

BOOK REVIEWS

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PRELIMINARY MOON-SOIL SCIENCE: PHYSICOMECHANICAL PROPERTIES OF LUNAR SOIL *

Reviewed by M. V. Malyshev

The book summarizes all the research done till 1971 concerning the physicommechanical properties and the structure of the lunar top soil layer. The authors report on modern means and methods of research which are applicable to the study of lunar soils: cosmotechnical apparatus and lunar stations, instrumentation with which laboratories in orbit or in the proximity of the moon are equipped, and terrestrial laboratory apparatus for conducting experiments under simulated lunar conditions. As lunar soil the authors define "any rocks accessible to Man in the foreseeable future and, above all, the top layer of the solid crust exposed to exogenous influences."

Described are experiments made in a flight laboratory and on a centrifuge, to reveal the effect of gravitation on the bearing capacity of loose and rigid soils. The authors use the basic principles of terrestrial soil mechanics for planning experiments with lunar soils and for interpreting the test results. By analyzing the solutions to problems in the theory of ultimate equilibrium of loose media, the authors have established the lack of correlation between experimental and theoretical data — especially in the case of loose soils. Considering the probable curvature of the shear diagram for low pressures would bring about a correlation, however, as has been suggested already more than once in our literature on this subject and even by the authors themselves (p. 107).

Great importance is attached in this book to the selection and analysis of terrestrial analogs of lunar soil, volcanic sand being the foremost example. In connection with this, interesting data are presented about existing volcanic deposits in Kamchatka, and about structural—mechanical properties of friable granular soils and high-porosity materials such as pumice or slag. Interesting peculiarities in the build-up and in the deformability of such soils and rocks have been revealed in experiments, namely: the effect of twofold porosity, intragranular and intergranular, the predominance of residual local deformations, the low value of the Poisson's ratio, the complete fracturability of brittle porous and spherically shaped specimens under hydrostatic compression, etc.

The main factor governing the mechanical properties of terrestrial analogs of lunar soil is the closeness of their packing. Data are shown in the book pertaining to the effect of deep vacuum on the mechanical properties of granular materials, and the effect of gravity on the resistance of granular materials to external loads. It has been established that dense coupling between grains will, as was to be expected, tend to make the soil insensitive to gravitation.

Research done with unmanned lunar stations is described in detail. The authors report the results of chemical and granulometric analysis as well as density, compressibility, and shear resistance measurements performed on lunar soils. Of special interest are the results of the first studies made on lunar soil specimens brought down to Earth. All this information is the first to be made available in the literature on soil science and it is characterized by the complex and universal coverage. The authors conclude their book with a rather condensed summary of physicommechanical data on lunar soil. The book is written in a clear style, it is easy to read, and it should certainly be of interest not only to soil science specialists but to all looking for knowledge about lunar soils.

*Izd. Nauka, 1971. Editor: Academician A. Yu. Ishlinskii.

Translated from *Inzhenerno-Fizicheskii Zhurnal*, Vol. 23, No. 5, pp. 938-939, November, 1972.

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The value of the authors' contribution to the scientific literature about the Moon is undisputable. The long list of bibliographic references does rather adequately reflect the role of Soviet and foreign scientists in the field of research covered in this book.

In the next edition of the book – and another edition seems absolutely necessary – the authors will undoubtedly add new information picked up by the Soviet "Lunokhod-1" and the unmanned "Luna-20" station, also during the "Apollo-16" spacecraft expedition, taking into consideration the widening scope of problems involved as, for example, the thermophysical properties of lunar soils and taking into account the thoroughness of the data evaluation.