CHAPTER VII

NATURE AND ORIGIN OF LAKES

GENERAL

The various lakes that are situated in Kumaon are important not only from the scenic point of view, but geologically too, they have attracted much attention from a number of investigators in the past. Almost all the previous workers have been intrigued by the group of lakes that occur at fairly high altitudes in the Kumaon and they have put forth diverse opinions to explain the exact nature and origin of these lakes.

In a broad way, the Kumaon lakes could be divided into two groups:

(i) Nainital group of lakes

(ii) Bhimtal group of lakes.

A perusal of the views put forth by the previous workers (Ball, 1878; Oldham, 1880; Medlicott, 1881; Heim and Gansser, 1939; Auden, 1942; Thomas, 1952; Devendra Pal, 1973) has shown a general agreement that so far as the Nainital group of lakes are concerned, they are structurally controlled. Though in matters of detailed structure and mechanism, there is some divergence, yet it is generally agreed that faulted valleys choked by huge landslips might have given rise to the lakes around Nainital.

MORPHOLOGY OF BHIMTAL GROUP OF LAKES

The Bhimtal group of lakes that lie within the study area comprise Bhimtal, Nakuchhiyatal, Sat-tal and Punatal (Fig. 1.2). Of these four, the first two are more prominent and occupy the main Bhimtal valley. The Sat-tal and Punatal are smaller and occur at a slightly higher elevation. A brief morphological account of the various lakes is given below.

Bhimtal

Largest of all the Kumaon lakes (including Nainital), Bhimtal is roughly triangular in shape and covers an area of 0.5 sq km situated at an altitude of 1322 m. The lake has a maximum depth of 27 m. It is fed by Nauti Gad, that flows in from the north-west. At the three corners of the triangle, small gaps occur; the gap on the east is of the nature of a deep cutting through which flows out the Bhimtal Gadhera southward. To the north of the lake, lies a fairly extensive terrace which typically indicates the original extent of the lake.

Nakuchhiyatal

Nakuchhiyatal is a curiously shaped lake having nine irregular projections around it. It lies at 1300 m above the sea level and covers a total area which is slightly less than that of Bhimtal. It has a maximum depth of 40 m. No conspicuous stream flows in this lake, nor its water finds any major outlet, except through one small stream that flows westward and meets the Bhimtal Gadhera.

Sat-tal and Punatal

Sat-tal and Punatal are the two lakes which are conspicuous by the altitude at which they are situated. The two lakes, are not only small as compared to Bhimtal

and Nakuchhiyatal, but they are strikingly different in their location and setting. Both the lakes are situated within an entirely rocky surrounding, and steep slopes rise abruptly above the water level on all sides. The Sat-tal is a V shaped lake, such that the tips of the two limbs are over 700 m apart. The height of the water level is 1300 m above the sea, the maximum depth of the lake being about 20 m. A few small streams flow into the lake. The outflowing stream is only one, which flows due west along steep slopes and meets the Balia Nadi.

The Punatal, roughly squareshaped, lies to the north of Sat-tal at a distance of about 500 meters. Each side of the lake is roughly 150 m. The altitude is almost the same as that of Sat-tal. A low small ridge separates the two lakes.

ORIGIN OF THE LAKES

Blanford (1877) and Theobald (1880) suggested that these lakes could be of glacial origin. Ball (1878) however did not agree with the glacial origin, and he for the first time advocated the origin from structural valleys enlarged by denudation and finally blocked up by landslips at their mouths. Thomas (1952), Mathur (1965) and Kharkwal (1971) have more or less supported Ball and have come to

conclusion that the lakes of Bhimtal area owe their origin to factors other than glacial.

According to Thomas (1952, p.395) the quartzites and basic igneous rocks in the Bhimtal region comprised the less rigid members of the heterogeneous rock assemblage and during the upthrust movement along the Main Boundary Fault, the rigid masses had their bearings directly on the sole of the thrust and thus suffered maximum upward displacement while the less rigid portion in the centre of the Bhimtal basin slumped back in irregular hollows.

Mathur (1965) has discussed the origin of the various lakes of Bhimtal area in some detail. He writes (op. cit.), "The region in which these lakes are situated is a typical example of the outer Himalayan topography. The main tectonic features are tightly folded hills with steep anticlines and synclines..... An examination of the geology of the area around the Bhimtal shows that trap occurs to the east of the lake and quartzites to the west. The junction of the two formations lies somewhere on the eastern edge of the lake where at a few spots thin strips of quartzite are also exposed. Originally a stream flowed into this valley from the north and took a course which ran roughly along the junction which is composed mostly

of soft phyllites which are easily eroded. The erosion of the main course of stream was extended and supplemented by undersurface erosion, by water, which found way into softer rocks below the surface through joints and fissures in them. The original outfall of this stream was, it appears certain, to the south where a small hillock stands at present. This hillock is made up of broken, and subsequently reconsolidated, blocks of traps and quartzites undoubtedly brought into this place by landslip. This stopped the outlet of the stream channel and the valley was gradually filled up with water giving birth to this lake. The present outlet of the Bhimtal is towards its eastern side. The deep cutting made by the Bhimtal Gadhera probably runs along a line of weakness and was cut by the overflow".

