the Russell, Barker and Boult collections of butterflies and moths; the Schlesch and other collections of marine, land and fresh-water mollusca; the Swailes collection of eggs, and the Boynton, Pease and Fortune collection of British birds.

FIRMS in the Swedish rubber industry together with the Swedish Cooperative Union, have formed a company to provide Professor Svedberg, head of the Physical Chemical Institute at Uppsala, with better facilities for working out his process for the manufacture of synthetic rubber using calcium carbide as the main raw material. The initial capital of the company is 175,000 kr., but this is capable of being increased to 525,000 kr. The site for an experimental works and for a new laboratory has already been purchased near Uppsala.

The Lancet states that as a tribute to the courage and endurance of the people of Malta, the Nuffield Foundation has, with the approval of Lord Nuffield, offered to provide grants for the training in Great Britain of six Maltese physicians chosen by the government of Malta for appointments in the public service of the island. The grants will be tenable for a period not exceeding two years. The men or women who are chosen will receive a grant of £400 per annum if unmarried, and £600 if married and a further allowance in traveling expenses. The recipients will be required to give an undertaking to return to the island at the end of their training to take up the appointment for which they have been selected. The institutions in which they will receive their training will be chosen by the trustees of the foundation in consultation with the Colonial Office.

DISCUSSION

CONFUSION OVER GLACIAL LAKE SPOKANE

No small part of exploratory science has been the work of amateurs. In general they have received generous treatment from professional researchers, though no doubt they are annoying at times. The amateur can sometimes function, figuratively speaking, as a navigator of a trial balloon. Having no reputation at stake he may "take a flyer" into a field which looks unpromising to a professional. Twenty-one years ago SCIENCE (September 22, 1922) published a report of such an adventure. The reporter who is now furnishing this memorandum had encountered difficulties in getting information needed for making the physiographic features of the Spokane region have any meaning to his high-school students in general science. After fruitless inquiries of local and some other geologists and eighteen months of puzzling in the local field, two trial papers were written—the first for the students, the second read before the Associated Engineers of Spokane. The latter was sent to Chicago University Geology Department and to the U. S. Geological Survey. That summer, 1922, both sent representatives to investigate. One could find nothing with which to agree. The other seemed to be in substantial agreement. (The Chicago representative's visit was the beginning of a series of eight field seasons spent in this locality, and a very interesting controversy.)

This interest shown by real geologists gave the amateur courage to send his conclusions to SCIENCE for publication. They dealt almost exclusively with evidence of glaciation about Spokane. For the present memorandum the important matter among the thirteen conclusions presented was the evidence of a glacial lake in the valley of the Spokane River, formed by an ice dam made by a lobe of the Cordilleran ice-sheet which approached Spokane from the north and extended almost due south on its eastern margin, at least to a short distance south of Spangle, twenty miles south of the city. This eastern margin was marked by a moraine consisting mainly of large ice-dribbled boulders in the valley floor and waterlaid gravel with a mingling of enormous granitic boulders at Pantops, the southeastern corner of the city. No undisputed glacial deposits are found in the valley for some distance eastward. The terminal moraine of the Rathdrum glacial lobe appears in Idaho. This lake was given the name of Lake Spokane. It was believed to receive all waters from Eastern British Columbia, western Montana and northern Idaho as far south as the St. Joe River at the southernmost extremity of Lake Coeur d'Alene. Thus it was conceived of, not as a mere melt-water marginal lake, but as a major interruption of drainage, impounding the waters flowing westward from the Continental Divide and diverting them over a low range of mountains through its outlets at Mica, twelve miles southeast of Spokane, by two channels which, when they ceased to function as a water course for a vast drainage, left a crest of 2,478 feet (bench mark at Mica). The lake level may then be assumed as about 2,500 feet A.T. at its lowest level, giving a depth of about 500 feet in the immediate vicinity of Spokane. In other words, the 2,500 feet contour line on topographic maps of Washington and northern Idaho would about mark

the shoreline of this lake. This enlarged Lake Coeur d'Alene greatly.

