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DEPARTMENT OF SUPPLY AND DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

REPORT No.

RECORDS No. 1951/20

VISIT TO INDIA - JANUARY 1951

by

M.A. Condon.

CANBERRA JANUARY 1951.

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INTRODUCTION

The Government of India invited the Australian Government to send a representative to the celebration of the Centenary of the Geological Survey of India during January 1951.

The first meeting of the Pan-Indian Ocean Science Congress was scheduled for the first week in January, 1951 so the Bureau of Mineral Resources, Geology and Geophysics selected M.A. Condon to attend the Science Congress and the Centenary Celebrations because his work in the North-West Basin of Western Australia would be of some interest to geologists working around the Indian Ocean.

ITINERARY.

27th December, 1950 - Travelled from Canberra to Sydney. Left Sydney by Constellation 'plane for Calcutta.

29th December, 1950 - Arrived Calcutta. Met by Dr. W.D. West, Director of the Geological Survey of India.

30th December - Travelled by 'plane from Calcutta to Bangalore. Met at airport by officials of the Indian Science Congress

1st January, 1951 - To Indian Institute of Science, Bangalore. Met Dr. B. Sanjiva R ao, Secretary of the Indian Science Congress. Dinner at the Palace, Bangalore, as guest of the Maharaja of Mysore.

2nd January - Opening of the Thirty-eighth Session of the Indian Science Congress and the First Session of the Pan-Indian Ocean Science Congress. Addresses by the Maharaja of Mysore, the Prime Minister and the presidential address by Dr. H.J. Bhabha.

Preliminary meeting of delegates to the Pan-Indian Ocean Science Congress. Sub-committee formed to draft a constitution.

3rd January - Combined meeting, Agriculture, Engineering and Geology Sections on Drainage and Land Reclamation. Papers by Dr. W.C. Deleeuw of Holland (Reclamation of the Zuyder Zee), Dr. Devan (Damodar Valley Project) and Dr. C. Mahadevan (Water Logging). Visited the Raman Institute.

4th January - Meeting of Geology Section - discussion on problems of Archaean geology in India.

Paper by R.F. Thyer - Gravity Anomaly at Watheroo, Western Australia. Paper by M.A. Condon - Palaeozoic Stratigraphy of Western Australia. Exhibit by Dr. A.B. Walkom - lantern slides showing rosettes of leaves of Glossopteris and Gangamopteris on stems.

5th January - Meeting of Geology Section - Presidential Address by Dr. J.B. Auden on Geology in Multi-Purpose Projects. Address by Professor Bogomolov (U.S.S.R.), translated by Mr. Tarasov, on Land Development in the U.S.S.R. Address by Professor S.W. Carey on Continental Drift. Visited Central College, Bangalore (University of Mysore), Mr. L. Rama Rao, Principal. Visited Geological Survey of Mysore (Dr. C.S. Pichamuthu, Director).

6th January - Visited Kolar Goldfield. Inspected the Champion Reef Gold Mine, 9,100 feet deep.
Meeting of delegates to Pan-Indian Ocean Science Congress to discuss constitution.

7th January - Plenary Session of Pan-Indian Ocean Science Congress. Interim constitution was adopted. Professor Ross invited the Pan-Indian Ocean Science Association to hold its second congress in Australia in about August 1953.

8th January - Left Bangalore by 'plane. Arrived Madras. Dr. A.K. Dey and Mr. A.P. Subramanyam of the G.S.I., led the party to inspect the type area of the Charnockite series at St. Thomas' Mount. Visited the headquarters of the Southern Circle, G.S.I.

9th January - Visited the "Seven Pagodas" some of which are cut out of monoliths of garnet gneiss, at Mahabalipuram, 56 miles by road south of Madras. Visited Presidency College, Madras (Professor T.N. Muthuswami, Professor of Geology); inspected the School of Geology.

10th January - By 'plane from Madras to Calcutta. Met at Dum Dum Airport by members of the Geological Survey of India. Taken to the Grand Hotel, Calcutta.

11th January - Visited the Head Office of the Geological Survey of India and inspected the offices, laboratories, library and museum. Attended the Annual General Meeting of the Mining, Geological and Metallurgical Institute of India. Attended lectures by Dr. B.R. MacKay (Geological Survey of Canada) on "Coal in Canada" and by Dr. W.J. Pugh, Director, Geological Survey of Great Britain, on "An ancient shore-line of Great Britain." Attended the Mining, Geological and Metallurgical Institute of India dinner at the United Services Club.

