by Eber at the same 1952 convention at which Peters made his initial report. It is entertaining to think of these two men passing each other in the crowded corridors immersed in thoughts of virtually the same "unique" apparatus.

The priority issue in a case like this is not important enough to concern anyone very much. Indeed, given some knowledge of devices like the old Yerkes multiple-choice apparatus and the current interest of psychologists in learning and in small cooperating groups, the independent convergence of separate workers on something like what Peters and Murphree have described would seem to be nearly inevitable. Still, the incident does raise the question of how close neighbors scientists have to be in order that one may know what the others are doing. It would not surprise me to learn that McCurdy and Lambert were mistaken in 1952 when they referred to their method as "new." Bibliographic research is rarely as thorough as it ought to be, and, what with publication lag and inadequate abstracting and all the other barriers that exist in spite of everybody's good efforts, the communication lines get pretty tangled.

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Rejoinder

We wish to express our appreciation for having attention called to work so very similar to our own, with which we were not familiar, and also to express our entire agreement with the ideas in the preceding "Communication" on the present tangled condition of communication in psychology.

Although almost every statement made about our apparatus can, with slight change, be made about McCurdy and Lambert's, we believe that there is a fundamental difference in the uses to which the two have been put. McCurdy and Lambert emphasized, as most of the other studies have, the product or "gross outcome" of cooperation; we applied the procedure to the *process* of cooperation. This emphasis naturally followed from the use of the procedure with chronic schizophrenics, in whom the very possibility of cooperation is often questionable, and where communication is at a level even lower than that among psychologists.

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Computations of Total Sediment Discharge, Niobrara River near Cody, Nebraska

A need has existed for many years for a practical procedure for measuring or computing the total quantity of sediment transported by a natural stream. Methods of measuring the part of the total sediment load of a stream that is carried in suspension in the flowing water and that can be sampled with approved suspended-sediment sampling equipment, are much farther advanced than those for measuring the quantity of sediment moving on or near the bed. Several investigators have developed equations on the basis of laboratory observations and experiments to meet this need. It was the objective of this investigation by the Geological Survey to test the application of these equations in a natural stream and, perhaps, to derive an improved procedure for determining the total quantity of sediment transported by an alluvial stream.

A natural chute in the Niobrara River near Cody, Neb., constricts the flow of the river, except at high stages, to a narrow channel in which the turbulence is sufficient to suspend essentially all the sediment transported by the stream. Periodic suspended-sediment measurements have been made at the relatively unconfined sections of the stream for comparison with measurements at the contracted section. The average of 71 ratios of measured concentration at relatively unconfined sections to measured concentration at the contraction was 0.51.

Alluvial material in the bed of the stream, at relatively unconfined sections near the chute, has a median diameter of 0.28 mm and falls mostly in the size range from 0.125 to 0.50 mm.

Sediment discharge at these relatively unconfined sections was computed by a form of the DuBoys formula, by the Schoklitsch formula, and by the Straub formula. All three of these formulas gave sediment discharges that increased much less rapidly with increasing water discharge than the measured discharges of sediment coarser than 0.125 mm in the contracted section. The Einstein procedure was applied to an alluvial reach that included 10 defined cross sections and gave much better agreement between computed sediment discharge and measured sediment discharge at the contracted section than did any one of the three other formulas that were used. Total sediment discharge computed for 8 different days with varying water discharge ranged from 63 to 175 percent of daily average sediment discharge at the contracted section and averaged 111 percent. The size distributions of the computed sediment discharge compared poorly with the size distributions at the contracted section. The sediment discharges computed by the Einstein procedure, when applied to a single section, averaged several times the measured sediment discharge at the contracted section.

The Einstein procedure was then modified to compute total sediment discharge at a single alluvial section from readily measurable field data. The modified procedure makes use of measurements of bed material sizes, suspended-sediment concentrations and sizes from depth-integrated samples, stream flow, and water temperatures. Twenty-four computations of total sediment discharge were made at several unconfined sections, and the ratios of computed total sediment discharge to measured sediment discharge at the contracted section ranged from 0.56 to 1.87 and averaged 0.97. If two of the computations based on data of questionable accuracy are disregarded, the range in ratios becomes 0.66 to 1.46. The size distributions of the computed and of the measured sediment discharges agreed reasonably well.

The major advantages of this modified procedure include applicability to a single section rather than to a reach of channel requiring measurements at several sections, use of measured velocity instead of water-surface slope, use of depth-integrated sediment samples, and apparently fair accuracy for computing both total sediment discharge and approximate size distribution of the sediment. Because of these advantages, this modified procedure is being studied further to increase its accuracy, to simplify the required computations, and to define its limitations.

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The Geology of Glacier National Park and Vicinity in Montana

Field work for the U.S. Geological Survey in and near Glacier National Park, Montana, was conducted from 1948 through 1951, and Richard Rezak's work on the stromatolites (algal deposits) there continued through 1953. The results of these field studies, supplemented extensively by use of hitherto unpublished data, mainly those gathered by parties of the Geological Survey under the leadership of M. R. Campbell from 1911 through 1914, are summarized here.

The rocks of the region range in age from pre-Cambrian to Recent. The thickest units belong to the Belt series (pre-Cambrian), and these were given special attention. The Belt series as a whole comprises rather fine-grained argillaceous, sandy, and calcareous (largely magnesian) rocks with subordinate amounts of conglomerate. This series has been sufficiently metamorphosed so that it now consists largely of argillite, quartzite, and comparable rocks. The lower part of the series is mainly somber-colored; the upper part, reddish purple and green. