A DAY IN A CEYLON GEM FIELD

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In March, 1932, having two free days between steamers in Colombo, Ceylon, I made arrangements to quickly visit Ratnapura, 55 miles southeast of Colombo, the center of the gem-washing industry of the island. A hired Buick "saloon" made the journey in about three hours, over a well paved but narrow and winding macadam road, leading at first through rice fields and coconut groves, but with an increase in the elevation, through rubber and tea plantations. Comfortable accomodation in a delightful location was available at the Government Rest House just outside of Ratnapura, and a guide was found who promised to show me the few garan idamas (washing places) that were still in operation during these depression days.

That the Ceylon gem fields have been known for a very long time is indicated by the fact that Friar Odoric who travelled in the East from 1316 to 1330 described them, and "that literary pirate and arch liar of the fourteenth century, Sir John Mandeville, plagiarizes the tale in a more interesting manner."[1]

Ratnapura (a Singhalese word meaning "City of Gems") is shown on Sheet L 19, 20, 24, 25, an excellent topographic map of the Ceylon Survey, on a scale of one mile to the inch, a copy of which I had previously purchased at the Surveyor General's office in Colombo, for rupees 2.10. A more general map of the gem bearing districts is given in the Administration Report for 1904, Part IV. Although the center of the industry, Ratnapura is actually in the northern part of the area of the deposits, which extend south nearly as far as the coast at Galle. I had been informed that most of the southern part of the district was inactive, but that I would be able to see a typical operation at Pelmadulla, some 12 miles southeast of Ratnapura.

Dr. Frank D. Adams visited the Pelmadulla[2] district on his trip around the world a few years ago, and described the district, and the gem operation in some detail.[3] The following description is

[1] Ball, S. H., Early gem mining, real and otherwise: *Mining and Metallurgy*, vol. 9, p. 490, November 1928.

[2] Adams spells this name Palmadulla, but the spelling Pelmadulla is that used on Coomaraswamy's map.

[3] Adams, F. D., A visit to the gem districts of Ceylon and Burma: *Annual Report of the Smithsonian Institution*, **1926,** pp. 297–318.

based on my own observations and on the account of Adams and the government report by Coomaraswamy.[4]

Ratnapura lies in a deep valley at the junction of the Denawak Ganga with the Wey Ganga rivers, in a region of mature topography. The underlying rock is a diorite(?) gneiss, with very prom-

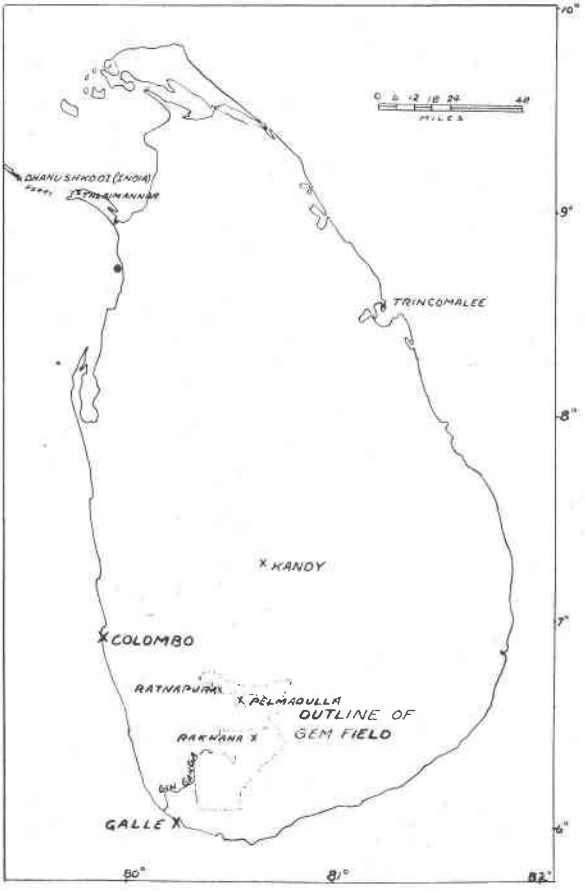

FIG. 1. Map of Ceylon showing location of gem field.

inent gneissic structure, and conspicuous drag folding. The surrounding ridges and hills, many of which are sharp peaks with shear cliffs, rise to elevations of 2750 feet, and up, culminating in

[4] Coomaraswamy, A. K., Report of the Director of the Mineralogical Survey: *Administrative Report*, **1904,** pp. E 11 to E 19.

