many holes of intermediate depth, not only for setting ablation stakes but also for placing seismic shots.

Kasser's system is interesting not only because of its special usefulness for intermediate-depth drilling, but also because of its great potential for further improvement. For example, by making the pump separate, the heating pot could be replaced by thin-walled aluminum tubing coiled and baffled to obtain more efficiency with less weight. In addition, changing the action of the pump lever from an up-and-down motion to a side-to-side motion should reduce operator fatigue, which must be considerable after a few hours of drilling with Kasser's equipment; however, Kasser* tried both before selecting the up-and-down motion. Operating the heater under pressure, by connecting the pump to its inlet rather than to its outlet, would permit higher water temperatures (even greater than 100° C.), which would result in greater drilling speed; Kasser* points out, however, that the superheated water will boil explosively if the pressure is for any reason suddenly released; also, he found in actual trials that wear on hoses, gaskets, valves, and other parts was markedly increased by operation at greater temperatures and pressures. Machining the shell of the hotpoint out of aluminum or copper, roughening or corrugating it on the inside, and making it thinner at the tip would tend to increase heat transfer, and hence to improve still further the drilling speed.

Suggesting improvements, however, is easier than putting them into practice. Kasser is to be congratulated, therefore, for having produced a practical design that is extremely simple, highly efficient, fast-drilling, easily portable, and, not least important, completely burnout-proof.

R. L. SHREVE

S. P. SUSLOV. *Physical geography of Asiatic Russia. Translated from the Russian by Noah D. Gershevsky and edited by Joseph E. Williams.* San Francisco and London, W. H. Freeman and Co., 1961. 594 p. £5 5*s*.

SERGEI SUSLOV who died in 1953 was a Professor in the University of Leningrad, and was an outstanding authority on the physical geography of Soviet Russia. The second edition of his book was published posthumously in 1956. It covers the geology, zoology, botany, geomorphology, and hydrology of Asiatic Russia, and thus enables the Western reader to understand something about the nature of this vast and practically unknown region.

The work is divided into four sections—Western Siberia, Eastern Siberia, the Far East, and Central Asia.

The ice of the Kara Sea and the glaciers of Novaya Zemlya and the Severnaya Zemlya Archipelago (p. 20), are shown on a very adequate map accompanying a description of the region. The Quaternary Era and its ice advances and retreats are well covered, those of Severnaya Zemlya being shown in greater detail on a larger scale in a map on p. 167.

Permafrost is believed to cover nearly 45 per cent of the U.S.S.R., and considerable space, accompanied by an excellent map, is devoted to a detailed account of its incidence and features.

In the hydrology section of Eastern Siberia, there are maps showing the isochrones of the freeze and break up of river ice.

The Sea of Okhotsk naturally has an important influence on the climate of its coasts and these, including those of Sakhalin Island, are dealt with very fully. The Bering Sea, with its sea ice, currents and salinity, is also very well handled. In the Far East the same applies to the Sea of Japan. The Sayan Mountains in the south of Central Siberia, with their cirques and glaciers, are described in considerable detail.

Probably the most important part of the work for the glaciologist is that describing the mountain regions of Central Asia—Stalin Peak 24,590 ft. (7,500 m.), the highest summit in

* These facts have been supplied to the reviewer by the author.

the U.S.S.R., the Ice Age glaciations, and the present-day ice cover of the district. These are all illustrated with excellent photographs.

The description of the Fedchenko Glacier is of special interest, even though, in this particular case, much literature already exists. It is the largest glacier in the U.S.S.R. extending for 46 miles (74 km.). It receives 37 tributary ice streams.

In addition to the many maps and photographs, the various regions described are shown in a carefully prepared key map at the end of the book.

It has only been possible in a short review to enumerate the most outstanding features of a really remarkably fine piece of original work and its equally excellent translation made by Dr. N. D. Gershevsky of the University of Washington, and admirably edited by Mr. J. E. Williams of Stanford University.

G. SELIGMAN

ADRIAN E. SCHEIDEGGER. *Theoretical geomorphology*. Berlin, Göttingen, etc., Springer-Verlag, 1961. 333 p. DM. 48.*

THE science of *geomorphology*, in its more restrictive sense, is primarily concerned with the study of surface features, which are due to processes originating outside the solid Earth (exogenetic processes). In its widest sense, it naturally includes both the description of present-day landscapes and the elucidation and explanation of their histories. Until relatively recently geomorphology has been a purely descriptive science spattered only by occasional mathematical outbursts contributed by physicists, geophysicists and mathematicians in their search for reasonable and rigorous explanations of the more commonplace features of the Earth's surface. To many geomorphologists the introduction of a mathematically expressed law, an integral or an equation relating to a land-surface feature is foreign, but as this science evolves and advances it is inevitable that geomorphologists must think, record and analyse their observations in a more rigorous fashion.

In his book, Dr. Scheidegger has valiantly attempted the long overdue union of field observation and equation, which he has achieved with some measure of success. In discussing the six main topics of the book—mechanics of slope formation, river bed processes, development of drainage basins, theory of aquatic effects, niveal effects (why not a less cacophanous and better-known expression?) and theory of aeolian features—the author has found it necessary to review briefly the resultant forms described in the literature and to introduce the reader to relevant basic physical principles, the understanding of which is essential before delving into the major part of the book. For instance, amongst other principles the physical properties of ice, the theory of plasticity and the various flow laws of ice are quoted.

In some thirty pages, devoted to "niveal effects", the reader is taken carefully through a critical discussion of theories concerning ice ages, followed by the theory of longitudinal flow and sliding of glaciers, the dynamics of glacier snouts, the formation of transverse crevasses and the geomorphological effects of longitudinal glacier motion. Three-dimensional ice movement (including a brief reference to ice caps), pingos and "niveal" solifluction all find their place in the discussion. In this remarkably short space the author has succeeded in stating and illustrating clearly all the relevant arguments and equations that he has combed from the more important recently published (and older) literature. The theory of glacier motion is disseminated through the pages of countless journals in English and a dozen foreign languages, but here there is an adequate summary to encourage the young glaciologist to deeper reading.

Although the origin of the shape of drumlins and pingos is considered at relative length, the reader might be disappointed to find that more important geomorphological features, such as the transverse profile of glaciated valleys, eskers, moraines and glacial cirques, are briefly

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