## WEST KOOTANIE.

mined by the river and brought down it in times of flood, but which, owing to the quantity of rocky matter attached to their roots, have become anchored on this submerged delta. This shoal reaches nearly across the mouth of the North-east Arm, and will doubtloss in the coarse of time separate this Arm from the main lake. Another shoal area, also marked by snags, occupies the narrow funnel-shaped southern end of the lake where the river flows out, extending for perhaps half a mile.

Seasonal rise and fall.

The season of high water in the lake, depending upon the rise of the Columbia, is that in which the melting of the snows upon the more lofty mountains is proceeding most rapidly, which occurs generally in the early summer. Owing to the relatively inconsiderable snow-fall of the preceding winter, the high-water of 1889 was not as well marked as usual. In June the water stood six feet below a distinct high-water mark which had frequently been attained in previous years, while persons familiar with the lake stated that the winter low-water stage was at least twelve feet below the same datum. The ordinary seasonal rise and fall may therefore be stated as about twelve feet.

Hot spring.

Orifice of spring.

Eleven miles from the head of the Upper Arrow Lake, on the east side, is a somewhat remarkable hot spring. It is situated about a third of a mile back from the lake, on a rather steep wooded mountain-slope and at a height of about 400 fect, but may readily be found in coasting the lake by means of a conspicuous vertical cliff which forms the shore of the lake just a mile to the north of it. The water flows from two principal sources within a few yards of each other, and there are said to be several other smaller springs in the vicinity, which were not seen. The water from the two sources just mentioned forms a small brook, which runs down the mountain side to the lake. I had no means of accurately ascertaining the volume of the discharge, but estimated it to be about 300 gallons a minute. One of the springs issues among partly comented, stony drift material, the other from a crevice in the solid rock. The temperature of both, carefully taken on June 13th, proved to be 123.5° F. The water emits a rather strong smell of sulphuretted hydrogen, and a scanty deposit, apparently siliceous, occurs on stones over which it flows. The taste is not disagreeable, and the quantity of saline matter held in solution is evidently small. In the stream of hot water flowing from these springs a copious growth of green, yellow, red and white confervoid matter is found.

Little solid rock is seen near the springs, but that forming the orifice of one of them is a fine-grained grey gnoissic material containing a good deal of black mica. This, at the lips of the orifice, has been decomposed by the long continued action of the hot water to a depth of half an inch or rather more, the rock being bleached and its felspar completely