that *Dermacentor andersoni* becomes infected with *S. enteritidis* by ingesting the germs. These can be found in the feces of the vector, which is able to transmit the infection to guinea pigs 35 days after the contaminated meal has been ingested. It is possible to transmit the infection to the descendants of the tick by means of their eggs. Supported by the fact that epizootics caused by *S. enteritidis* can develop in guinea pigs inoculated with *Ripicephalus sanguineus,* the authors have suggested the possibility of natural infection of the latter with such Salmonella.

In this laboratory guinea pigs were injected with several groups of *B. annulatus, B. microplus,* and *A. persicus,* and colonies of *S. newport, S. enteritidis, S. typhimurium,* and *S. poona* were isolated from the spleens of some of the guinea pigs. It it believed that the infection was due to other causes than the existence of Salmonella infection in the ticks in the experiment.

Experimental studies on infection and transmission of *S. enteritidis* by *Pulex irritans* and *Ctenocephalus canis* have recently been undertaken by us.

White mice were infected intraperitoneally with *S. enteritidis.* After 24 hours, when the animals showed clear signs of acute disease and blood cultures made were positive to Salmonella, fleas of the species mentioned above were fed on the infected mice. It was possible to isolate *S. enteritidis* 24, 48, and 96 hours after the fleas were fed. The isolation was carried out by culture of a portion of the grounded fleas on the usual Salmonella media. Cultures made from the feces of the fleas 24 hours following infection were found negative to Salmonella.

In another experiment fleas infected 24 and 48 hours before, and then maintained fasting for 24 hours, were used. These were fed on 12- to 14-day-old mice, since younger animals are more susceptible. All the mice showed no symptoms after one month. Cultures made with ground spleen of the animals on the 1st, 2nd, 4th, 6th, 20th, and 30th days after being bitten were negative.

Another lot of fleas were infected in the same way and then fed on two 28- and 30-year-old adult men. After a month of clinical observation we were not able to note any symptoms, and repeated cultures made from their feces were negative.

The negative results obtained in attempts to transmit *S. enteritidis* infections by the bite of several fleas infected with such germs seem to demonstrate that if such infection is produced, it is so slight that it cannot be diagnosed either in man or in young mice.

### References

1. Huang, C. H., and Lien, V. T. *Chin. med. J.,* 1937, **52,** 345.
2. Parker, R. R., and Steinhaus, E. A. *Publ. Hlth Rep.,* 1943, **58,** 1010.
3. Steinhaus, E. A. *J. Bact.,* 1941, **42,** 757.

## The Eurasian Continental Glacier of the Late Pleistocene

William Herbert Hobbs
*Professor Emeritus, University of Michigan*

Three-quarters of a century ago Prince Kropotkin reported his discovery of glacial erratics and of ancient moraines which indicated the former presence of a continental glacier in eastern Siberia (*3*).

Against the view of Lyell, current at the time, that such evidence could be explained by the "drift" of icebergs, Kropotkin offered cogent arguments. That the observations of so competent and reliable an explorer-geologist were generally disregarded is explained by the powerful influence of the well-known Russian climatologist, Woikov (*6*), and the highly placed geologist, Tscherski (*5*), each of whom acted to strongly discredit them. Woikov wrote in 1881:

> Geologists are agreed that at least since the Pliocene the great climatic features of the Asiatic Continent have remained essentially unchanged. The high mountains and plateaus were there and the interior portions of the continent were therefore cut off from the moist regions of the north, west and south. . . . Such an aridity naturally excludes and excluded glaciers, with the exception of some quite small ones in the high mountains.

Despite the influence of this oracular pronouncement of Woikov, some Russian explorer-geologists in Siberia continued to collect evidence of a past glaciation, and the outstanding geologist, W. A. Obrutschev, for 40 years piled up the evidence, until in his "Geologie von Siberien," published in 1926,[1] he supplied a short summary account of a Siberian glaciation. Four years later he treated the subject much more fully and supplied a sketch map of the glaciated area (*4*). After another seven years (1937) there appeared the first volume of the *Great Soviet atlas,* in which large-scale glacial and soil maps were included.[2]

Due to World War II, which opened as this volume was issuing, it is likely that glacialists are only beginning to know of these Eurasian continental glaciations,

[1] This appeared in *Fortschr. Geol. Paleontol.,* 1926, **15,** 381–399.

[2] This *Great Soviet world atlas,* Pt. I: *Maps of the world,* was prepared under the cooperative editorship of A. F. Gorkin, O. J. Schmidt, V. E. Motylef, M. V. Nikitin, and B. M. Shoposhnikov. The director of the Scientific Editorial Institute was V. E. Motylef. The soil map is Plate 40–41–42, and the glacial map, Plate 90–91.

Three years later there appeared a translation into English of the titles and subtitles of this superb work which has no parallel in any other country (*Great Soviet world atlas.* Pt. I. Trans. by Andrew Perejda and Vera Washburne under the direction of George B. Cressey, Department of Geology and Geography, Syracuse University, Syracuse, New York. Ann Arbor, Mich.: Edwards Bros., 1941).

and it has seemed to me best to bring out for the benefit of English-speaking geologists some account of the latest of these glaciations, interpreted with regard to the nature and behavior of such glaciers, as has been learned by recent studies of the still existing ones, and particularly that over Greenland (*1*).

wheatlands of south-central Siberia. On other borders of the Eurasian *Wurm* glaciation the loess is represented by the tundra silt, and in mountainous areas by the silt of the "mountain tundra," since loess is there retained only on crests, due to effective slope erosion.

