

may be read with the utmost accuracy. The tubes and scales are protected from the weather by wooden hinged casings, which can be opened at will.

To obtain a given height or pressure at a given moment, the cock of the corresponding glass tube must be opened, and the hydraulic pump set to work. When the mercury reaches the cock, it rises at the same time in both the steel and the glass tube. By working the hydraulic pump slowly, it can be brought exactly up to the required level, but if the mark be overshot, a certain quantity of water under pressure is allowed to escape near the pump at the bottom. This arrangement is carried out in the laboratory at the foot of the tower. The necessary communication between the two operators, one at the bottom and the other at any required height, is effected by means of a telephone which the ascending or descending operator carries with him, and through which he can speak with those in the laboratory below. If the mercury rises by mistake above the top of any one of the glass tubes it returns to the foot of the tower through an overflow pipe.

As the graduated scales behind each glass tube are not always vertically superposed, their readings are harmonized by means of two connected reservoirs of water joined by an India-rubber tube. The horizontal plane for the base of each scale corresponding to the upper level of the preceding scale can be ascertained from this artificial level.

A laboratory has been erected in the west pillar of the tower, containing the hydraulic force pump, the mercury reservoir, the telephonic station, and other accessories. Among these is a metal gauge of large dimensions connected with the mercury under pressure. It is marked to scale to show first the pressure in atmospheres, and second the numbers corresponding to the different cocks up the tower. The operator is thus able to tell at once and beforehand into which glass tube the mercury ought to rise under a given pressure, and the right cock to get opened to show the level it has reached. To calculate the pressure according to the height to which the column of mercury is raised, the mean temperature of the column in each experiment must be found. This is done by measuring the variation in the electric resistance communicated by the column to the telephonic wire.

The apparatus here described will be found of the greatest use for making experiments on pressures hitherto impossible, and its value from a scientific point of view can scarcely be overrated. The thanks of all scientific men are due to M. Eiffel, who generously undertook the whole expense of constructing and setting up the pressure-gauge, and also to M. Cailletet, to whose skilful designs the success obtained is chiefly due.

PRECIOUS AND ORNAMENTAL STONES AND DIAMOND CUTTING.¹

UP to the present time there has been very little mining for precious or semi-precious stones in the United States, and then only at irregular periods. It has been carried on during the past few years at Paris, Me.; near Los Cerrillos, N. Mex.; in Alexander County, N.C., from 1881 until 1888, and on the Missouri River near Helena, Mont., since the beginning of 1890. True beryls and garnets have been frequently found as a by-product in the mining of mica, especially in Virginia and North Carolina. Some gems, such as the chlorastrolite, thomsonite, and agates of Lake Superior, are gathered on beaches, where they have fallen from rock which has gradually disintegrated by weathering and wave action.

A very limited number of diamonds have been found in the United States. They are met with in well-defined districts of California, North Carolina, Georgia, and recently in Wisconsin, but up to the present time the discoveries have been rare and purely accidental.

Of the corundum gems (sapphire, ruby, and other colored varieties) no sapphires of fine blue color and no rubies of fine red color have been found. The only locality which has been at all prolific is the placer ground between Ruby and Eldorado bars, on the Missouri River, sixteen miles east of Helena, Mont. Here

sapphires are found in glacial auriferous gravels while sluicing for gold, and until now have been considered only a by-product. Up to the present time they have never been systematically mined. In 1889 one company took the option on four thousand acres of the river banks, and several smaller companies have since been formed with a view of mining for these gems alone or in connection with gold. The colors of the gems obtained, although beautiful and interesting, are not the standard blue or red shades generally demanded by the public.

At Corundum hill, Macon County, N.C., about one hundred gems have been found during the last twenty years, some of good blue color and some of good red color, but none exceeding \$100 in value, and none within the past ten years.

Of the beryl gems (emerald, aquamarine, and yellow beryl) the emerald has been mined to some extent at Stony Point, in Alexander County, N.C., and has also been obtained at two other places in the county. Nearly every thing found has come from the Emerald and Hiddenite mines, where during the past decade emeralds have been mined and cut into gems to the value of \$1,000, and also sold as mineralogical specimens to the value of \$3,000; lithia emerald, or hiddenite, to be cut into gems, \$8,500, and for mineralogical specimens \$1,500; rutile, cut and sold as gems, \$150, and as specimens, \$50; and beryl, cut and sold as gems, \$50. At an altitude of 14,000 feet, on Mount Antero, Colorado, during the last three years, material has been found which has afforded \$1,000 worth of cut beryls. At Stoneham, Me., about \$1,500 worth of fine aquamarine has been found, which was cut into gems. At New Milford, Conn., a property was extensively worked from Oct., 1885, to May, 1886, for mica and beryl. The beryls were yellow, green, blue, and white in color, the former being sold under the name of "golden beryl." No work has been done at the mine since then. In 1886 and 1887 there were about four thousand stones cut and sold for some \$15,000, the cutting of which cost about \$3,000.

