

peak of production was reached during World War I; after 1928, the district was virtually dormant until the outbreak of World War II. At the end of 1944, the output had reached a total of 93,000 tons of lead and 37,000 tons of zinc. By 1943, however, three out of every four lead-zinc properties in the district were too nearly exhausted to be productive, and the total production of lead and zinc together for 1943 and 1944 was less than 10,000 tons.

Although many ore bodies end downward in zones of high-angle faults, very few faulted continuations of the ore bodies exist because most of the faults are older than the ore. Prospecting should search along the conduits—either above or below ore bodies already mined.

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## Landslide Investigations along the Columbia Valley in Northeastern Washington

Landslides occur in the surficial deposits along the upper Columbia River Valley with such great frequency that their consideration has become an important factor in relation to engineering developments and land utilization. Geologic investigations have been in progress since 1942 in an effort to develop criterions for predicting the probable amount of land that will be affected by sliding. The area of studies extends along the upper 200 mi of the Columbia River Valley in the state of Washington, reaching upstream from Grand Coulee Dam along Lake Roosevelt to Canada and downstream from Grand Coulee Dam along the Columbia River nearly to Chief Joseph Dam. Numerous fresh landslides in a relatively uniform physical setting present an unusual opportunity for a study of geologic processes and for a statistical analysis of landslide data. The application of statistical methods is believed to be a new approach to the study of landslides and the stability of natural slopes.

Early examinations revealed a wide variety in the size and shape of slides, and these differences seemed to reflect the particular geologic setting. Preliminary studies, however, were inconclusive on why a slide would occur in one place and not in another, and on why a slide would cut deeply into one terrace and shallowly into another. Comprehensive research was begun in 1950 to determine the factors underlying these apparent differences.

Investigations consisted of studies and measurements of more than 300 landslides in the Nespelem silt of Pleistocene age. Slides were classified into type groups, so that each type might be analyzed and compared with the others. The geologic environment was

subdivided into the classification factors—material, ground water, terrace height, drainage, original slope, submergence, culture, and material removal. These factors were subdivided into quantitative or qualitative categories that could be determined by field examinations.

Elements of the geometric configuration were measured and analyzed with relation to the classification units in important type groups. For the purpose of this study and its practical significance, the key measurement of a landslide has been conceived as the ratio  $HC/VC$ , where  $HC$  and  $VC$  are, respectively, the horizontal and vertical distances from the foot to the crown of the landslide taken at midsection normal to the slope. Of the eight classification factors analyzed by statistical methods, only material, ground water, original slope, and submergence proved to be significantly related to the  $HC/VC$ -ratio. By using the various categories of each of these factors, a formula has been developed for predicting the  $HC/VC$ -ratio of landslides, thus providing the geologist with a new method of estimating the amount of land that may be affected by impending landslide action in a geologic setting similar to that of the Columbia River Valley.

The stability of natural slopes is being investigated by combining classifications and measurements of slopes on which slides have not occurred with those on which slides have occurred. The analysis includes the variable factors—material, ground water, terrace height, original slope, and submergence. This technique of geologic classification and statistical analysis may be considered a new tool to assist geologists and engineers in estimating whether natural slopes are relatively stable or unstable.

A report describing this work is in preparation. The next phase of the investigations will test the practical application of the slope stability technique and the formula for prediction of the  $HC/VC$ -ratio of landslides.

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## On "Audiogenic Seizure and the Adrenal Cortex"

THE interesting paper by W. P. Hurder and A. F. Sanders, "Audiogenic seizure and the adrenal cortex," *Science* 117, 324-326 (1953), is unfortunately marred by a faulty analysis of variance and an unsatisfactory interpretation of that analysis, leading to conclusions which are unjustified and largely erroneous.

By using their published treatment means and standard deviations, a correct analysis of variance can be constructed. It appears in Table 1, in different units and after correction of various errors.

The analysis of variance shows (1) some indication that there is an interaction of all three factors together, (2) a "significant" interaction of test and susceptibility, (3) "highly significant" interaction of