12th January - Called on the Australian Trade Commissioner Mr. Wootton. Went on a tour of Calcutta; inspected J ob Charnock's tomb (of Charnockite from Madras), Fort William, the Victoria Memorial and the Tollygunge Club. Attended the unveiling of a bust of Birbal Sahni in the Palaeontological Gallery of the Indian Museum. Attended lecture by Dr. A. Bentz (German Geological Survey) on "Oil Fields of Germany."

13th January - Visited Government House to meet the Governor of West Bengal, Dr. K.N. Katju. Visited the Royal Asiatic Society of Bengal. Attended the Commemoration Ceremony of the Geological Survey of India.

14th January - Charter flight in C-46 'plane to see Mount Everest and Kinchinjunga. Visited the G.S.I., for Group Photographs. Visited the Geological Institute, Presidency College (Professor N.N. Chatterjee). Left the Grand Hotel and boarded the G.S.I. special train at Howrah Railway Station. Left Howrah at 10.30 p.m.

15th January - At Asansol for breakfast. By car to Bhaladih to examine the sand-stowing plant of the Equitable Coal Company. To Kulti to see the discharge of the sand into bins at the coal-mine. Re-joined the train and travelled to Dhanbad. Visited the Dhanbad School of Mines and Applied Geology. Travelled by bus to Sindri to inspect the Indian Fertilizer Plant (under construction). Visited the National Fuel Research Institute at Digwadih, 10 miles south of Dhanbad, and inspected the laboratories. Returned to the train at Dhanbad.

16th January - Travelled during the night to Kodarma, 75 miles north-west of Dhanbad. Visited the Tilaiya Dam (under construction, on the Barakar River 20 miles south of Kodarma). Visited a mica factory of Messrs. Chatturam Horilram, Ltd., to see methods of splitting and grading mica for export. Visited the Kalakthambi Burria No.2 Mica Mine of Messrs. Chrestien Mica Industries, Ltd., in the Kodarma Reserved Forest 10 miles north of Kodarma. Inspected the muscovite-bearing pegmatite dyke, up to six feet thick, intruding mica schist. Returned to train at Kodarmo.

17th January - Travelled by train to Bermo, in the Damodar Valley, 40 miles south of Kodarmo. Visited an outcrop of the Talchir Boulder Bed at Chapri, 6 miles north-east of Bermo. Visited the open-cut coal mines - Kargali and Bokara Collieries - which are separated by a fault. Visited the Bokara Thermal (Electric Power) Plant at Konarbandh on the Konar River about five miles from the coal which it is proposed to use. This plant, at present under construction by the Damodar Valley Corporation, is designed for an ultimate capacity of 200,000 KW.

18th January - Travelled during the night to Jamshedpur, 70 miles south-south-east of bermo. Visited the Tatanagar Steel Works of the Tata Iron and Steel Co., Ltd. Inspected the town of Jamshedpur, built by the Tata Company and visited the Dimna Dam which supplies the town with water.

19th January - Travelled during the night to Noamundi, 60 miles south-west of Jamshedpur. Visited the Noamundi Iron Mine.

20th January - Travelled during the night to Nagpur. Visited the Kandri Manganese Mine, 20 miles north of Nagpur. Mining to date has been by open-cut methods. Visited Ramtek Temple, situated on a hilltop about 500 feet above the surrounding country. Continued to Deolapar, where the G.S.I. had a training camp.

21st January - At Deolapar Training Camp. Inspected the Sausar Series (high-grade calcareous metamorphic rocks) under the leadership of Dr. W.D. West. Inspected the work of the field section-cutter.

22nd January - At Deolapar. Inspected the para-gneiss which surrounds the Sausar Series. Returned to Nagpur. Attended dinner of Mining, Geological and Metallurgical Institute of India (Nagpur Branch).

23rd January - Travelling by train all night and day. Arrived at Agra 6.30 p.m. Visited the Taj Mahal by moonlight.

24th January - Visited the Taj Mahal, the Agra Fort, Fatehpur Sikri (23 miles south-west of Agra) and Akbar's Tomb.

25th January - Travelled during night to New Delhi. Left train. Taken to Constitution House. Called on the Australian High Commissioner, Mr. H.R. Gollan. Visited the National Physics Laboratory and inspected the laboratories.

26th January (Republic Day) - Witnessed Republic Day Parade of the Armed Forces, and Historical Pageant. Attended at afternoon garden party at Government House. Dined with Mr. H.R. Gollan.

27th January - Visited National Museum and Red Fort. Visited Engineering Exhibition.

28th January - Left Delhi by 'plane for Calcutta. Stayed at Grand Hotel.

