

THE COUDERSPORT ICE MINE
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About four miles east of Coudersport, Pennsylvania, and some three hundred yards southwest of the little village of Sweden Valley on the state road to Wellsboro, is a "glaciere naturelle," or natural refrigerator, known as the "Coudersport Ice Mine." It is situated on a hillside and a rough mountain road enables you to drive a motor to within six feet of the entrance.

The story of the Ice Mine is rather curious. About 1894 some people conceived the idea that silver might exist in the hill near Sweden Valley and proceeded to dig a shaft to search for it. Instead of silver, as they dug down, they found layers of ice in the rocks. In the fall they abandoned their enterprise. The next spring ice formed in the shaft and this now occurs annually. The name "Ice Mine" came of itself from these circumstances and, although some people criticize the name because no ice is ever taken from the shaft, to me it appeals strongly in that it is not only descriptive, but that it is also distinctive from the names of all other glaciers. It was pure accident which led to the discovery of ice in the rocks surrounding the Ice Mine, and ice might have continued forming there unnoticed year after year except for the digging of the shaft. And this suggests that there may be, and that there probably are, many other such natural refrigerators still unknown in mountainous regions.

Of course, the wonder of the dwellers of Coudersport and vicinity was aroused and all the old theories about glaciers were put forward once more to account for the formation of the ice: that the ice is mysteriously due to

the heat of summer; that there are chemicals in the rocks; that the ice is consolidated vapor; that it is caused by pressure ; that it is due to evaporation, etc. Some of the statements made about the Ice Mine are identical with statements made about glaciers by the peasants of various European countries for at least two hundred years. Of late, however, these untenable theories are gradually losing currency, although the conversation of the natives and the little booklet sold at the Mine show that the true principles of the formation and disappearance of the ice have not yet been thoroughly grasped.

This is clearly shown in "The Automobile Blue Book" for Pennsylvania, 1921, p. 336, which says:

Coudersport, Pa. (Population 3,100 - altitude 1,650 feet). Several years ago an Ice Mine was discovered here, which has been a puzzle to geologists, as the ice which melts in winter congeals in the summer time.

The truth, however, is that the formation of the ice is not a puzzle. And this paper is intended as missionary work to dispel illusion and advance knowledge in accordance with the traditions of the American Philosophical Society.

The Ice Mine is located in the side of a hill, now sometimes spoken of as the Ice Mountain, and its surroundings are true glacier country, damp, shady, and free from draughts or sunlight. The exposure of the Ice Mine is north and the sides of the hill are covered with thick second-growth forest which completely shelters the Mine from sun and wind. If this forest were ever cut down, it is almost certain that the ice would largely stop forming.

The Ice Mine is surrounded by a tall wooden fence with a locked door, which the female guardian of a little restaurant immediately adjacent to the Mine opens for 50 cents a person. After you have put on your overcoat, paid your fee, and passed through the guarded portal, you find yourself on a level space, with the rocks rising some fifteen feet in front of you surmounted by the wooden fence, and with the shaft, a big, nearly square hole, some ten feet in

length by eight in breadth and thirty in depth, going straight down into the rock. The top of the shaft is covered with a wooden floor with a large trap door, which is usually kept shut, as people frequently climb over the fence (Fig. i). The floor of the shaft is reached by a long ladder, and when I visited the Mine, on the 12th of August, 1921, was covered by a layer, perhaps two or three feet thick, of dirty ice. On three of the sides rather thin ice curtains were streaming down. These were melting, as was also the ice floor, the glaciere in fact being in a state of thaw, with the thermometer several degrees above freezing point.

The ice, it is said, begins to form about April and to be at its best perhaps in June. After this it slowly diminishes and vanishes by about October. The ice goes quickest in rainy weather and more slowly in warm weather. Both these times of the appearance and disappearance of the ice and these effects of wet or dry weather are normal glaciere phenomena.

The only theory about the formation and the disappearance of the Coudersport ice which meets all the facts is the theory which applies universally to all glaciers. Two things are necessary for the formation of ice : cold and water. In glaciers the cold of winter furnishes the cold and the thaws of spring furnish the water: That the winter's cold furnishes the cold is proved by the fact that every known glaciere is in a place where there is snow and ice in the open in winter. The winter air sinks from its weight into the glaciere and the rock cracks leading to it. And the reason ice does not form then is that at that time the water is all frozen up on the outside. But when the thaws of spring melt the outside ice and snow into water this flows into the glaciere and its communicating rock cracks and meeting the cold air within, congeals. The only effect of the heat of summer is slowly to melt the ice.

