

Karewas: a geological treasure and heritage of Kashmir

The Kashmir valley is an oval-shaped basin, 140 km long and 40 km wide, trending in the NNW–SSE direction. It is bounded by lofty and glacier-chiselled mountain chains of the Himalayas. It is an intermountain valley fill, comprising unconsolidated gravel sand and mud succession appearing as plateaus above the present plain of Jhelum and its tributaries. These plateau-like terraces are called 'Karewas' or 'Vudra' in the local language. Despite the continuous erosion since a couple of million years, about half of the valley is still occupied by the Karewa sediments. These sediments are dominantly lacustrine in origin. Due to the rise of Pirpanjal, the drainage was impounded and a lake of about 5000 sq. km area was developed and thus formed the basin.

Karewa sediments are witness to and treasure of many human civilizations and habitations. The Stone Age man has survived the harshest of the Pleistocene glaciations. The artefacts left by him are still embedded in the deep soil horizons of the plateau lands. The choppers, hand axes and sharp stone blades are worth mentioning, forming a storehouse of the Stone Age factory. The *Elephas* remains found within the sediments provide evidence of his ability to hunt animals. Apart from the Stone Age man, the remains of Buddhist Stupas on the Karewas show Buddhist influence of the time. The Brahman rulers have also left their footprints on these sediments, which can be seen near Pattan, Awantipora and Mattan. Rishis and Sufi saints are not far behind when it comes to occupying the highest reaches of the Karewas.

The Karewa deposits in the Kashmir valley have been conventionally divided into two stages, lower and upper, representing argillaceous and arenaceous facies respectively. The upper Karewas are less fossiliferous than the lower Karewas, and are separated by an unconformity representing an erosional interval as a result of which about 600 m of the lower Karewas was eroded from the crust of the anticlinal fold, as observed in Hirpur of Shopian tehsil along Rembiara River. The thickest of the succession of

Karewas is exposed in Pakharpur and therefore referred to as Pakharpur Formation; here the Karewas rest over the Panjal volcanics with an angular unconformity. The entire belt touching the foothills of the Pirpanjal represents the lower Karewas, which has been exposed by the rivers starting from the south such as Veshav, Rembiara, Romushu, Dodhganga, Shaliganga, Boknag nar and Ningli, thus exposing lower Karewa sections at Aharbal, Anantnag, Arigam, Baramulla, Handwar, Ichguz, Aglar, Wapzan, Hirpur, Naugam, Nichihom, Pakharpur, Shupian and Yusamarg. The rest of the Karewa sediments occupy the middle of the entire flank of the valley, including Pampore, Srinagar, Burzuhom, Dilpur, Pattan, Parhespora, and parts of Baramulla District represent upper Karewas of the valley.

The Late Cenozoic deposits exposed in the Kashmir valley assume special significance as they are extensive fluvioglacial, fluvial, lacustrine and eolian in origin. The age determination of the Karewa group is based on the correlation between Karewa and Shiwalik fauna from India and Pakistan. As far as the age of Karewas is concerned, the lack of chronological control has impeded the development of a detailed reconstruction of the Karewas depositional history in the intermountain basin of the valley. In the past, correlations between exposures have been based primarily on lithological similarities and limited palaeontological data. Magnetostratigraphy and fission-track method dating allow a reliable chronology for the sediments deposited in the basin. The dated Karewa sediments span the interval from 3.0 to 0.4 m.y.

Geological field expeditions by a number of national and international workers have helped collect a wealth of fossil data in the last two centuries. Vertebrate palaeontological studies of the Karewa Group date to the time of Godwin-Austen (1864), reports of fish scales from Gogjapatri, Liddarmarg and Yusmarg. Hora described the remains of *Schizothorax* and *Oreinus* from the Ningli Nala section at Butapatri. DeTerra and

Paterson reported *Elephas hysudricus*, *Cervus*, *Rhinoceros*, *Felis* and *Shivatherium giganteum* from Somber and Nagam sections. Apart from the micro and mega vertebrate fossils, Karewas are rich in Ostrocods, which provide palaeoecological significance. The different studies carried on Ostrocods show that the upper Karewas was deposited in a large, permanent, cool, slightly alkaline lake which was fed by a number of sluggish weedy tributaries. In the same way palaeoenvironment of lower Karewas was deposited under partly shallow to deep lacustrine, partly fluvial and swampy conditions. The Ostrocods are highly suitable for palaeoecological studies because of their excellent preservation, great abundance and rapid dispersal. The study of diatoms also gives clues about the non-marine origin of the Karewa sediments.

More work needs to be done on the Karewas using sophisticated instruments to reach the abyss. However, people in the area seem to be destroying these table lands at the cost of development and petty commerce, ignoring the geological and aesthetic significance of these formations. Although alternative construction and building material is available in vast amounts, this only shows our ignorance about understanding earth sciences as a subject. The rich fertile soil is being used for landfill purposes at construction sites which is not only wastage of resource, but a threat taking into account the seismic risk factor in the valley. In fact, the agriculture of the valley dominantly survives and sustains on Karewa soils. The world famous saffron from Pampur and apples from Shopian are best examples in support of my claim. The rampant anthropogenic erosion since a couple of years has reduced these plateau lands into ugly ravines. Thus we need to preserve this geological treasure and legacy for the generations to come.

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