Prior to the recognition of Lake Spokane erratic boulders as far up the Coeur d'Alene River as Kellogg, Idaho, were suspected by Hershey to have been carried in by floating ice. Attempts to place the lake border to the northeast and into Montana is only futile guessing, for a well-marked characteristic of the whole area of the lake is the presence, everywhere almost, of boulders and boulder till carried in on stranded icebergs, indicating that the glaciers and lake joined in that direction. In absence of such obstructing ice Lake Spokane would have overflowed the low divide just north of Sandpoint, Idaho, into the valley of the Kootenay River and would never have attained a level much over 2,700 feet A.T.

The Mica channels lead to Latah (Hangman) Creek Valley, which was also blocked by the glacier near Spangle. A low divide at the head of North Pine Creek permitted an overflow into North Pine Creek Valley, the final high level of this divide being just under 2,450 feet. (For recorded evidence of these levels see U. S. G. S. topographic maps, Spokane, and Oakesdale Quadrangles.) To the impounded water in the valley of Latah Creek, Dr. Bretz gave the name, Lake Latah.

In SCIENCE of September 10, 1943, Professor William H. Hobbs announces his discovery in the past summer of a Pleistocene lake in Spokane Valley to which he gives the name of Lake Spokane. Between the time of writing the article and its publication (September 10, 1943), he discovered in the *Pan American Geologist,* date 1924, a description of Lake Spokane, apparently having failed to find the earlier article in SCIENCE of 1922. Immediately on finding the earlier observations and naming of the lake, he sent compliments on "keenness of observation" but insisted the lakes were not the same because the one he had described was on a much larger scale. This larger scale lake in the same valley is determined by the finding of a delta of a creek in the basin of Lake Latah indicating a water level of 2,508 feet or 30 feet higher than the present level of the bottom of the Mica channel, and 58 feet higher than the highest present level of the North Pine Creek outlet. Neither of these channels have carried a stream of water since the melting of the ice barrier at Spokane. Hence they are, probably, near their Ice Age levels. The volume of water carried by these channels was of course the same for each pair, and considering the area drained it is fair to assume that was considerable. The comparative erosion rate can not well be estimated. It may be assumed also that each channel was deepened somewhat. In width the channels do not differ much. It would require only a depth of water of thirty feet flowing over the summit at Mica to invalidate all claim to a larger lake. A temporary ice dam in the North Pine Creek channel is not impossible but is probable. There was an abundance of floating ice. Such an obstruction in the North Pine Creek outlet of fifty-eight feet would raise the lake level enough to permit a delta of the height Dr. Hobbs found.

This North Pine Creek Valley is the eastern-most of the many "scabland channels." As there is in this channel no hint of glaciation it offers a good check on the possible effects of torrential waters which seem to be a stumbling block in Dr. Hobbs's acceptance of Dr. Bretz's explanation of the scablands. It is a miniature Grande Coulee conveniently located where the highway between Spokane, Pullman and Moscow parallels North Pine Creek, two miles north of Rosalia.

It will no doubt be interesting to have a glacialist of Dr. Hobbs' wide experience enter this field of central Washington with its still smouldering problems of the formation of the "scablands," but is unfortunate in its timing for few geologists can spare time from the war effort to reconsider these problems of great controversy of the twenties.

What seems a ground for agreement in this case is the probability that Dr. Hobbs, in his hasty survey of the area, has found evidences of an earlier and more extensive glaciation than that of the "Spokane ice" (evidence of which has not been entirely overlooked hitherto) which could be capable of producing the "anticyclone" effect which he has found in his studies in various parts of the world to be responsible for the formation of loess wherever it is found. In this case the loess deposits are the wheatlands of the Big Bend, the Pendleton and the Palouse regions. The recognition of this as the earlier glaciation of the region and of Palouse soil as loess would be in accord with our observations that the formation of the Palouse soil preceded the Spokane glaciation, as shown by the fact that there is no mantle of this soil in the North Pine Creek Valley, from which it was swept by the waters from Lake Spokane. Dr. Hobbs' westward extension of Lake Spokane as Lake Leverett seems to fit nicely as the immediate water source for the heads of Dr. Bretz's scabland channels, through which the water, 500 feet deep in Lake Spokane, was funnelled when the ice dam burst, and from Lake Missoula, 1,200 feet deep at Missoula, came, perhaps in successive floods, as the recurring periods of advance and "recession" of the glacier occupying the Purcell Trench operated the valvelike outlet at the head of Lake Pend Oreille of the waters covering a great part of western Montana.

THOMAS LARGE

SPOKANE, WASH.