This theory is not a new one. In essence, it is found in the earliest account we have of a glaciere, a visit to Chaux-les-Passavant, published in 1586, in which the author, Benigne Poissenot, a Paris lawyer, says:

After having thought over in my mind the cause of this antiperistase, I could find none other but this : to wit, that as heat dominates in summer, the cold retires to places low and subterranean, such as is this one, to which the rays of the sun cannot approach, and that in such an aquatic and humid place, it operates the results, which we have shown above.

Since Poissenot's times, numerous scientific men have made hundreds of observations in many of the several hundred glaciers known, and their consensus of opinion is strongly in favor of the winter's cold theory.

In one respect the Ice Mine differs from some of the big European glaciers, in which the size of the cavern and the nearness of the ice to the mouth make it unnecessary for any other cold air than that which comes through the mouth to get in to form the ice. For at Coudersport the size of the shaft is hardly large enough to contain a sufficient volume of very cold air long enough to do all the work which evidently is done there. And therefore some further cause must be sought.

And this is found mainly in the fact that the side of the hill itself at that spot, and not merely the Ice Mine, is a natural refrigerator. When the shaft of the Mine was sunk ice was met in the rock crevices. This is a not uncommon form of subterranean ice and there are numerous examples of it both in the eastern and the western United States.^ And the causes of its formation are evidently identical with that of the ice in caves, namely, the cold air of winter sinking into the fissures in the rocks and the thaws of spring sending in their waters.

Now, at Coudersport there are unquestionably plenty of small cracks or fissures in the rocks, else there could not be the layers of ice which are found by digging there. And in these cracks much ice undoubtedly is formed and stored in the spring. And from these layers of ice in the hillside above the Mine freezing cold air must keep sinking into the shaft as soon as the temperature in the shaft begins to rise and continue forming ice in the shaft much longer than would be the case without this extra supply.

This function of rock crevice ice I must insist on here somewhat forcibly, for although it has been noticed before, it has been so with a lack of emphasis. And this is not surprising, for in many of the larger glaciers of Europe the size of the glacier permits a volume of freezing cold air to remain over into the spring sufficient for the work of refrigeration. But in certain cases, where the ice of the glacier is far back from the mouth, and where the phenomena are less patent, freezing cold air entering the glacier from the rock crevices above it may well be an auxiliary, insufficiently noticed up to now, in the formation of the ice. Indeed, the ice stalactites which issue from holes in the roof or the walls of caverns may well obtain from their own rock crevices instead of from the main body of the glacier some at least of the cold which causes their formation.

Another factor which surely has an influence on the ice at Coudersport is an artificial one, namely, the wooden floor and the trap door. These prevent almost entirely radiation and they probably have a considerable effect on the ice, according to whether the trap door is left shut or open. If the trap door is closed or open in winter, it would militate against the cold air descending into the shaft and vice

versa; if it is shut or open in summer, it would help to prevent the cold air in the shaft from warming up and vice versa. When I entered the door in the fence the trap door was wide open, but the guardian said it was usually kept closed. Apparently, therefore, it is effective up to a certain point, much as is a door in an artificial refrigerator; and I have no doubt that the wooden floor and trap door add materially in keeping the temperature low.

Of one thing, however, I feel very sure, and that is that the Coudersport Ice Mine is a true glacier and obeys the identical natural laws which hold sway in all glaciers. And I base this unscientifically dogmatic statement on the visits I have made in past years to some forty other glaciers. Reduced to its simplest formula, the law of glaciers is that the cold of winter furnishes the cold, the thaws of spring furnish the water, and the heat of

summer melts the ice. The Ice Mine has its local peculiarities, but every glaciere has these. And although, when compared with some of the great glaciers of Europe, with Chaux-les-Passavant, Saint Georges, the Schafloch, the Kolowratshohle, Dobsina, and several others, the Coudersport Ice Mine is but a small glaciere, yet it is the most impressive one known in the eastern United States, the one which exhibits the best ice curtains, ice floor, and other glaciere phenomena in the spring and early summer. And any traveler who has not visited one or more of the big European glaciers, and who may happen to stray to Coudersport during his wanderings, will certainly see there a natural phenomenon which, while not in the least unique, yet is a good deal of a rarity and quite different from the phenomena usually met with in every-day life.