemble the grains of the dark minerals chromite, magnetite or ilmenite, from which, however, they can be separated by careful panning, as the platinum is heavier than any of those minerals.

Platinum will not amalgamate with quicksilver alone, but will amalgamate with quicksilver and sodium. If ordinary quicksilver amalgam is used the flakes of platinum float on the surface and can be removed. If sodium amalgam is used the platinum may be separated from any gold in the amalgam by washing with water until the sodium is converted to sodium hydroxide, when the platinum will come out on the surface, provided the amalgam is sufficiently liquid.

Platinum has a hardness of 4 to 5 and can be scratched with a knife. It is so malleable that it can be hammered into very thin sheets without heating. It is practically infusible, and grains of it can not be melted together, as can particles of gold and lead.

One test for platinum is relatively simple. The metallic particles to be tested are dissolved by boiling in concentrated aqua regia and the resulting solution is allowed to dry. The dry residue is dissolved in hydrochloric acid, and the solution is evaporated by boiling until it becomes a thick mass but is not quite dry. This mass is diluted with distilled water and to it are added a few drops of sulphuric acid and of potassium iodide, which cause it to assume a very characteristic wine-red color if it contains considerable platinum or a reddish-pink color if it contains only a small quantity. This test, though it is fairly delicate, will not

detect traces of platinum if the solution contains large quantities of iron or other elements.

A second test of the residue from the aqua regia solution after it has been dissolved in hydrochloric acid to form the thick mass described is to add to it potassium chloride (KCl), which, if the dissolved residue contains platinum, will precipitate yellow crystals or potassium platinic chloride ($K_2PtCl_6$).

A third test may be made by adding to the aqua regia solution ammonium chloride ($NH_4Cl$), which, if the solution contains platinum, will precipitate yellow crystals of ammonium platinic chloride.

The precipitates from the second and third tests are both insoluble in alcohol but are soluble in water and by heating may be reduced to platinum sponge.

The tests described above, though they are comparatively simple and positive if made on single grains, can not be relied upon if the material tested contains other elements than platinum. They should therefore be restricted to grains of a single mineral picked from concentrates obtained by panning a sample of either rock or gravel.

The adequacy of the future supply of platinum in the United States, as far as it can be assured, depends on the results of work of three kinds—first, the determination of our present supply, particularly of unmanufactured platinum metals, in order that it may be mobilized; second, systematic search for new deposits, and third, scientific exploitation of the deposits discovered, to assure their maximum yield. Work of the first two kinds is now being done by the Geological Survey, and it is hoped that work of the third kind—the technologic work—may be in part done by means of federal and private investigations.

A detailed report on the production of platinum in 1916, with information on the world's resources of this metal and hints for prospectors, by J. M. Hill, of the U. S. Geological Survey, is now in preparation and will be ready for distribution in July. Copies of this report may be obtained by addressing the Director, U. S. Geological Survey, Washington, D. C.

## SPECIAL ARTICLES

### IS THE HOUSE OF TCUHU THE MINOAN LABYRINTH?

WHILE going through a back number of the *American Anthropologist*[1] the writer's attention was attracted by the figure illustrated in Fig. 1. This was in a short paper by Dr. J. Walter Fewkes entitled "A Fictitious Ruin in the Gila Valley, Arizona." In this he showed that this symbol which was first observed by an eighteenth-century Spaniard scratched in the sand by a Pima Indian did not represent the plan of a ruin as previously interpreted, but was used in some way in a game "the house of Tcuhu" (Tcuhiki).

It was curious but this diagram was familiar to the writer and his familiarity came from a distant part of the world. As shown in Fig. 2 this diagram appears on the reverse of a silver coin of Cnossus in Crete of the Greek Period (B.C. 200–67). In this case the figure represents the Minoan Labyrinth. On other coins from Cnossus it sometimes appears in a square form, but even then it has the same ramifications. A comparison of this Greek coin, with House of Tchuhu when inverted, shows that the two are identical in every respect.

There are three possible explanations for the coincidence. First, these symbols may have arisen independently in the new and the old world. Secondly, the symbol may have originated in the old world and have been transported to the new in pre-Columbian times. Thirdly, that the symbol was introduced into America with the Spanish conquest.

On the one hand, it has been pointed out by Fewkes (*loc. cit.*) that the symbol or something like it was early known to the Pima Indians, as the diagram in slightly modified form appears scratched on the adobe wall of the Casa Grande ruin among obviously Indian pictographs. On the other hand, it is possible that this diagram may have had a Spanish origin.

While it is quite generally accepted by American ethnologists that such simple forms

[1] N. S., Vol. IX., 1907, p. 501.