

CYCLES IN DHARWAR SEDIMENTATION

BY DR. C. S. PICHAMUTHU

(University of Mysore)

NOW that the sedimentary origin of many of the constituents of the Dharwar System in Mysore has been recognised, it is for consideration whether these ancient sediments share any of the characteristics of later formations. There are many aspects of this problem, but attention will be confined here to one of the important features of thick accumulations of sedimentary rocks, namely, the recurrence in cycles of sequences of certain types of sediments.

Sediments usually accumulate to great thicknesses in large subsiding troughs which are called geosynclines, and subsequently these areas become mountain ranges. The general course of events is somewhat as follows: the geosyncline gradually sinks during long ages; this downwarp gets slowly filled in by sediments which accumulate as sinking goes on; the geosynclinal downwarp caused by the accumulation of thousands of feet of sediments in such a basin of deposition results in the rise of the isogeotherms; this produces expansion and lateral pressure as a consequence of which the sediments are folded; further increase of pressure causes overfolds and thrusts, and the final expression of this is orogenesis when the geosyncline is elevated to form a mountain range. Each orogenic revolution is accompanied by abyssal injection and followed by volcanic action.

This sequence of events must undoubtedly leave an impress on the type and structure of the rocks. The nature of a sedimentary deposit has a direct bearing on the depth at which it is formed, and in a subsiding basin, the succession is ordinarily a conglomerate, followed by sandstones, clays, and limestones. In metamorphosed regions, the rock sequence is conglomerates, quartzites, schists, and crystalline limestones. This sedimentary cycle can be observed in several formations of different ages in India, e.g., in the Salt Range and Spiti areas, and in the Cuddapah and Vindhyan formations. The cycle is not often complete or obvious because of the disappearance of strata due to denudation or to tectonic disturbances.

The Dharwars are much more ancient in age, and hence the probability of the preservation of evidences of such sedimentary cycles is somewhat less. It is remarkable, however, that though the Dharwars have been highly disturbed and metamorphosed, the sedimentary sequence in many regions is reasonably clear. In such favourable areas the sedimentary cycle can be recognised.

This succession of quartzites, shales or schists, and limestones is seen in many occurrences of Archæan rocks in the Peninsula. The Aravalli System starts with a basal quartzite and is succeeded by phyllites, and cherty limestones. In the Delhi System, quartzites are succeeded by phyllites and biotite schists which are overlaid by calc-schists and calc-gneisses. In the Gangpur Series, the succession is quartzites, mica schists and phyllites, and dolomitic and calcitic marbles. The Sausar Series commences with a quartzite overlying

which are schists, calciphyres, dolomites, and crystalline limestones. In Bastar State, the oldest Pendulner Stage is composed mostly of quartzite; this is overlain by the Bengpal Series which is formed of andalusite-gneiss and cordierite-gneiss which represent metamorphosed aluminous sediments; the Bailadila Iron Ore Series which comes next is formed mainly of calc-schists, amphibolites, and banded ferruginous quartzites. In many other regions, schists succeed quartzites, but the limestones are wanting.

It is interesting to note that in Mysore State also this sedimentary cycle can be recognised. In the Shimoga Schist Belt, both the middle and upper Dharwars exhibit very well the sequence of conglomerate, quartzite, schist, and limestone.

SHIMOGA SCHIST BELT

Upper Dharwars—

Ferruginous quartzites.
Thin bands of limestone.
Agrillitic calcareous silts.
Quartzites.
Conglomerates.

Middle Dharwars—

Banded hæmatite quartzites.
Limestones and dolomites.
Phyllitic and chloritic schists.
Secicitic grits and quartzites.
Conglomerates.

CHITALDRUG SCHIST BELT

Upper Dharwars—

Ferruginous and Manganiferous quartzites.
Chalybitic rocks.
Clay schists and phyllites.
Sandstones.
Conglomerates.

Middle Dharwars—

Banded ferruginous quartzites.
Limestones
Shales, phyllites and schists.
Quartzites and grits.
Conglomerates.

Thus we see that the Dharwar sediments in their order of deposition conform generally to what has been noticed not only in the younger formations but in the analogous rock series in other parts of India. In this respect, the Dharwars of the Peninsula resemble also the Pre-Cambrian formations of China, United States, and Canada.

From what has been said above it is clear that in the Dharwars of Mysore, two distinct sedimentary cycles can be recognised each commencing with a conglomerate which passes on into quartzites (often showing current bedding and ripple marks), and succeeded by shales or schists, and limestones associated with banded manganiferous or ferruginous quartzites.

