

The route for this expedition was Gangotri-Gaumukh-Basukital-Suralaya-Seweta and then through Kalindi pass (19510feet) (Plates on cover page). The objective of this research expedition was to explore about the Gangotri glacier catchment with regards to source of sediment, ablation zone, line of equilibrium, accumulation zone, tributary glaciers, and geo-morphological landforms, etc. In addition, of soil (debris), water, and ice sample were also collected from the different parts of glacier catchment for scientific investigation. After completing all necessary, logistic and administrative formalities, the team started for the expedition from 25 August 2000 from Uttarkashi. On 26 August, 2000 the team started from Gangotri and reached for Bhojbasa, where the base camp was situated (for six month glacier discharge and suspended sediment monitoring-April-Oct) Gangotri to Bhojbasa, a 14 Km trek was well known to me, as plenty of times during the last two years I have crossed this way. We reached Bhojbasa at 1 p.m. and there after made necessary preparations and technical gear, ready for the next day. It was a plus point with me, that I did not need acclimatization around upto 4000 m. On August 27, 2000 journey was started early morning at 6.15, towards Nandanvan via Gaumukh "the lateral ice cave and the snout of Gangotri glacier, from where holy Ganges gushes out. After an hour's tiring glacial zigzag trekking from snout we reached the confluence of Raktavarana glacier. During this course we passed an outlet of a stream flowing down cascades through the wall blocking the entrance to the valley. After another two hours of laborious march we arrived at the outlet of Chaturangini valley. We turned left from this point as an exposed traverse over an ice wall where huge boulders and ice slabs made climbing very difficult. We reached the Chaturangini glacier the surface of which was completely covered by stones. We crossed it on its side by passing over a very steep and stone covered slope of the moraine. On reaching its edge, we had an unexpectedly beautiful view of green meadows and crystal streams. This was Nandanvan, a pleasant grassy pasture (4335 m) in the fork of Gangotri and Chaturangini glaciers. From Nandanvan the peaks Kharchkund, Kedardome, Kedar peak, Kirti Stambh, Shivling, Thaligar, Bhirgu Pant and Meru were clearly visible.

From Nandanvan we proceeded to Chaturangini valley. On our way we came across a pleasant meadow along side a stream, then a crust of the moraine. Behind this one could see peaks Meru massif and the east face of Bhirgupant. An Unnamed peak rises far ahead of us. After a march of 8-9 Kms., we reached the confluence of Chaturangi and Basuki glacier, a rope was fixed to climb 60°-65° slope, a mixture of mud and scree. And then we descended diagonally right towards the snout of lateral glacier from the bed of gully, diagonally left upon a very steep unstable slope (danger of stone and avalanche). From its edge we have the view of the shallow moraine lake Basukital (4900m). a little stream coming out from their black ridge of Basuki peak that feeds the Basuki lake. We pitched our tent on the NW ridge of Basuki Parvat.

On 28th August 2000 we left for Basukital through the depression between true left lateral of Chaturangini glacier and north face of Bhagirathi II peak and rhyme rock walked on the ridge with gentle gradient.

The next day the team descended towards Suralaya Sweta junction point and followed cairn marked route. The previous day we followed through middle where few glacier tables were observed. The route leads to a precipitated crest of the moraine and traversing the avalanches ridden slopes of Basukiparvat which reach the outlet of the Sunder valley. We camped at near Suralaya, in a small grassy pocket. Next day we started to Sweta glacier and Satopant peak appears all of sudden from behind a bend with the mighty rock wall surmounted by seracs rising in the back gravel. We crossed the glacier and climbed upon the crest of the moraine then diagonally left across a steep rocky slope, we came to the edge of fields covered with the boulders at the foot of the rock water. This pinnacle ends the ridge dividing the Sudar and Suralaya valley. Then we headed towards a huge block behind which we camped (5200m). From the bivouac near the boulder we went slightly uphill reaching the outlet of Suralaya valley which is surmounted by an unnamed peak and Mana Parvat. Further, we have a steep and tough trek across the Suralaya glacier and along the northern slopes of Chandra Parvat we camped at the left moraine of the Seta glaciers near its junction with the Chaturangini glacier. Here we found the accumulation zone of the Gangotri glacier the way was very tough and adventurous. On both sides of the glacier, scenes are amazing. We also heard the roaring sound of avalanches falling in this area. It was dreadful event of my life. Next day we moved early at 6 a.m. Our team should have reached Kalindi Pass early, but we could reach only at 8.30 a.m. at Kalindi pass base camp after a long trek on accumulation zone in chilling cold. We could clearly see from Kalindi Pass base camp. Due to melting of ice and snow the crevasses were opening. It might be dangerous for us to ascend the pass summit as we all are tired and facing headache and our porter Kedar was unfit. We took rest at this point, and pitched tent at Kalindi base camp.