Adams Peak, 10 miles to the northeast, which has an elevation of 7360 feet. The Ganga rivers at their junction are flowing below the 100 ft. contour, and are muddy shallow streams during the dry season, but become raging torrents in the wet season, and often cause serious floods.

The wide flood plains of the rivers and creeks, the so-called deniyas, are the sources of the gem gravels. The surface of these plains, where not worked over and over during the gemming operations, is used as paddy fields. No washing was noted in any of the creeks themselves, but in the Administration Report, above mentioned, by Mr. Coomaraswamy, it is stated that in the small hill streams that are swift flowing, rich deposits of gem minerals are found in the river beds. In those deniyas I visited, the low water level of the creek was ten to twenty feet below the alluvial flats, or flood plain surfaces. No higher level terraces were noted.

The gem gravel, or illam,[5] lies just above the decomposed rock surface, or malawa, at the bottom of the flood plain, and below typical alluvial material of sand and clay. The illam was obviously a placer deposit formed in the bed of the river, when it was occupying a different channel than it now uses. This process of shifting its channel and building a wide flood plain is of course the familiar operation of any stream that has cut down to grade and has begun to meander, as it erodes laterally. In the deniyas I visted, the alluvium in the flood plains did not exceed thirty feet, but Mr. Coomaraswamy states that a maximum of 120 feet has been noted. Two layers of illam have been described, separated by sand or clay, called makul, and represent deposits at two different stages in the development of the alluvial flat, the younger one having formed after the bed of the river had silted up several feet. That the lower bed is the richer in such cases may be explained by the fact that at the later, more sluggish stage of the river, conditions for forming a placer deposit of heavy minerals, was not so favorable.

The illam is a deposit of white quartz pebbles, ranging in size from that of shot, up to boulders as large as footballs, in which are mixed the heavy and gem minerals of the placer deposit. When removed from a gem pit, however, it has become so mixed with mud that has settled out in the pit, that a pile of illam resembles a pile

[5] The phonetic English equivalent of Tamil and Singhalese words here given are taken from the report by Coomaraswamy.

of sticky clay rich in mica and it is not until it is washed that the gravel appears.

The largest operation examined was that near Pelmadulla, where the Rada Ela and Kirindi Ela come together to form the Denawak Ganga. There a large alluvial flat, over a quarter of a mile wide lies between the steep slopes of the ridges. On the topographic map referred to, the locality may be found at a secondary road that turns north off the highway to pass the Ganegama School. One pit was in operation just west of this secondary road, another at the edge of the plain three or four hundred yards south of the highway, opposite the secondary road, and five closely spaced pits on the north side of the highway, one hundred yards or more east of the secondary road.

Adams gives this interesting information about Pelmadulla: "Much attention has recently been directed to the gem fields at Palmadulla about 12 miles in a southwesterly direction from the town of Ratnapura, on account of a remarkable 'find' made there a couple of years ago, sapphires and other gems to a value of some 9 lakhs of rupees ($297,000) having been taken from an area of between 3 and 4 acres in extent in a certain paddy field. These included some very large fragments of excellent blue sapphire 1 and 2 pounds in weight, as well as fine yellow sapphires and other less valuable stones."[6]

The operation of gemming is as follows: A patale or shaft is sunk in the alluvium. All those that I saw, except one, consisted of two compartments. Such a double compartment shaft is roughly 15 feet long, and 7 feet wide. The shaft timbers are of bamboo, and the walls are lined with split bamboo, backed by palm leaves to exclude the water. The tools used in sinking the shaft are: a heavy hoe-like tool used throughout India and Ceylon for every possible purpose involving digging or shoveling, called in Tamil "mamoty" or "momiti,"[7] and in Singhalese "udella"; and the "illamkura," a light crowbar used for loosening the hard earth and illam.

