Ceylon: The Island of Jewels*

A Rich Industry Monopolized by the Natives

By Leopold Claremont

THE gem-minerals with which Ceylon is so generously endowed are remarkable, not only for their beauty, but also on account of the great variety of them.

Although the diamond, opal, emerald, and peridot are conspicuous by their absence, all the other well-known transparent gems are abundantly represented in the island. There are also many very beautiful precious

Anakie, the green variety is fairly plentiful, while the red and purple are entirely absent.

Some of the corundum gem-stones exhibit the phenomenon of *asterism*, that is, they display a bright shimmering six-pointed star with the rays divergent from the center of the stone when it is cut with a smooth convex surface.

They are found almost exclusively in Ceylon (a few

There is a remarkable name-red variety of spinel, the color of which is unique in the whole mineral world, not even excepting the ruby. It is an exquisite gem of great value.

The chrysoberyl is an attractive gem stone, although its beauty is somewhat unappreciated. It occurs in shades of Autumn green, brown, and yellow, and possesses great brilliancy. There are, however, two varieties of this gem-mineral which form well-known and valuable precious stones; of these, the most important is known as the *alexandrite*. (See Fig. 2.) Fine examples of this gem by daylight appear pistachio-green, changing to rich mulberry-red by artificial light.

Ceylon is the chief source of alexandrites, although a few are found in Siberia.

The other important variety of chrysoberyl is the *cymophane* or cat's eye, which, when cut with a smooth convex face presents a narrow white line glittering across it, which has a fancied resemblance to the iris of a cat. The position of the line or ray alters as light strikes it from different angles, giving a peculiarly mysterious effect. Cymophanes are only found in Ceylon.

The rarest and most curious of all precious stones are those cat's eyes which change from green to red, as do the alexandrites.

By the superstitious natives the cymophane is considered to be an entombed spirit, and this can be more readily understood than many other similar conceits, because of the strange resemblance of the stone to the eye of an animal.

Many shades of soft yellow, brown, cinnamon and green are displayed by specimens of the mineral jargoon or zircon. (See Fig. 3.) This gem-stone is strangely unappreciated, for not only is the coloring most pleasing, but the brilliance is second only to that of the diamond.

Another reason why the neglect of the zircon is unaccountable is that this beautiful gem is comparatively inexpensive.

The writer has only space briefly to complete the list of precious stones of Ceylon, for his object is to give the reader some idea of the manner in which they are handled.

There are garnets, red, brown, violet and cinnamon; topazes, white and blue; tourmalines, red, claret, green, yellow and blue; aquamarines or beryls, sky-blue and sea-green; besides iolites and moonstones. (See Fig. 1.)

From the foregoing paragraphs it should be apparent that these gems present a pageant of color unequalled by those of any other district.

From the finding of a precious stone in a river bank or gem pit, to its use as a jewel by a woman of fashion, it passes through many strange hands, and undergoes much alteration in appearance.

The securing, cutting, polishing and marketing of such a large number of gems necessarily comprise an important industry. The entire trade is controlled

Fig. 1.—Crystals of Adularia or Moonstone (actual size).

These gems are almost colorless and transparent by transmitted light, but display when cut with a smooth convex surface (*en cabochon*) a white or bluish blush or spot from which they take their name.

stones with which the general public at all events is more or less unfamiliar.

The principal mineral is corundum, of which the red and blue varieties constitute the gems ruby and sapphire. (See Fig. 4.) It, however, also occurs in a long series of different colors of varying shades, which range from the ruby-red to delicate rose pink; from the royal sapphire to sky-blue; from plum to violet and lilac; and from golden orange to primrose.

There is also a most attractive rich salmon-pink variety, resembling the tint of the "Sunrise" rose, and which is known to Ceylon as *patparagum*, and very rarely only, the mineral is found green in the island.