Turquoise, which was worked by the Aztecs before the advent of the Spaniards and since then by the Pueblo Indians, and largely used by them for ornament and as an article of exchange, is now systematically mined near Los Cerrillos, N. Mex. Its color is blue, and its hardness is fully equal to that of the Persian, or slightly greater, owing to impurities, but it lacks the softness of color belonging to the Persian turquoise. From time immemorial this material has been rudely mined by the Indians. Their method is to pour cold water on the rocks after previously heating them by fires built against them. This process generally deteriorates the color of the stone to some extent, tending to change it to a green. The Indians barter turquoise with the Navajo, Apache, Zuni, San Felipe, and other New Mexican tribes for their baskets, blankets, silver ornaments, and ponies.

The finest garnets and nearly all the peridots found in the United States are obtained in the Navajo Nation, in the north-western part of New Mexico and the north-eastern part of Arizona, where they are collected from ant-hills and scorpion nests by Indians and by the soldiers stationed at adjacent forts. Generally these gems are traded for stores to the Indians at Gallup, Fort Defiance, Fort Wingate, etc., who in turn send them to large cities in the east in parcels weighing from half an ounce to thirty or forty pounds each. These garnets, which are locally known as Arizona and New Mexico rubies, are the finest in the world, rivaling those from the Cape of Good Hope. Fine gems weighing from two to three carats each and upward when cut are not uncommon. The peridots found associated with garnets are generally four or five times as large, and from their pitted and irregular appearance have been called "Job's tears." They can be cut into gems weighing three or four carats each, but do not approach those from the Levant either in size or color.

Since the discovery of gold in California compact gold quartz has been extensively used in the manufacture of jewelry, at one time to the amount of \$100,000 per annum. At present, however, the demand has so much decreased that only from five to ten thousand dollars' worth is annually used for this purpose. In addition to the minerals used for cabinet specimens, etc., there is a great demand for making clocks, inkstands, and other objects.

During the year 1887 about half a ton of rock crystal, in pieces

¹ From Census Bulletin No. 49, by George F. Kunz.

weighing from a few pounds up to one hundred pounds each, was found in decomposing granite in Chestnut Hill township, Ashe County, N.C. One mass of twenty and one-half pounds was absolutely pellucid, and more or less of the material was used for art purposes. This lot of crystal was valued at \$1,000.

In Arkansas, especially in Garland and Montgomery Counties, rock crystals are found lining cavities of variable size, and in one instance thirty tons of crystals were found in a single cavity. These crystals are mined by the farmers in their spare time, and sold in the streets of Hot Springs, their value amounting to some \$10,000 annually. Several thousand dollars' worth are cut from quartz into charms and faceted stones, although ten times that amount of paste or imitation diamonds are sold as Arkansas crystals.

Rose quartz is found in the granitic veins of Oxford County, Me., and in 1887, 1888, and 1889 probably \$500 worth of this material was procured and worked into small spheres, dishes, charms, and other ornamental objects.

The well-known agatized and jasperized wood of Arizona is so much richer in color than that obtained from any other known locality that, since the problem of cutting and polishing the large sections used for table tops and other ornamental purposes was solved, fully \$50,000 worth of the rough material has been gathered and over \$100,000 worth of it has been cut and polished. This wood, which was a very prominent feature at the Paris Exposition, promises to become one of our richest ornamental materials.

Chlorastrolite in pebbles is principally found on the inside and outside shores of Rock Harbor, a harbor about eight miles in length on the east end of Isle Royale, Lake Superior, where they occur from the size of a pin head to, rarely, the size of a pigeon's egg. When larger than a pea they frequently are very poor in form or are hollow in fact, and unfit for cutting into gems. They are collected in a desultory manner, and are sold by jewelers of Duluth, Petoskey, and other cities, principally to visitors. The annual sale ranges from \$200 to \$1,000.

Thomsonite in pebbles occurs with the chlorastrolite at Isle Royale, but finer stones are found on the beach at Grand Marais, Cook County, Minn. Like the chlorastrolites, they result from the weathering of the amygdaloid rock, in which they occur as small nodules, and in the same manner are sold by jewelers in the cities bordering on Lake Superior to the extent of \$200 to \$1,000 worth annually.

In New York there are sixteen firms engaged in cutting and recutting diamonds, and in Massachusetts there are three. Cutting has also been carried on at times in Pennsylvania and Illinois, but has been discontinued. In 1889 seven of the New York firms ran on full time, but the others were unemployed, respectively, 14, 50, 61, 120, 125, and 240 days, owing to inability to obtain rough material at a price at which it could be advantageously cut. The firms that were fully employed were generally the larger ones, whose business consisted chiefly in repairing chipped or imperfectly cut stones, or in recutting stones previously cut abroad, which, owing to the superior workmanship in command here, could be recut at a profit, or in recutting very valuable diamonds when it was desired, with the certainty that the work could be done under their own supervision, thus guarding against any possible loss by exchange for inferior stones.