Hoisting the earth is done in one of two ways. There is either a windlass by which factory made kegs, or old 5-gallon petrol tins or baskets are raised, or there is an andiya, which is a long counter-

[6] Adams, F. D., *Op. cit.*, p. 300.

[7] The first spelling is from Coomaraswamy; the second was given in a "Self Study Course" in Coolie Tamil which I used in South India. Every writer has his own ideas of the phonetic English for native words.

poised pole, supported on a high fulcrum, made of bamboo framework, by means of which the kegs or tins which hang by a rope from an end of the pole are raised or lowered. Anyone familiar with old New England and French Canadian farms has seen similar mechanical devices constructed to raise a bucket of water in the well, and the invention presumably antedates our Colonial history by several thousand years.

When the pay zone of gravel, or illam, is reached, the sand is stirred up with some water, and the shaft is then allowed to fill with water. This causes the "slimes" to be taken into suspension, and represents a first step in the washing of the gravel. The water is then baled out, a gang of Tamil coolies, hired in South India, turning on the windlass, or pulling on the pole of the andiya. In most of the patales near Pelmadulla, the operations were very modern, only windlasses and factory built kegs of about twenty gallon capacity being used, with two kegs to a windlass, operated by cranks at each end. A bamboo shelter erected over the shafts protects the coolies from the sun.

When the water is baled out, the illam is raised in the small baskets holding about a half bushel, and piled in a heap, inside a "cajan" fence (made of woven leaves of the coconut palm), and covered with palm leaves, the enclosure being close to the hut of the maestrie, or foreman. Any attempt at theft would involve a removal of the palm branches, which would be heard by the foreman. A small altar is erected near the spot, and before the illam is raised an offering is made, usually to Saman Dewiyo.

After the illam in the bottom of the shaft is exhausted, mining laterally into the bed of illam from the shaft is practiced, but in most places can not be carried far owing to the heaviness of the ground.

When the washing is to be done in the bed of the river, boys carry small baskets, called punchi kude, which are filled with illam from the stock pile, to the creek edge, where it is dumped into a wooden mixing box, resembling the type used by American plasterers in mixing mortar. There the sticky gumbo is made up into a paste, with water, so that when washed, lumps will not form. When ready, a dozen coolies wade into the creek carrying the garan kude, or gemming basket—a sort of "gold pan." It is a conical shaped basket, of woven fiber, with a stout rim, roughly 28 inches in diameter, and 15 inches deep. The mesh of the basket is sufficiently

loose so that fine sand and slime can be readily washed through the openings.

Two coolies stand between the bank and the circle of waiting "panners." The mixing man tosses a dripping basket of mush to the first boy who skillfully catches it, at the same time tossing back an empty basket, the two baskets passing in mid air, like the trick balls of a vaudeville performer. The second boy throws an empty basket, catching a full one which he in turn passes to one of the "panners." The panners begin a panning action, holding the garan kude immersed in the river, with only the rim partly above water. As the quantity of illam is reduced, more is added until a sufficient, or lucky number of small baskets-full have been received. Fifteen or twenty-one are considered lucky numbers. The panning action is prolonged, (about 10 to 15 minutes) until all of the fine sand, and the light minerals have been washed through the openings, or out over the rim, leaving only the heavy minerals, and some limonite concretions.

Each "panner" now wades ashore, and dumps the quart or two of heavy concentrate in his garan kude, into one basket. When all have been dumped, the foreman squats before it, and paws quickly through the mass with his fingers, his sharp eye at once spotting any stone of value. The foreman at the Pelmadulla operation was a young Singhalese man of intelligent appearance who, clad in a dhoti and shirt, and sporting a wrist watch, but of course barefoot, took no part in any menial tasks, for in the East a man either works with his hands or his brain—never with both. Watching him in two successive examinations of the concentrate, I saw him select a yellow sapphire crystal, of possibly 30 carats weight, but of poor quality from the first batch, and two valueless spinels and an inferior cats-eye from the second.

I attempted to buy the inferior quality stones I saw recovered, but was informed that as the men worked on shares, they would not be content to sell any stone, until it had been properly appraised.