The next day trek was for Kalindi Pass. Hence the team marched towards east, through medial moraine of Sweta Kalindi glacier and then to north-east, since the route through the moraine turned towards east and negotiating a crevasses started descending on an ice field and reached a boulder ridges from where turned towards north through the left lateral moraine of Kalindi glacier and reached the Kalindi Pass. Kalindi Pass separates the boundary of Gangotri glacier catchment from Badrinath valley. We reached here

at 8 a.m. (Plate 4) many peaks and glacier are visible from this height. After an half hour rest as per my suggestion two porters were cutting curve steps in an ice wall which were approximately 130 feet. They have done just half of work suddenly porter Bardev Singh skid from this wall and reached down with rolling and bouncing. We were shocked to see him fall but he said I am okay. After an hour of efforts we rescued him. The pass was completely filled with ice and snow and chilled cold storm was blowing. Ice and snow was malting in the pass at 11 a.m. So for the safety point of view I canceled descending and decided to stay at pass. We pitched tent at a safer side. In the night we were hearing the roaring sounds of frequent avalanche breaking, and the speedy blinbirds was over the pass and cruelly shaking our tent, and we all were facing acute headache, we could not sleep properly.

Next day at 5.30 a.m. we trek to another route with the help of map and struggled against two broad crevasses with the help of rope and technical gear. Ultimately we succeeded to ascend the pass and reached the snow field, and searched our ice axes which were fallen the previous day, and started to ascend from the snow field which was slightly dangerous as it is filled with loose boulders and snow and ice with 55°-60° gradient slope. Within one and half hour we successfully ascended, and reached another glacier catchment and after one hour we reached near Arwa tal (lake). And we pitched our tent by this pleasant place. Now Arwa tal lake has filled with sediments only a rivulet flow over the lake, which comes from Arwa glacier. Next day we departed to Ghastoli, which was 16 km. from Arwatal, during the trek, many streams which feeds to Sarswati river were crossed. Next day we trekked 12 km from Ghastoli and reached Mana village and then Badrinath.

The observation

From the snout of Gangotri glacier to Kalindi base camp we observed nine tributary glaciers of Chaturangini glacier. Chaturangini glacier is the longest glacier of Gangotri glacier system. The numerous enchanting glacier lakes spread over the glacial system (Plate 2), generally is responsible for glacial outburst events. Observation were also made regarding active landslide, rock fall avalanche prone zone and different debris fans. Debris fans along the lateral moraine of the glacier system can be responsible for extra sediment supply or sporadic events to the sub glacial channel in normal discharge cycle in monsoonal period (Kumar et al. 2001). This can be proved from oblique lateral moraine eroded landforms in the glacial valley (Plate 3). The ablation zone of the Gangotri glacier is covered by a thick pile of supraglacial moraines and is characterized by several serrac ice sections, melting into pool of supraglacial lakes. Because of subsidence and fast degenerating nature of the glacier and the supraglacial lakes scattered in the entire glacier system (Naithani et al. 2000). A clear line was also visible between ablation and accumulation zone. One could observe that this line is thinning as well as tributary glacier's snout, the ablation zone was also covered with debris and boulders with giant longitudinal and traverse crevasses. And in the accumulation zone some stagnant ice pillars were found near Kalindi glacier (Plate 1). Some observations were also made through ground trotting through geocoded data (IRS-1D 1998 and IRS-1C 1998) and toposheet (53 0/1) survey of India of this area. Change detection work is still in progress.

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Plates (as displayed in the cover page):

1. Stagnant ice pillars in accumulation zone of Gangotri glacier
2. Supra glacial lake in ablation zone of Gangotri glacier
3. Oblique view of eroded lateral moraine of Gangotri glacier
4. Glacial expedition team reached on summit of Kalindi Pass

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