"The Naukuchhiya Tal was formed possibly by mountain streams which rushed in form the southern hills. These hills are mainly composed of quartzites. Traps are exposed on the northeast of the lake and occupy the valley beyond. Coming down to the bottom of the streams found a barrier in the traps, which being harder, resisted the action of water. Small pools were formed at the softer boundary of the traps, and they gradually became larger due to constant churning

action of water. Later on these pools got connected to form the deep hollow in which this lake is now situated."

"The mode of origin of the lakes of the Sat-Tal group also appears to be similar. They are structural hollows in the mountains. The Sat-Tal has a very small outlet, but the Puna Tal has none. The trapped water of these lakes assisted in deepening the bottoms in the quartzite country rock".

Mathur has ruled out glacial action, and according to him, the area does not afford any convincing proof of glaciation to which the origin of these lakes could be attributed.

More recently, Kharkwal (1971) has also invoked almost identical origin. He has suggested that the Bhimtal and Nakuchhiyatal were formed by the choking of the river valley through landslips. He has visualised formation of a large lake by some massive landslip and this lake was subsequently divided into small and independent lakes(Bhimtal and Nakuchhiyatal) due to further landslips. As regards the Sat-tal group of lakes, Kharkwal has explained their origin due to tensional faults and cracks affected by landslip.

The present author has found it rather difficult to fully understand these intriguing lakes. He does agree with the previous workers that faulting and landslides have played an important role, but he is rather doubtful whether these were the main and dominant factors in the origin and evolution of the lakes. A perusal of the topography and drainage pattern of the study are clearly shows that the Bhimtal valley comprises an uneven rocky hollow which has been filled up with lacustrine deposits.

The author is reluctant to believe that Bhimtal and Nakuchhiyatal originally comprised one big lake. The configuration of the valley clearly suggests that the two lakes represent distinct hollows connected by a narrow opening. Taking into account the entire Bhimtal-Nakuchhiyatal depression it does not suggest any choked or dammed river valley. The rocky barriers to the east and south show little evidences of an erstwhile river valley.

It is obvious that originally the Bhimtal extended further northwest and occupied the area now seen as vast flat terrace like ground. Constant addition of rock debris from the overhanging rocky slopes by way of landslides,

and subsequent accumulation of the material within the lake, appears to be the most important process responsible for the filling up of the northern portion of an originally bigger lake.

It is not certain whether the flat terraces in the valley consist of river deposits. On the other hand, it appears as if the rock debris due to frequent landslides has been reworked by the lake waters to give rise to terrace deposits. It will therefore be worthwhile to investigate in detail the exact nature of the material that has filled up the Bhimtal-valley. Even to-day considerable rock debris is seen near the northern tip in the form of fan shaped accumulations.

The Sat-tal and Punatal though situated so closely to the Bhimtal do not form a part of the main valley. These are distinct rocky hollows at a higher altitude. The stream that flows out of Sat-tal does not go to the Bhimtal, but instead drains westerly slopes and meets the Balia Nadi. It is very difficult to explain the nature and existence of Sat-tal and Punatal by assuming the Bhimtal valley to be an early river.

It is rather difficult to agree with Mathur (1965), who has related the valley formation to the existence of a series of "highly folded hills with steep anticlines and synclines". Neither such folds exist, nor the valley is carved along a syncline. On the contrary the valley occupies the core of the Bhimtal-Bhowali anticline, and the trappean rocks within the core of this fold are foliated and cleaved. There is little doubt that these foliated and cleaved traps afforded an ideal site for rapid erosion.

Thomas (1952) has invoked sagging or slumping of the less rigid portion to explain the formation of the large hollow that contains the lakes. This mechanism is however not supported by the structural pattern. The present author did not find a single major fault or dislocation running along the southern side of the valley to suggest such a differential movement. The two faults recorded, only indicate that they played some role in imparting the present configuration to an earlier bigger depression.

The author is quite tempted to suggest original glacial action as the main agent of carving these depressions. The earlier workers have ruled out this

possibility on the basis of absence of adequate evidences of glaciation. But the author is of opinion that further and extensive investigations in the direction might reveal new facts hitherto unknown. There is a fairly strong case for believing that the valley was originally formed by glacial action and was subsequently modified by the joint effect of frost, landslides and minor faults.

Whatever may be the prime factor that gave rise to this vast rocky irregular hollow, its subsequent evolution is equally noteworthy. Landslides appear to have certainly dumped rock debris. This process in turn has been responsible for the gradual filling up of the depression. The slow uplift of the entire region also might have augmented to the process of the shrinkage of originally bigger lake.

It is hoped that future workers will be able to unravel the mystery of these lakes fully.