PART D

CHAPTER XI

Denudation Chronology

DENUDATION CHRONOLOGY

The morphometric analysis of the Mayurbhanj Upland was undertaken mainly for two reasons. First, it was hoped that morphometric analysis would reveal the former base levels in the region. Secondly, it would facilitate the description of the landform. In the present chapter only the first motive will be dealt with. But the final conclusion will not be based on morphometric evidence alone. Geological and field evidences will also have to agree with the morphometric evidences before a final denudation chronology can be established for the region.

Morphometric Evidence :

The value of morphometry lies in comparison of the results derived from application of different methods. Hence a comparative study is made of the results obtained from morphometric analysis of the landform and drainage of the Mayurbhanj Upland.

Prior to all discussions it is better to point out the limitations imposed by the selection of height ranges, so that it is impossible to distinguish the exact level of an erosional surface. Only an approximate value is possible. Also, when identification of two different levels are concerned, situated within the selected height range, most morphometric methods fail to distinguish between the two. Hence, it is very difficult

to check the two separate accordance of summit levels as indicated by the landscape profiles at 3250 and 3000 ft (991 m - 914 m) respectively. All the results obtained from arithmetical analysis of the landform has a common height limit of 500 ft (152 m). So the altimetric analysis emphasizes the maximum concentration of summits between 3001 ft (915 m) only and no more. The area-height diagrams reveal a scarcity of land above 3000 ft (911 m), which indicates that mostly peaks are dominant over this level. The clinographic curve shows a sudden steepening of slope over 3500 ft (1067 m), which again confirms that the highest altitude in the region is represented by peaks. The map of restored contour reveals that in the past, prior to dissection, a dominant surface area lay between 3000 and 3500 ft (914 - 1067 m). All these evidences support the existence of an erosion surface over 3000 ft (914 m), which, after upliftment of the region, has undergone much dissection, so that relics of this surface is now preserved in the form of flat-crested summits and peaks. There is no way to identify another erosion surface within the 3000-3500 ft (914 - 1067 m), height range.

Another former base level of erosion appears to be represente around 2000 ft (610 m) level, for both the area-height diagrams and the clinographic curves reveal a scarcity of area and steepening of slope below 2000 ft (610 m), as would result from recently uplifted erosional platform. The longitudinal river profiles of streams depict sharp breaks of the slope at 1750 ft (533 m). The valley

cross-profiles show deeply incised courses of the river before debouching to the surrounding plains. The cartographic maps of relative relief, dissection index, depth of dissection and average slope all commonly reveal a broad belt of greater relief, dissection, slope etc. encircling an area of lesser relief, dissection and slope which occupies the central and southwestern part of the Mayurbhanj Upland. They emphasize the relatively older landscape at the centre and the southwest, and the younger landscape encircling it. These, according to Prof. Thornbury (1954) are topographic unconformities that identify an uplifted peneplain.

Geological Evidence :

"The most crucial test that can be applied to an erosion surface thought to be a former peneplain is that its low relief surface truncates strata of varying resistance to weathering and erosion .... Truncation of strata is almost inevitable on a peneplain because of the fact that its surface slopes both laterally and seaward". (Thornbury, 1954).

To test the authenticity of the levels suggested by morphometric analysis, the geological maps of the Mayurbhanj Upland on the same scale is consulted. The geological section reveals the general truncation of all the strata disregarding their resistance. The resistance displayed by local outcrops, mainly on the second erosional plain over 2000 ft (610 m) is not to be considered as

disqualification, for even in old age 'the effects of varying geologic structure and rock resistance are never completely obscured' (Thornbury, 1954). Also, it is possible that the second cycle of erosion in the region was never completed to account for such structural controls.

The peaks located over 3000 ft (914 m) altitude, have been tested in relation to lithology. They display a complete disregard of the varying resistances of volcanic rocks, quartzites, ferrugenous shales and granites.

The breaks of the logitudinal river profiles are also generally developed on homogenous rocks. Structural control is found in the breaks of the profiles of a few north-flowing streams at 1750 ft (533 m), and the great break in the profile of Burhabalang river is found to be associated with a fault-line passing across its course. Hence the breaks in the logitudinal profiles of most of the rivers are confirmed to be nick points.

Thus geological evidence are found to support the two erosional surfaces as indicated by the morphometric evidences.

Field Evidence :

The morphometric evidence had definitely indicated the presence of two former erosion surfaces at 2000 ft (610 m) and 3000 ft (914 m) respectively. The geological evidence confirms

that these levels involve truncation of various rocks. To test the nature of these two erosion surfaces, field study was made in selected areas. A level plain was located beside the Khairi Nala that stretched from Gurguria village till Khendibil - a stretch of about four miles (6.4 km) and its width never exceeded 2 miles (3.2 km). The elevation of this plain was about 2000 ft (610 m).

Other small tracts of level land were seen on way to Barehipani village, whose elevation was around 2000 ft (610 m). Another long stretch of level land flanked the Burhabalang river north of Simlipalgarah, whose elevation was about 2500 ft (762 m) with a prominent slope downstream (i.e. northwards). On the divide between Baku Nala and Pitalisil Nala, a flat surface was seen, whose elevation was above 3000 ft (914 m).

The flat surface and plain referred to above were not flat in the absolute sense. Mostly they had a gently undulating appearance and resistant outcrops of rocks were seen to jut out here and there. The antiquity of these surfaces were verified by the presence of alluvium and laterites which thickly veneered the surface, the thickness being verified by the presence of some badland formation about 10 ft (3.04 m) in relief.

The following sequence of events may be derived from the above study of the Mayurbhanj Upland :

1. In the pre-Cambrian time the area was denuded mainly by fluvial action. The area was levelled down to the base level of erosion and the surface was then composed of older metamorphics predominantly.

2. The area was occupied by a geosyncline in the pre-Cambrian time when a series of sedimentary rocks were formed on the initial basement surface composed of older metamorphics predominantly.

3. The area was then uplifted by tectonic forces and was again subjected to erosion.

Intrusive rocks changed the character of the sedimentaries and a variety of metamorphic rocks were formed including the iron ore series of the area.

Granites were intruded into the whole series and the area was subjected to erosion bringing the level down to the base level of erosion.

4. Volcanic activities associated with tectonic upheaval by about 1000 ft (305 m) modified the landform as well as the rock type and intrusions along the peripheral zone raised the rim of the area in relation to the central part which subsided to form a sag, and thus, a basin-like structure was formed. This surface was subjected to erosion for a long time and the surrounding areas were denuded down to the base level while the central part remained

at an elevation of 1000 ft (305 m) above the base level.

5. The area was uplifted again by about 2000 ft (610 m) after the deposition of sedimentary rocks and landscape evolution under fluvial action continued since then to produce the present surface with all its irregularities. Tensional cracks developed along different lines which modified the drainage characteristics in certain areas. Quartzites, granites and basalts produced a variety of landscape characteristics by differential weathering and erosion and micro-details of landform, as observed to-day, were formed particularly in the post-tertiary period.