Epochs of sedimentation have always been followed by intervals of vulcanism. The geological record contains many examples of vulcanism after a period of geosynclinal sedimentation. The earliest records throughout the world bear ample evidences of this, and the sedimentary rocks are seen to be intruded by

and interbedded with igneous material. The Dharwars, again, are no exception to this. In Mysore, as in similar formations in many other parts of the world, the Dharwars start with an igneous complex of basic, intermediate, and acid lava flows and intrusives. Then the middle Dharwar cycle of sedimentation commences. At the closing phases of this cycle, extensive igneous action takes place. Batholiths and stocks of acid rocks have stoped their way upwards and some of them have reached the surface. In the Shimoga Schist Belt we have examples of the granite masses of Rangan-durga, Balekal, and Shimoga; and, in the Chitaldrug Schist Belt, the Pitlali and Bukka-patna granites. It is probable that at this stage the sediments were thrown up into huge mountains.

Subsequent to such mountain building activity, minor intrusions and volcanic flows, mainly of the composition of basalts are usual, and in the Dharwars of Mysore we have again good examples of such igneous phenomena. In the

Shimoga Schist Belt there are the Bababudan epidiorites, and in the Chitaldrug Schist Belt, the Jogimardi and Bellara traps.

The mountain ranges of this period were then subject to erosion and peneplanation, and the stratified rocks of the second cycle would then have been laid down upon a probably folded and faulted and planed-off body of rocks, commencing with conglomerates and succeeded by quartzites, shales, limestones, and ferruginous quartzites. The same sequence of events must have been repeated, ending again with a period of igneous activity. The granitic rocks which have now been identified as portions of the Peninsular Gneiss, and the horn-blendic and norite dykes are evidences of this third phase of vulcanism which marked the close of the second cycle of Dharwar sedimentation.

It will thus be seen that in the Dharwars of Mysore we can recognise at least two distinct cycles of sedimentation each with its attendant igneous phenomena.

FOURTH INTERNATIONAL CONGRESS FOR MICROBIOLOGY

NEWS has been received at the office of the Indian National Committee of the International Association of Microbiologists that the Fourth International Congress for Microbiology will be held at Copenhagen, Denmark, from July 20th to 26th, 1947. The business of the Congress will be conducted through 9 sections, as follows:—

Section I.—General Microbiology; Antibiotics; Growth substances. *Section II.*—Medical and Veterinary Bacteriology; Diphtheria; Pertussis; Pathogenic streptococci; Tuberculosis Brucellosis. *Section III.*—Viruses and Viral Diseases; Poliomyelitis; Influenza. *Section IV.*—Serology and Immunology; Fundamental Principles of Serology, partly in relation to Infection-Biology, partly from physical and chemical view-points. *Section V.*—Variation and Mutation in Micro-organisms; Adaptation; Induced Mutation. *Section VI.*—Plant Pathology and Mycology; Plant pathogenic bacteria—their taxonomy and nomenclature; Nomenclature of plant viruses; Physiologic (pathogenic) races of fungi; Fungus flora and decay in wood pulp. *Section VII.*—Water and Soil Microbiology; Antibiotic activity in the soil; Nodule bacteria and nitrogen fixation in the soil; Microbiological methods for determination of soil fertility; Autotrophic bacteria; Methods for quantitative determination of *Escherichia coli* in water; Pathogenic bacteria in sewage; Bacteriology of the biological purification of sewage. *Section VIII.*—Dairy and Food Microbiology; Sour-milk for therapeutic purposes; Lactic acid bacteria in silage; Food poisoning. *Section IX.*—Alcoholic and other Fermentations; Butanol-acetone fermentation; Food yeast.

The International Society for Microbiology was established in 1930 "with the object of promoting scientific thought by creating a closer relationship between scientific workers in different countries, and especially of spreading the idea that all its members were united in a common ideal of peace and constant friendship."

The Society is directed by a Central International Committee and a Permanent Commission. The Central Committee is composed of members of the Society's Board, the members of the Permanent Commission and the Chairmen of the National Committees.

Each country of geographical region forms a National Committee made up of workers in various universities, research institutes and other institutions concerned. The constitution enjoins that workers wishing to contribute papers must apply for membership through the National Committee of the country concerned and when the Central Committee approves of such application, they then become full members on payment of the required fee. The office of the Fourth International Congress is located at Kommunehospital, Copenhagen, Denmark. The office of the Honorary Secretary, Indian National Committee (Dr. A. C. Ukil), is located at the All-India Institute of Hygiene and Public Health, 110, Chittaranjan Avenue, Calcutta, from whom further information on the subject can be obtained.

For the information of those who will contribute papers, it is stated that a summary not exceeding 200 words should be in the hands of the General Secretary of the Congress at Copenhagen not later than the 1st January, 1947.