

basin. Between 1 p. m. on the 15th and 1 p. m. on the 16th the river again rose 25 cm.; from 1 p. m. on the 16th to 1 p. m. on the 18th it dropped 28 cm.; but once more rose $14\frac{1}{2}$ cm. during the following 24 hours. These rapid oscillations of level were of course caused by the freezing of the river. On the 8th December the velocity was normal; and the drift-ice had decreased in quantity. A good deal of that which still remained was forced in underneath the permanent ice that had already formed a little lower down. On the 15th there was merely an insignificant quantity of drift-ice left, and the current was so sluggish that we were unable to get a reading on the velocity instrument. This slowing of the current was the cause of the greater transparency in the water. The great drop which took place between the 8th and the 15th, or more properly between the 14th and the 15th, was caused by masses of drift-ice having become packed together in some narrow passage, thus causing an obstruction. And the rise which followed in the next 24 hours was due to the hindrance having been removed. The second subsidence was in like manner caused by a fresh stoppage, and this in its turn was succeeded by a rise of less magnitude, the quickened energy in the erosive activity of the river producing (on 19th Dec.) a diminution in the transparency of the water. This much by way of explanation of these violent oscillations, which no doubt decrease in amplitude quite suddenly. And there actually was a stoppage in the river, as I learned from one of my servants, who told me, after his return from Korla on the 16th Dec., that for a long way below that town the highway was flooded, in consequence of the river's getting frozen and of the stoppage caused by the drift-ice.

But the real cause of the extremely great retardation in the rate of flow would appear to be the fact that the ice, which now covered the entire area of the river's surface, as well as grew day by day thicker, increased the friction which the water had to overcome, by opposing to the layer that flowed immediately underneath the icy covering an opposition very nearly as great as that which the current encountered at the bottom of the river. The body of water was flowing, so to speak, through a tube, all round the periphery of which the velocity was equally slow, and the rate of movement quickest along the plane that was farthest removed from the inner surface of the tube, that is to say, midway between the ice-sheet and the river-bottom. Hence it was that the velocity was so slight on the surface in the open places. Add to this, that the process of congelation, which was just then taking place, naturally deprived the stream of considerable quantities of water, of course diminishing its volume to a proportionate extent. When, therefore, the stream is thus all at once checked in its flow, and the power of gravitation which carries it down its bed is to a certain extent nullified by the frost, it is clear, that in the spring, when the frost comes to an end, the arrested gravitation resumes its effect upon the river, and carries through to a successful conclusion the labour which was suspended at the beginning of winter. The velocity becomes therefore greater in the spring than in the end of autumn, when the frost flings its icy fetters across the river, and the volume, notwithstanding that the influx of water from the contributories has decreased rather than increased, becomes a good deal greater than it was in December, owing to the water which has been held up by congelation being now set free again. The natives show that they have quite correctly inferred the cause of the first flood, the