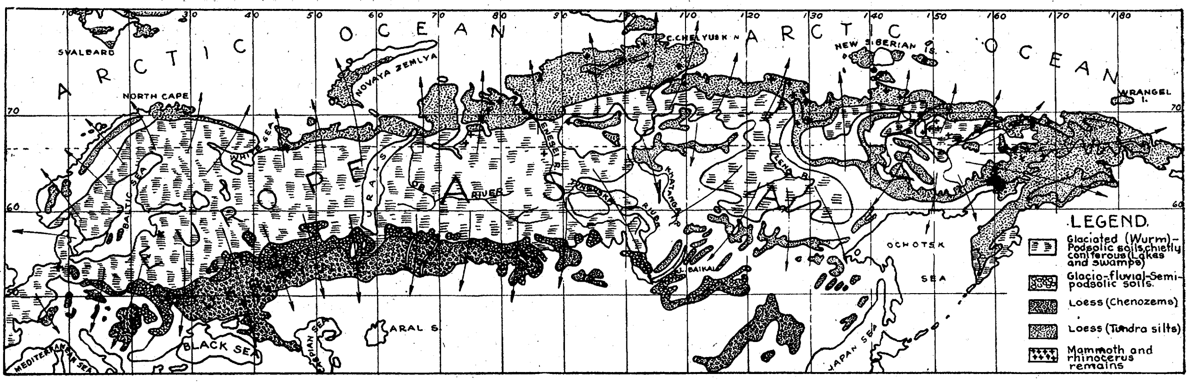


FIG. 1. Map to show the area covered by the latest Eurasian continental glacier of the Pleistocene, with its surrounding zones of outwash and loess. (*After* the world soil map, Plate 40–41–42, of the *Great Soviet world atlas,* but with additional material.)

Of the four glaciations already recognized for the European region, three have now been definitely identified in Siberia. The next to the latest, the *Riss,* was the most extended. The latest, the *Wurm,* which with little doubt corresponds to the Wisconsin in North America, is much the easiest to delimit, since it is so recent as still to be poorly drained, covered over as it is by lakes and swamps. Since lakes are so short-lived in a geological time sense, none have survived from the three earlier glaciations, and the areas in which the deposits of these earlier glaciers are found are perfectly drained. Their deposits are also in part buried under the outwash and surrounding loess aprons of the *Wurm,* due to the outblowing winds of continental glaciers and to the alternation of summer and winter. The outwash is an area of meltwater deposition during the warm seasons and one of active deflation during the succeeding cold ones.

The area of podsol (Fig. 1) with its lakes and swamps is the area once covered by the *Wurm* glaciation. That of semipodsols, which borders it, is largely outwash (sands and gravels), as is clearly indicated by the part included from Europe. This was already well known (*2*).

Outside the outwash and surrounding it as an outer apron to the glacier is the loess zone. On the southern border this is the area of Czenozems, recognized as an eolian deposit. This is followed in continuous deposit through southern Europe, the wheatlands of the Ukraine, and across the European border into the

That the tundra silt is a Pleistocene eolian deposit is clearly indicated by the entombed bones of the air-breathing Pleistocene mammals (mammoth, rhinocerus, equus, bison, etc.),[3] by the embedded trees (birch, larch, etc.), and also by moss and turf.

The map relationships of the outwash and loess required the presence everywhere of outward-blowing winds from the glacier (the glacial anticyclone), and curving lines have been added to the map to make this clear. By this anticyclone system the glacier is nourished from its central area of downdraft, which pulls down the water locked up in the ice needles of the cirri. This source in the upper layers of the atmosphere makes the glacier quite independent of the air circulation at and near the surface of the ground outside, even if in Pleistocene time the region had been arid, as Woikov had contended.

## References

1. HOBBS, WILLIAM H. *C. R. Congr. Intern. Géogr.* (Paris), 1931, **2,** Sec. II; *Pap. Mich. Acad. Sci., Arts, Letters,* 1939, **25,** 477–480; *J. Geol.,* 1942, **50,** 556–559; *Proc. Amer. phil. Soc.,* 1943, **86,** 368–402; *Amer. J. Sci.,* 1943, **241,** 333–336; *Sci. Mon.,* 1943, **57,** 289–300.
2. HOBBS, W. H. *Amer. J. Sci.,* 1943, **241,** 333–336.
3. KROPOTKIN, P. A. *Mem. Russ. geogr. Soc.,* 1876, **7.**
4. OBRUTSCHEV, W. A. *Geol. Rundschau,* 1930, **21,** 243–283.
5. TSCHERSKI, J. D. *Bul. Russ. geogr. Soc.,* 1882, **12,** Nos. 4–5.
6. WOIKOV, A. J. *Z. Ges. Erdk.,* 1881, **16,** 259–264.

[3] Some of the localities where mammoth or rhinocerus remains have been found entombed have been entered upon the map of Fig. 1, after maps by Tolmachoff (*Trans. Amer. phil. Soc.,* 1929, **23,** 20) and Osborn.