In Central Queensland, however, at a place called

ruby star-stones are found in Burmah), and under the name of *asteras* or *star-stones* are highly valued by connoisseurs when of choice quality. For some unknown reason, the yellow and green varieties of corundum do not exhibit the phenomenon of asterism.

Another gem-mineral which possesses a similarly extensive range of color, except that yellow is missing, is the spinel. Some specimens of this somewhat resemble rubies and sapphires, and are therefore often described as "spinel rubies," and "spinel sapphires," respectively. It is, however, very much softer than corundum, and is one of the three gem-stones, occurring in the form of crystals, which are singly refractive, the other two being diamond and garnet.

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Fig. 2.—Crystals of Alexandrite (actual size).

The alexandrite and cat's-eye are both varieties of the mineral chrysoberyl, and in very rare cases the cat's-eye variety also possesses the power of alteration of color. Although Ceylon is the chief source of the alexandrites and the sole source of the cat's-eye, the most choice specimens of the former are derived from Siberia.

Fig. 3.—Crystal of Jargoon or Zircon (actual size).

When cut as faceted stones, jagoons possess the power of dispersion of light approaching in some cases to that of the diamond.

Fig. 4.—A Somewhat Water-worn Crystal of Sapphire.

Fig. 5.—Natives of Ceylon Working a Gem Pit.

Fig. 6.—The "Gemming" Basket in Use.

Fig. 7.—The Basket is Handled With a Circular Movement.

locally by the Moormen, many of whom are extremely wealthy.

The foremost of them not only buy up the most important stones as they are found from time to time, but send out expeditions into the principal gem-producing areas to search for them. They all either retain their own cutters or superintend the work given out to be done. No foreigner is admitted within the magic circle of the Moormen except as a customer.

The Moormen are descendants of the Moors who once occupied Ceylon, and of whose forts large ruins still exist in the island.

The value of the precious stones annually exported to Europe and America from Ceylon is estimated at fifteen million dollars, and high prices, especially for choice specimens, are realized locally from travelers and tourists.

Fig. 8.—The Lighter Stones Slip Over the Edge of the Basket.

The gem-stones are of igneous origin, and have been loosened from the granite and gneissic rocks in which they were formed by disintegration. They are found in a stratum of alluvial gravel which is known to the natives as "illam," which is reached by digging pits of from three to thirty feet in depth. They are generally in the form of more or less water-worn nodules, undamaged crystals being very rare. (See Fig. 4.)

When the pits are deep, the illam is hoisted to the surface by means of a primitive kind of wooden crane, and it is then carried to the nearest stream or pool to be washed.

It is often found, in low-lying spots, that old disused gem pits which have become filled with water are available for the washing of the gem-bearing material.

The illam consists of gravel embedded in yellow or reddish clay, and is usually brought to the surface in a dry condition, but when the gem pit is below the level of a neighboring stream it is rather muddy.

Sometimes the stratum of illam *crops out*, or is exposed upon the surface of the country, and this is generally found to occur on the slopes and banks of rivers and streams. When this is the case very little excavation is done, as the material is more easily obtainable.

The searching for gems is carried on from October to March. The washing is done by means of a circular basin-shaped basket, about twenty-eight inches in di-

excitement among the natives, and many would-be buyers eagerly endeavor to outdo each other in obtaining a bargain. The price asked is generally several times greater than that which is eventually accepted, and by continual bartering the gem changes hands repeatedly.

Also, there are ever ready pilfering fingers to purloin from the rightful owner, or to substitute an inferior stone for one of good quality. The diggers and washers are continually watched to prevent anything of the kind from taking place.

It is a matter of great difficulty for Europeans to

Fig. 9.—Gem Pit Showing Primitive Crane and Pool at Which the Earth is Washed for Gems.

ameter and twelve in depth, which is called a "gemming basket;" the native wading up to his knees holds the basket in the water.

A circular turning movement is given to the basket, which is occasionally allowed to tilt below the surface of the water, and in this way the lighter stones slip over the edge, and the heavier ones remain in the basket.