29th January - By 'plane from Calcutta to Dibrogah via Gauhati. The face of the Himalayas east of Gauhati is scarred by landslides caused by the earthquake of 15th August 1950. Travelled by car to Digboi Oil Field. Mr. Dewhurst, Resident Geologist, showed us around the field during the afternoon.

30th January - Mr. Dewhurst described in outline the geology of Assam. VVisited the Ledo Coal Mine and oil seepages.

31st January - Inspected the Digboi chemical laboratory. Returned to Dibrogah, saw the damage by the floods caused by the earthquake and went on to Mohanbari Airfield. By 'plane from Mohanbari to Dum Dum. Stayed at Grand Hotel.

1st February - Visited G.S.I. Called on Dr. Auden and Dr. K. Jacob. Dr. Jacob asked Mr. M.V.A. Sastry to show me the Gondwana Floras. Examined the Gondwana Floras in the Indian Museum. In the afternoon, examined the fauna of the marine Permian of the Salt Range.

2nd February - Visited the Indian Museum to examine the Cretaceous faunas.

3rd February - Left Grand Hotel. In BOAC bus to Dum Dum. Left Dum Dum at 3. 0 a.m. for Sydney via Singapore, Djakarta, Darwin.

5th February - Arrived Sydney. By 'plane from Sydney to Canberra.

GEOLOGICAL NOTES.

Kolar Goldfield.

The Kolar Goldfield is situated in the State of Mysore at Lat. 12° 57'N., Long. 78° 18'E.

The main lode, "Champion Lode", is an auriferous quartz reef with small amounts of pyrite, arsenopyrite and pyrrhotite and minor amounts of galena. The lode strikes a few degrees west of north and dips to the west at about 45° near the surface, gradually changing to near vertical in the deep levels. About one third of a mile west of the Champion Lode is the Oriental Lode which occupies a north-south shear zone with auriferous black quartz containing up to 5% of pyrrhotite and arsenopyrite.

The lodes are developed over a length of five miles towards the southern end of a narrow belt of hornblende schist which is surrounded by gneiss. Opinion is still divided on the relative age of the schist and gneiss although it is probable that the schists occupy a narrow synclinorium, with the gold concentrated in saddle reefs in the crests and troughs of tight folds.

The rock temperature increases at the rate of 1° F. for 108 feet of depth. Rock temperature at the 9,100 feet level is 147°F. Air conditioning reduces the air temperature to 100 to 110 degrees and as the rock is dry and drilling is dry the humidity is low.

The ore from the Champion Lode is not refractory and yields its gold by a combination of blanket concentration, amalgamation and cyaniding. Recovery is 98%, the bars produced containing 925 parts gold and 70 parts silver per 1000. In the past ten years production has averaged about 500,000 tons of ore from which about 180,000 ounces of gold were obtained. This is total production from the five working mines.

St. Thomas Mount, Madras.

This small hill, eight miles south of Madras was designated the type locality of "charnockite" by Sir Thomas Holland. The typical charnockite is a dark blue-grey granitoid-textured rock consisting of blue quartz, microcline-perthite and hypersthene. In this type locality there is a very obvious bedded structure with, parallel to it, a banding which has the characteristics of the flow structures of rhyolite. As the bedding and flow structure have not been destroyed by metamorphism, it is probable that these rocks were poured out and solidified as the types which are present. These flows have many similarities with the Devonian acid flows of the Eildon district in Victoria. Samples of the charnockite were obtained.

Bihar Mica Belt.

The ruby muscovite is mined chiefly at Kodarma and Giridih. It is a constituent of pegmatite dykes which intrude Archaean mica schists. The pegmatite consists normally of plagioclase felspar and quartz with variable microcline, muscovite and other minerals. The muscovite crystals ("books") are mainly between six and twelve inches across and three to four inches thick. Books of 3 feet and 2 feet thick are exceptional. The mica occurs usually towards the sides of the vein which range up to 100 feet in thickness. Payable mica is developed in shoots within the pegmatite. Mining to date is shallow (down to 600 feet) and methods are very crude. Prospecting by contract drilling is aimed at finding new shoots at shallow depth. No attempt is made to prospect by deep drilling the continuation of a pegmatite dyke which is being mined. The Geological Survey of India is attempting to discover the factors determining the development of the shoots within the pegmatite.

Bokaro Coalfield.

This coalfield is one of many developed in the outliers of Gondwana (Permian) terrestrial rocks which are a feature of the Damodar Valley.

The Bokara Coalfield is about 40 miles long from west to east and five miles wide. It was mapped in 1866 by the G.S.I., but was not developed until 1915.

The coal seams are part of the Barakar Coal Measures in a down-faulted syncline surrounded by Archaean mica schist. In this field there are four principal seams namely, from the lowest upward: Karo Seam (120 feet thick), Bermo Seam (45 feet thick), Kargali Seam (70 to 110 feet thick) and Twelve-foot Seam (12 feet thick).

The Kargali Seam is worked by open-cut methods in the Bokaro and Kargali Collieries. In the Bokaro Colliery, the seam is 90 feet thick and the thickness of overburden (interbedded sandstone and siltstone) is up to 50 feet. In the Kargali Colliery, the seam is 70 feet thick and the overburden, up to 140 feet thick is moved by mechanical excavators and trucks. The mining is done by manual labour - hand picking and carrying in small baskets to the railway trucks. Each colliery produces about 3,000 tons per day using 8,000 employees. The coal is black bituminous medium grade metallurgical (coking) coal containing:

Moisture 1%
Volatiles 24%
Fixed carbon ... 50%
Ash 25%

Calorific value - 10,000 B.T.U.

Noamundi Iron Mine.

The iron ore is interbedded in a succession of pre-Cambrian sedimentary rocks dipping at very gentle angles. The iron-ore formation includes hard massive coarsely-crystalline ore (predominantly of hematite), thin-bedded to laminated ore (finely-crystalline hematite with silica and alumina containing 61% iron), very fine-grained ore - "blue dust" containing 66% iron and interlaminated hematite and chalcedony or jasper (called Banded Hematite Quartzite). The Iron-ore formation rests on ferruginous shale.

The iron-ore probably originated as a precipitate of iron hydroxide in a lake or sea into which very little coarse clastic sediment came. The chalcedonic silica also is suggestive of a colloidal precipitate and the two indicate that the land surface from which iron and silica derived was of very reduced topography and deeply weathered. This is also indicated byy the presence of alumina probably in clay minerals. The "Banded Hematite Quartzite" has been suggested as the "mother rock" of all the iron-ore but there is little field evidence to support this. The Banded Hematite Quartzite is developed in the upper part of the iron-ore formation and there is little possibility that there ever was inter-bedded silica in the lower part of the formation.

Kandri Manganese Mine.

At Kandri, the manganese ore is a bedded deposit of braunite and psilomelane occurring probably as a lens in medium-grade metamorphic rocks. The strata are folded into a synclinorium pitching south-east at about 60 degrees. Rocks associated with the manganese ore include "Gondite" - consisting essentially of quartz and spessartite with minor manganese; pyroxene and amphibole, - rhodonite schist, mica schist. The ore probably originated as a sedimentary precipitate of the colloid type under conditions of reduced clastic sedimentation.

Deolapar.

The G.S.I., training camp provides an intensive course in field mapping and mining geology for newly recruited officers, university graduates and approved students. This has helped to achieve some uniformity in methods of mapping which was very necessary under the conditions of rapid expansion which have existed for the past five years.

The G.S.I., in petrologically complicated areas makes use of the petrological microscope in the field by having in the field party a section cutter who prepares finished sections of rocks for examination on the spot. The equipment comprises two squares of plate glass (for grinding the rock chips), coarse and fine abrasive powder, glass slides and coverslips, prepared Canada Balsam, spirit lamp, tripod, metal plate, wind shield, tongs. The cutter at the training camp prepares four slides per day.

At Deolapar an extremely interesting suite of high-grade metamorphic rocks outcrops. Calcareous metamorphic rocks include wollastonite schist, tremolite schist, garnet-anthophyllite schist marble, "banded calc-granulites". The structure is believed to be a nappe.

Digboi Oil Field.

The Digboi Oil Field is on a steep anticline above a high-angle thrust in probably Middle Miocene fresh-water greywacke and siltstone. Production began in 1889 in the outcropping Nahor Sand. The high wax content of the oil (16%) and high pour point (95°F.) had caused the crude to set in the outcrop and thus to provide a seal to the oil in the sand. Oil continues to flow from a well only 600 feet down-dip from the outcrop. The permeability of the oilsands in this field is generally very low and it is almost certain that most of the permeability is due to joint fissures produced by the thrusting. The oil probably migrated up the thrust fault but whether it came from the Eocene-Oligocene beds or from older beds is not known.

The landslide stripping of the face of the Himalayas caused by the Assam earthquake of August 1950 provides startling visual evidence of the importance of earthquakes as an agent of erosion in this high mountain environment. Landslides dammed the Brahmaputra River, stopping the flow for three days. When this dam broke the resulting flood, carrying a tremendous load of landslide debris, caused tremendous damage along the valley, changed the course of the main stream and left behind a thick deposit of sediment and trees over much of the flood plain.