

FIG. 2.4. India : Distribution of Cuddapah Rocks

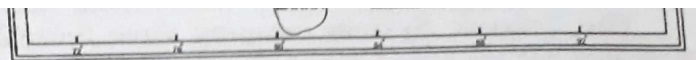


FIG. 2.5. India : Distribution of Vindhyan Rocks

the *Haimanta System*. This 1600 metre thick deposit consists of slates, quartzites and dolomites. Similar formations are found north of Kullu and Lahul in Himachal Pradesh as well as in the Baramula district of Jammu and Kashmir. In Kumaon, some slaty and sandy rocks of the Cambrian period are found. In the salt range on the Indo-Pak border, the Cambrian is represented by 900 metres of fossiliferous sandstones, shales and dolomites underlain by salt marl (clayey salt) known as the saline series.

The **Ordovician rocks** after the Ordovices, former inhabitants of Wales (500 million years) include quartzites, grits, sandstones and limestones. They overlie the Haimanta system in all parts of the Spiti in the form of a thick series underlain by conglomerates. They are also present in the Lidar valley of Kashmir and in the Kumaon region.

The **Silurian rocks** after the Silures, former inhabitants on the borders of Wales and England (440 million years). In the Spiti valley, the Silurian rocks are in continuation with the Ordovician. Round the core of the Lidar anticline there runs a thin but continuous band of Silurian strata. The Lahul and Kullu valleys of Himachal Pradesh also have some Silurian deposits. The limes and shales of the Kumaon region belong to the Silurian period.

The **Devonian rocks** after Devonshire in England (400 million years) are a great thickness of massive white quartzite reaching a thickness of 900 m at certain places. They are devoid of any fossil remains. These rocks have definitely been identified in the Muth quartzite of Spiti and Kumaon, on the flanks of Lidar anticline and in the Haridwar district of Uttaranchal.

The **Carboniferous rocks** (350 million years) comprise mainly of limestone, shale and quartzite. These rocks are generally divided into the *Upper Carboniferous*, *Middle Carboniferous* and *Lower Carboniferous* systems. The *Upper Carboniferous* rocks are made of limestone and dolomite. Mount Everest is composed of *Upper Carboniferous* limestones. The *Middle Carboniferous* has been the age of great upheavals. The rocks of this group are mainly found in the Spiti valley, Kashmir, Shimla and Panjal trap, and some rocks of the *Lower Carboniferous* group are included slates of different types, Pir Carboniferous in Geology means coal bearing.

4. THE ARYAN ROCK SYSTEM

The Aryan System comprises the rock formations ranging from the *Upper Carboniferous* to *Recent*. They are fairly preserved in the Peninsular India and are found in a perfect sequence in the Himalayan region along the entire northern border.

The **Gondwana System** derives its name from the Kingdom of the Gonds, the most primitive people living in Andhra Pradesh. It has relevance with the Gond region of Madhya Pradesh also where these rocks were first discovered. The Gondwanas consist of sandstones with some shales and clays. They are of continental origin, fluvial and lacustrine deposits laid down in geosynclinal troughs on ancient plateau surface. As the sediments accumulated, the loaded troughs subsided which led to thick deposits of fresh water and subaerial sediments into which were embedded the terrestrial plants and animals. These flat sedimentary strata, some 6,000 m thick, were laid down from the start of the Permian period some 250 million years ago. The system shows several climatic changes during its deposition.

The main areas of Gondwana rocks in the Peninsula are along the Damodar Valley in Jharkhand, along the Mahanadi river valley in Chhattisgarh and Orissa, in the southern part of Madhya Pradesh and a series of troughs along the Godavari from Nagpur to the delta (Fig. 2.6). In the extra-peninsular region these rocks are found in Kashmir, Darjeeling and Sikkim. Here they are so much deformed that they have lost their original identity and are entirely different from the peninsular rocks.

Economically, the Gondwana rocks are the most important in India containing about 98 per cent of her coal reserves. They have rich deposits of iron ore, copper, uranium and antimony. Sandstones, slates and conglomerates are used as building materials.

The **Triassic System** meaning three fold (280-225 million years) is almost unknown in the Peninsula but are found over extensive areas from Hazara to Nepal. Impressive sections of the system are exposed on the south flank of the Great Himalaya range from Kashmir to Byans in Eastern Kumaon. The trias are generally divided into lower, middle and upper divisions. The *Lower Trias* is over 100 m thick in Kashmir, 50 m in Byans and only 12 m in Spiti. The *Middle Trias* is 275 m thick in Kashmir. The *Upper Trias* of Kashmir is 1200-1800 m thick well bedded limestones. In the Spiti both these stages are represented by about 1,000 m thick dominantly calcareous strata.

The **Jurassic System**, after Jura mountains on the borders of France and Switzerland (180 million years) overlies the Triassic, covering wide areas in Tibet, South Ladakh, Spiti, Nepal and Bhutan.

where limestone occurs to a depth of 600-900 m. The marine transgression in the latter part of the Jurassic gave rise to thick series of shallow water deposits in Rajasthan and in Kachchh. There is 190 km long and 64 km wide area in Kuchchh which is covered by rocks of the Jurassic system. Coral limestone, oolitic limestone, sandstone, conglomerates and shales occur in Kuchchh. The Jaisalmer area of Rajasthan also has some Jurassic rocks. Another transgression on the east coast of the Peninsula between Guntur and Rajahmundry has resulted in the development of marine Upper Jurassic strata interbedded with the upper Gondwana formation.

The Cretaceous System, from Creta, the Latin name for chalk (135-70 million years), is one of the best developed marine systems of India showing a variety of facies and represented by a wide variety of rocks, deposited in the land, sea estuaries and lakes. No other system is so widely distributed in India as the Cretaceous System is, both in the Peninsular and the Extra-peninsular parts.

The Cretaceous rocks of the Spiti area include sandstones, quartzites, limestones and shales. In the Kumoun region, the important rocks are sandstones and shales. Cretaceous limestones are also found in Rupshu and Burzil areas of Kashmir. The plateau of Meghalaya has sandstones. The upper Cretaceous system occurs in the Pondicherry-Tiruchchirapalli belt. Some detached outcrops of marine Cretaceous, known as Bagh Beds in Gwalior are found along the Narmada Valley where they underlie the Deccan Trap. In the Central parts of the Peninsula occur estuarine and lacustrine deposits called the *Lemeta*⁵.