After a good many baskets full of gravel have been washed in this way, the residue, which is found to contain thorianite and thorite and other heavy minerals, is carefully searched for gem-stones.

The number of gems found of insignificant value is extremely large in proportion to that of the choice specimens, so that often a great deal of work is done before there is any prospect of recompense.

When an important stone is discovered there is great

obtain details or photographs of the gemming industry, for the natives are very jealous and secretive, and object to company upon their expeditions. They are also exceedingly superstitious, and believe in all sorts of devils and evil omens; they will not even allow one of their own women to go near a gem pit, because she would be sure to bring bad luck to it.

There are several extensive districts in the island where precious stones occur, but the most productive locality is the hilly country of Saffragan, the chief town of which is Ratnapura, or in other words "the city of rubies."

Nearly all the different kinds of gems are found occurring together, the exceptions being moonstones, amethysts, and alexandrites, the last of which are principally derived from Galle.

Fig. 10.—Native Gem Cutters at Work With the Overseer Watching Them.

Fig. 11.—A Moor Lapidary, Ceylon, With His Simple Apparatus.

Fig. 12.—The Gems of Ceylon Are Recut in Europe by Skilled Lapidaries.

The natives have a great prejudice against sending gems out of the island in the rough state, and always cut and polish them locally. This is due to their anxiety to see exactly to what extent the beauty of each stone is developed by the cutting, and thus accurately to estimate the value. They do not care to part with the rough stones, for Europeans to reap the benefit of any increase in value.

The cutting and polishing is done by the Singhalese upon perpendicular leaden wheels, smeared with emery, against one side of which the gem is pressed with the left hand, while the wheel is rotated by means of a bow and cord held in the right. (See Figs. 10 and 11.) The whole apparatus is most simple and primitive, the success of the work depending entirely upon the skill of the operator.

The cutters squat upon their haunches behind the wheels, and sometimes an overseer watches the progress of work to prevent theft. (See Fig. 10.) Much of the cutting is done by the roadside in view of every passer-by, but many little "tricks of the trade" are withheld from public view.

The native gem cutters' chief object is to so manipulate the precious stone that the maximum of size and weight is retained, often to the sacrifice of symmetry and brilliancy. They are wonderfully adept at retaining and regulating the color, which in some gem-stones is not of uniform density throughout, and in dexterously hiding feathers and flaws. Owing, however, to irregularity, and also the want of symmetry and proper proportion, it is generally found that the gem-stones in the "native-cut" condition are unsuitable for the require-

ments of high class European jewelry. It is therefore necessary, before they can be used for the purpose, that they shall be re-cut by a skilled lapidary with a knowledge of mineralogy and optics.

In principle, the apparatus used by the European gem-cutters is similar to that used by the Moor in Ceylon. The wheel is, however, made of copper and diamond dust, and revolves horizontally instead of perpendicularly (see Fig. 12).

The operator sits at a bench and places the gem, mounted on a small ebony holder, against the surface of the wheel which he rotates by means of a crank held in the left hand. Although the apparatus is simple, much expert knowledge, skill and experience are requisite for success in this extremely delicate and artistic craft.

A Review of Animal Experimentation—I*

Its Benefits to Mankind

By W. B. Cannon, M.D., George Higginson Professor of Physiology in Harvard University, Boston

OBSERVATION AND EXPERIMENTATION.

Two ways are open to us for obtaining a knowledge of Nature: We may merely watch natural events as they occur, or we may arrange conditions so that the events will appear or disappear, or be modified, as we may wish. For example, the growth of wheat we may study carefully in different native surroundings, or we may place the wheat where we can at will examine the effect on it of heat and cold, sunlight and darkness, wind, gravity, drought and the chemicals of the soil, as these various agencies affect its growth and productiveness. The former method is purely observational, the latter is experimental. The experimental method, in which the conditions to be observed are under control, is, in the main, the distinguishing procedure of modern science.