The industry employed 236 persons, of whom 69 were under age, who received \$148,114 in wages. Of the nineteen establishments, sixteen used steam power. Foot power is used in only one establishment. Three of the firms are engaged in shaping black diamonds for mechanical purposes, for glass cutters and engravers, or in the manufacture of watch jewels.

Beginning in the latter part of 1888, and through 1889, there was a marked increase in the price of rough diamonds, resulting in rapid advances of from 20 to 25 per cent at a time, amounting in all to an advance of from 80 to 100 per cent above the prices of the previous years.

The importation of rough and uncut diamonds in 1880 amounted to \$129,207, in 1889 to \$250,187, and the total for the decade was \$3,133,529, while in 1883 there were imported \$443,996 worth, showing that there was 94 per cent more cutting done

in 1889 than in 1880, but markedly more in 1882 and 1883. This large increase of importation is due to the fact that in the years 1882 to 1885 a number of our jewelers opened diamond-cutting establishments, but the cutting has not been profitably carried on in this country on a scale large enough to justify branch houses in London, the great market for rough diamonds, where advantage can be taken of every fluctuation in the market and large parcels purchased, which can be cut immediately and converted into cash; for nothing is bought and sold on a closer margin than rough diamonds. There has been a remarkable increase in the importation of precious stones in this country in the last ten years. The imports from 1870 to 1879, inclusive, amounted to \$26,698,203, whereas from 1880 to 1889, inclusive, the imports amounted to \$87,198,110, more than three times as much as were imported the previous decade.

THE PENINSULA OF KAMTCHATKA.¹

THOUGH this country passed in 1696 into the hands of the Russians, it is still one of the least known parts of their empire. Professor Umlauf gives its area as 104,200 square miles. It is traversed along its whole length by a mighty chain of mountains, which rise into the regions of eternal snow. On the eastern side are numerous volcanoes, of which twenty-one are now active. Dittmar's map (1850) shows only twelve active volcanoes, from which it may be inferred that the subterranean forces have developed a large amount of energy since his time. At the southern extremity of the peninsula numerous isolated volcanic cones rise from the low ground, of which the Apatcha only is active. To the north of this mountain the country begins to rise, and at length two chains are formed, of which the western extends through the whole peninsula. Only one volcano, the Icha, is situated actually within the range, but several others lie between it and the western coast. Below the 57th parallel the river Tigil has eroded a narrow valley through the range, and a little further north a deep depression interrupts the continuity, but the elevation soon increases again, and is continued in the Voyampolka Mountains. The eastern range is far shorter, extending only to the 55th parallel. It also contains only one volcano; but the short range which runs off from it in a south easterly direction to Cape Shipunskie contains several, among them the Koryaka, which attains a height of 11,218 feet. They are particularly numerous in the elevated country which adjoins the eastern range, and entirely fills the space between the middle and lower Kamtchatka River and the eastern coast. Here stands the Klutshef, the culminating summit of the peninsula, 15,757 feet high. On the left bank of the Kamtchatka the Timaska, a low chain with rounded summits, runs eastward, and is joined on the north by the Novikofskaja Vershina, ending in Cape Stolbovi. Beyond the 57th parallel northwards there is only the one range. Numerous hot springs testify to the volcanic character of the eastern part of Kamtchatka. Dittmar found the temperature of a spring near the Mikishina to be 120° F. on Dec. 16th, when the temperature of the air was -11°. Owing to the great atmospheric moisture and the abundant rainfall, the country is irrigated by numerous rivers, of which the Kamtchatka is the largest. The Shupanof, on the east, and the Bolshaya Icha, and Tigil, on the west, are also important streams. The climate is changeable and severe, and much colder than that of countries in the same latitude on the other side of the Old World. When Dittmar visited the country, there was ice in May on an inlet of Avatcha Bay, and on the west coast, which is much colder, the thermometer stood at sunrise on Aug. 2d at about 34° F. In winter, temperatures of -40° and lower were recorded. The snow-line lies at a height of about 5,300 feet.

In Kamtchatka, as in central Siberia, the vegetation is surprisingly exuberant. Rich meadow-land alternates with dense woods, composed, in the south, of poplars, willows, and birches. Where the woods are thin, bushes grow freely, and flowering plants bedeck the ground. Wild animals are abundant, and hunting and fishing are the chief means of procuring food. The most important game are wild reindeer, wild sheep, hares, otters, sables, and ermine. Bears, wolves, and foxes are also numerous. Of birds, heathcock,

¹ From the Scottish Geographical Magazine, April, 1891.