

The modern Niagara took possession of the old Tonawanda channel, which had drained a portion of the Niagara tableland in pre-glacial times. Its valley was about one and a half miles wide and ninety feet deep, and crossed the course of the modern river. The rapids above the Falls represent the site of the modern waters, now descending over its side into the ancient Tonawanda channel, which had been filled with drift. This ancient valley is now buried, and continues westward of the whirlpool to form the St. David's Valley, about which so much has been written. The whirlpool gorge is only a modern enlargement of a small valley starting, in pre-glacial times, from near where the railway bridges are now located, and forming a little tributary of the Tonawanda channel, just mentioned.

The older geological features and the character of the strata have been known for fifty or sixty years, but the features here mentioned are those directly bearing upon the physics of the river, which were not formerly understood.

The episodes of the river may be briefly outlined. The first was of long duration, when the descent of the river was about 200 feet, and the volume of water one-fourth of that of the present amount (only the drainage of the Erie basin). Then we have all the waters of the upper lakes flowing over Niagara, and shortly afterwards the surface of Lake Ontario was lowered to 420 feet below the upper level of the river. Thus, in a general way, we have arrived at the time when the Falls had reached the foot of the whirlpool rapids, by which time the waters of the Ontario basin rose sixty feet or more above their present level. In the meanwhile there were three principal cataracts, the lower gaining upon the upper. But by the time the Falls had retreated to just above where the railway bridges cross the gorge the Ontario waters were again lowered, so that the modern descent of Niagara river is 326 feet. The physics of the short section along the whirlpool rapids is not yet understood; but even in spite of this, with the consequent errors in the theoretical determination, the age of the Falls so far has not been found to greatly differ from the computations made in 1893, which assigned the period between the time when the Niagara was a strait and the present day to be 32,000 years.

These changing episodes, which appear complex, are after all largely assignable to one cause, namely, the unequal elevation of the earth's crust in the lake region, the amount being greater towards the north-east than in the opposite direction. With the rise of the land, the Huron, Michigan and Superior, collectively named the Algonquin basin, was eventually drained by way of the Nipissing and the Ottawa valleys; and the waters of the Lundy basin, the name for the united Erie and Ontario basins, were lowered so as to leave only an insignificant Lake Erie, and the Iroquois gulf, extending in the Ontario basin to the foot of the escarpment at the mouth of the Niagara river, into which the Falls descended directly at their birth. With the continued rise of the land the waters of the Ontario basin sank, in so far as they affected Niagara, to eighty feet below their present level. The land, now rising more rapidly towards the north-east than the south-west, tilted the river of the Algonquin basin so as to raise a barrier across the Nipissing outlet (worked out by Mr. F. B. Taylor), which diverted the waters of the upper lakes into the Niagara drainage only some 7,000 or 8,000 years ago. The same kind of movement raised the barriers at the outlets of both Lake Erie and Lake Ontario so as to back their waters towards the heads of the basins; and, in the case of Lake Ontario, its surface rose some sixty feet or more in the lower part of the Niagara gorge. But a portion of the barrier at the outlet of Lake Ontario, being composed of drift, has recently been washed away by the St. Lawrence river so as to reduce the surface of Lake Ontario to its present level.

The movement is slow. The rise of the land in the Niagara district is about one and a quarter to one and a half feet a century; about the region of Lake Nipissing, nearly two and a half feet, and about the outlet of Ontario, between four and five feet a century. These upward movements were determined from geological observations made at Niagara, and their effect upon the tilted beaches, which had