There is nothing mysterious about experimentation. The method implies first that study of natural events suggests certain explanations for their occurrence, as for example, that lime in the soil or high temperature makes hard wheat, and that the cautious person, instead of immediately accepting suggested explanations as true, prefers to put them to test.

Of the two methods of learning about Nature, the experimental has proved much more fruitful than the purely observational, chiefly, I think, because experimentation is concerned with means of controlling natural forces. The different sciences, however, are subject to the application of the experimental method in different degrees. Most subject to it are chemistry and physics, since of all the natural sciences they are most simple. As a result of the employment of experimentation, astounding advances have been made during the past hundred years in chemistry and physics, and in their industrial applications. All about us are innumerable instances of the practical benefits that have flowed from the experimental study of Nature in its physical and chemical aspects. I need mention only the telephone, the telegraph and wireless telegraphy, steam and gas and electric engines, to indicate how prodigious have been the transformations in civilized society wrought by practical utilization of the scientific discoveries.

There are other sciences, however, that do not lend themselves so readily to investigation by experiment. In consequence our understanding of them is still very defective. Some phases of geology, for example, fall into this class. It has been pointed out that we to-day know little more about the mechanism of the volcano than Pliny when he watched the eruption of Vesuvius that destroyed Pompeii. We cannot control the conditions of volcanic action experimentally, and therefore have only the simple observational method to apply.

THE EXPERIMENTAL STUDY OF DISEASE.

In medicine, also, the growth of our knowledge was similarly limited, until about the middle of the last century. Up to that time disease had been studied mainly by observation of sick people. To account for sickness all sorts of theories were advanced, such as bad air, the influence of stars, and mysterious humors and miasmas; but these theories were subjected to almost no experimental test. Of course, the highly complex character of living creatures made the beginnings of experimental medicine difficult, for not only

do living beings exist together in very complicated biologic relations, but each one is an extremely complex structure, with obscure processes going on within it. In spite of these difficulties, however, the experimental method began about 1850 to be applied systematically to the study of disease, and during the sixty-odd years since then all manner of medical and surgical problems have been experimentally investigated. What has been the result? According to Osler, the experimental study of physiology and pathology during the second half of the last century did more to emancipate medicine from the routine and thralldom of tradition than all the work of all the physicians from the days of Hippocrates (460 B. C.) to Jenner (1749-1823).

In that marvelous period of transformation of medical knowledge and practice the most fundamental discovery was that of the relation between micro-organisms and disease. Pasteur, whose name will be forever linked with this discovery, was a chemist who became interested in conditions which produce bad taste in wines. In the "diseased" wines, as they were called, he found unusual micro-organisms. "Did they occasion the bad taste?" he asked. To test this idea, it was only necessary to introduce some of these minute plant growths or germs into good wines. This he did, whereupon these wines also were rendered distasteful, and thus Pasteur's idea was substantiated. Later, when his attention was called to a disease in silkworms, he again found micro-organisms present and thought that here, also they might be the source of the trouble. Applying, as before, the test of experiment, he introduced the micro-organisms into healthy silkworms and succeeded in reproducing in them the same disturbance. In this case the disease was no less certainly the product of the germ than the oak is the product of the acorn. The idea that all infectious diseases result from these microscopic invaders was a natural and logical next step. Thus originated the bacterial theory of infection.

This theory was soon tested experimentally by many investigators, who studied not only afflictions of the lower animals, but also those of man. And by the numerous proofs that were accumulated, the theory became so firmly established that we now no longer speak of the bacterial "theory" but of the bacterial or parasitic origin of infectious diseases.

TUBERCULOSIS.

