

extent, to the Gut of Causo. The most important at present of these gneissic areas is situated in the county of Guysborough.

In the Silurian valley between Halifax and Windsor, the gold districts of Lawrencetown, Montague, Waverley, and Renfrew, are situated on the east side of the valley; Mount Uniake and Hammond Plains on the west side. Around the gneissic nucleus in the county of Guysborough, the districts of Sherbrooke, Wino Harbour, Isaac's Harbour, Country Harbour, and Cochrane's-hill, are symmetrically arranged. The other districts, such as Tangier, Musquodoboit, Oldham, and Fifteen-Mile Stream, bear also a certain relation to gneissic areas, but enough is not known of this relation to admit of description.

The Cambrian gneiss occurs about two and a-half miles to the east of the worked lodes at Waverley, and about the same distance east from Goldenville at Sherbrooke. At Mount Uniake it is about the same distance to the west. Most of the known gold districts occur in close proximity to gneissic areas, but this arises from the circumstance that denudation has been most active on the more elevated intersections of the anticlinals, and has removed the Silurian strata, thus exposing the underlying gneiss. When comparatively low anticlinals intersect, there is no gneissic exposure. Two sets of main anticlinals intersect one another in Nova Scotia, one set having an easterly and westerly direction, the other at nearly right angles, or a northerly and southerly course. At the intersections of these anticlinals the gold districts are situated, and here, also, where denudation has removed the Silurian strata, the underlying gneisses are exposed, or have been brought to the surface by the great dislocations which accompanied the last, or north and south folding.\*

The districts of Waverley and Sherbrooke have been carefully surveyed, and their geological structure worked out with considerable detail. I was engaged in this duty during part of the autumn of 1868 and the summer of 1869, for the Department of Mines, and the maps which illustrate this paper are those which I prepared for the Department, and which, by permission of the Chief Commissioner, I have brought with me.

Waverley and Sherbrooke are types of all the known gold districts in Nova Scotia. One (Waverley) occurs with several others in a Silurian valley between two great exposures of gneissic rocks, the other (Sherbrooke) is one of many arranged round an island of gneiss.

## II.—ORIGIN OF THE GOLD.

The results of my surveys do not show any direct relation between the origin of the gold and the gneissic areas. I consider that all the evidence hitherto accumulated in Nova Scotia tends to show that the gold was originally deposited from oceanic waters, and diffused throughout their sediments, especially in beds of quartz. Much of it was, no doubt, subsequently concentrated in intercalated beds of quartz, and in some instances in fissure veins.

There is no evidence to show that intrusive rocks, or veins, or dykes had any share in the introduction of the gold; indeed, I have not yet seen any rocks in Nova Scotia near the gold districts which, upon close examination and study, can be regarded as intrusive rocks. Gold is found and worked in beds of quartz of contemporaneous age with the interstratified slates and quartzites, and in their beds or so adjacent to beds of quartz, throughout a vertical thickness of 6,000 ft. These beds are worked in one district or another throughout that thickness of strata on anticlinal or synclinal folds.

Waverley and Sherbrooke districts are eighty miles apart in an air line, and yet so uniform is the mineral composition of the series, that certain beds of grit can be identified at these distances, not only by the occur-

rence of peculiar forms, supposed to be an *Eospongia*, but by their mineral characters.

It must not be supposed, however, that all the worked auriferous lodes of Nova Scotia are contemporaneous beds. I conceive that a large number are intercalated, as subsequently described, and of the contemporaneous auriferous beds many have suffered much modification since first deposited.

## III.—STRUCTURE OF WAVERLEY GOLD DISTRICT.\*

The strata at Waverley† are arranged in the form of a long elliptical dome, tilted over to the north. This form was occasioned by the intersection of two great anticlinal folds, one having a course from east to west, the other from north to south. The east and west fold has a slight overturn to the north. At Mount Uniake the east and west fold has an overturn to the south, which is also the case at Sherbrooke.

The thin contemporaneous beds of auriferous quartz, or lodes, necessarily partook of all the movements to which the strata with which they are associated were subjected; hence, we find the outcrops of the lodes curving round the axis of the tilted east and west anticlinal in the form of long semi-ellipses, where denudation has exposed the edges of this bed. This distribution of the outcrop of the lodes is of the first importance, and it may be easily illustrated by bending a number of sheets of paper in the form of an arch, to represent the east and west anticlinal, tilting up one extremity to represent one side of the north and south anticlinal, and then cutting off a portion horizontally, to represent the effects of denudation. The exposed edges of the paper will then have the form of long semi-ellipses. It is evident that the outcrop of the lodes will be dependent upon the nature of the intersecting anticlinals, and the extent of denudation to which they have been subjected. Anyone familiar with the forms produced by the intersection of plain and curved surfaces, will readily understand how the mapping of the outcrop of these bedded lodes becomes a question belonging to stratigraphical geology.

In the autumn of 1868, the accompanying map of the Waverley district was prepared, and a lithographed reduction accompanies my report on that district. One of the most important lodes there is the Tudor lode, which was "lost," so to speak, at the point where the continuous line ceases on the map. This lode had yielded 8,727 ounces of gold from 6,972 tons of quartz, in 1865, averaging 1 oz. and 6 dwts. per ton. From a study of the structure of the district, the details of which are given in my official report, I indicated the course of the "lost" Tudor, as represented by the dotted line on the plan. Operations were commenced, late in the autumn of 1868, to discover this lode on the south side of the anticlinal, about 770 feet from the place where its alleged disappearance had occurred. In January, 1870, it had been traced, and in part worked back to the area where it had been "lost," through a distance on the curve of about 1,100 feet, connection with the original lode being broken by a small fault. The mean difference between the ascertained outcrop and the theoretical outcrop is 25 feet 9 inches in 1,100 feet horizontally.

The north lode is also a valuable lode at Waverley. This lode runs parallel to the Tudor on the north side of the anticlinal, and it has also been recently traced, and in part worked, parallel to the Tudor lode on the south side of the anticlinal, through a horizontal distance of 900 feet, the mean difference between the theoretical outcrop and the actual outcrop discovered being 25 feet 7 inches. The rocks throughout these distances of 1,100 and 900 feet are deeply covered with boulder drift, and of uneven surface, so that I may reasonably claim a closer approximation between theory and fact than a mean

\* The details of the structure of this district are given in my "Report on the Waverley Gold District," Halifax, N.S., 1869.

† For a description of the structure of the gold districts, see reports on Waverley and Sherbrooke.

† Waverley gold district is thirteen miles from Halifax, on the line of railway from Halifax to Windsor.