The concentrate from which the gems have been picked is known as nambuwa. It is an aggregate of small rubies, sapphires, spinels, tourmaline, ilmenite, rutile, garnet and other heavy rock silicates. Much of it has value for the content of thorium minerals it may contain (thorianite and thorite) but the nambuwa was not being saved at the operation I saw.

Adams says that the working on shares is apportioned as follows. The owner of the paddy field gets one fifth of any profits, the man who finances the operation another fifth, the remainder going to the men who carry out the actual work.

Stones are sold at auction in the bazaars, principally at Ratnapura, on special days. The gem dealers are said to be "moormen," that is, Tamils converted to Mohammedanism who have migrated to Ceylon from India. Ratnapura is also the center of much lapidary work, although by no means all of the stones are cut before they are sold. The lapidary work is exceedingly prim-

FIG. 2. A lapidary at work in Ceylon.

itive, but the men are very skillful. The grinding wheel consists of a vertical metal disk, running on a horizontal shaft, motivated by a contrivance like a violin bow. The string of the bow is given one turn around the shaft, and as the bow is pushed forward and backward by the right hand, the shaft is whirled, first one way and then the other. The stone is held in the left hand, or mounted on a wooden dop, held in the hand, without any support or guide. The selection of the facets is entirely done by eye, and the results of such

free hand work is remarkable in the uniformity of the facets, their number, and the smoothness of the planes.

Sawing the crystals, to select portions to be cut, is done by a hand hack saw, using carborundum, or alundum, as the abrasive medium. The time required to saw through a large corundum crystal in this way would overtax the patience of a European, but time is of no importance in the East.

Formerly the lapidaries prepared their own abrasive, from corundum dust, called Kurundugal, but I was told that all is now bought and is of German manufacture.

The gem placers of the Ratnapura district yield a remarkable assortment of stones, and any or all may be found in a single deniya. Those listed by Coomaraswamy are as follows: sapphire, ruby, topaz, cordierite, beryl, spinel, chrysoberyl, garnet, tourmaline, zircon, and quartz. The moonstones of Ceylon do not come from the gem gravels, but are obtained by quarrying a peculiar adularia bearing leptynite in the Dumbara district of the Central Province. (See Ceylon Administration Report, Mineralogical Survey, 1903, p. 10).

As to the source of the gem stones, Adams [8] quotes J. S. Coates, Esq., B.A., the present Government mineralogist as believing that the various forms of corundum originate in quartz-free pegmatites cutting the gneissic series. The beryls have been seen in quartz pegmatites and the zircons have their origin in the same rock. Coomaraswamy states that most of the gems have not as yet been found in their original matrix. Wayland[9] has postulated the source of the several gems and thinks that the spinel has come from limestones and intrusive mica-spinel rocks, and the cordierite, garnet, etc., has come from the gneisses and schists. It seems very possible to the writer that the crystalline complex may contain some calcareous layers, and the whole cut by many pegmatites of varying character.

The sapphire varies from deep blue to yellow, to colorless. A pink or flesh colored variety is sold as "King Topaz." The star sapphire is the most valuable stone found in the gravels, if of high quality. The rubies are inferior to those from Burma. Star rubies are common, and of no great value. The cats-eye, a variety of

[8] Adams, F. D., *op. cit.*, p. 299.

[9] Wayland, E. J., Notes on the sources of origin of Ceylon Gem-Stones: *Econ. Geology*, vol. **18,** pp. 514–515, 1923.

chrysoberyl, with an irridescent line, or lines, is also highly prized. Chrysoberyl also occurs as alexandrite. The "aquamarine" of Ceylon includes both green topaz, and pale beryl. A true emerald color is extremely rare. White topaz is sold as water sapphire, although the true water sapphire of Ceylon is cordierite and seems to be very rare. The majority of the stones described as toramalli (a Singhalese word from which we have taken tourmaline) are zircons (from the Arabic zaqun—called in Tamil jargoon). They are of various colors: green, yellow, pale brown and red. Pale brown zircons are burned to form the colorless "Matara diamond." Many green stones acquire a good yellow color when burned. The term Mangu toramalli is applied to genuine brown tourmaline. Quartz occurs as rock crystal, and as amethyst.

There is said to be some business in importing German synthetic stones, and mixing them with the parcels of native gems, against which the wary purchaser must be on his guard.