The study of diseases which we recognize in human beings is of special interest. First in importance among these, perhaps is tuberculosis. Klencke (1843) and Villemain (1865) have shown that "tubercle" was infectious by injecting into rabbits tuberculous tissue and sputum and thus inducing the disease, but its real nature was not clear until Koch, in 1882, announced the discovery of the germ always found with the disease, the tubercle bacillus. The proof that this germ is the cause of tuberculosis Koch obtained entirely by carefully controlled experiments on animals. He separated the bacteria from tuberculous tissues, made the bacteria grow "pure" outside the body, injected these pure cultures into healthy animals, thereby causing tuberculosis, and then recovered from their diseased tissues bacteria in all respects like the original. Conclusive proof was thus given that tuberculosis results from growth of the tubercle bacillus. All the preventive measures in our great modern campaign against the White Plague are the outcome of these and other experiments on animals. The sign in the street cars warning against spitting are there because animal tests proved that tuberculous sputum is infectious.

Twenty-six years ago Trudeau observed that rabbits

inoculated with tuberculosis recovered if kept in the open air and supplied with abundant food, whereas other rabbits similarly inoculated and placed in unfavorable conditions of light, air and food succumbed to the disease. By these observations belief in the value of dietetic and open-air treatment was confirmed; and the further demonstration of the efficacy of such care of human beings afflicted with tuberculosis has led to its universal adoption.

What have been the results of these researches on animals? From them we have learned that tuberculosis is not inherited, that it is communicable and therefore preventable, and that in its earlier stages it is curable. In most countries the death-rate from pulmonary tuberculosis has been steadily declining. In Boston, where for twenty years before 1882 (when the tubercle bacillus was discovered) the death-rate had been about 42 per ten thousand, it fell in the subsequent twenty years to 21 per ten thousand. It has since fallen to less than 18 per ten thousand. That decrease has meant a saving of thousands and thousands of human lives in the city of Boston alone. Throughout the civilized world the reduction of mortality has been incalculably great.

The alternative to these happy results has been clearly stated by Trudeau:

"If it were not for the knowledge which science has won by animal experimentation in the field of this disease in the last twenty-five years, we should still be plunged in the apathy of ignorance and despair toward it, and tuberculosis would still be exacting its pitiless toll unheeded and unhindered."

BUBONIC PLAGUE.

Another disease which has brought torment and great disaster to man is bubonic plague. Any one who has read of visitations of this horrifying pestilence knows how mysteriously and how swiftly death spread among large populations, and with what awful terror it was regarded. Defoe, in his "Journal of the Plague Year," in London, tells how the streets became hushed as the infection spread insidiously from parish to parish, how the carts moved about at night receiving the heaped bodies of the dead, and how the bodies were dumped pell-mell and by hundreds into huge pits dug for their burial. Thousands died week after week in the city. In the presence of such tragedy the fright and apprehension of the people caused homes to be abandoned, friends to flee from friends; and when the disease developed, the desperate victims often sought death by suicide or became insane. "People in the rage of the distemper," wrote Defoe, "or in the torment of their swellings, which was indeed intolerable, running out of their own government, raving and distracted and oftentimes laying violent hands upon themselves, throwing themselves out of windows, shooting themselves, mothers murdering their own children in their lunacy." Such was the plague in London in 1665, and such it has been in the great populations of the Orient in which it has so often raged.¹

The mystery of this frightful scourge was lifted when, in 1894, Yersin and Kitasato discovered the germ, *Bacillus pestis*, which invariably accompanies the disease, and when later Simond and others showed, by experiments on animals, that it was spread among rats by fleas, and could be transferred by these same insects from rats to monkeys. The rat-flea also feeds on man when its natural prey is not available.

¹ Trudeau: Animal Experimentation and Tuberculosis, Defense of Research Pamphlet II, 1909.

² In India alone, in the one year 1905, the number of recorded deaths from plague was 1,040,429.

*In this paper is summarized evidence which has been presented in detail in pamphlets published by the Bureau for the Protection of Medical Research of the Council on Health and Public Instruction of the American Medical Association. These pamphlets, written by experts in the several fields, are referred to in the present paper and should be consulted by persons desiring further information. A price list will be sent on application to the American Medical Association, from whose *Journal* this paper is here reproduced.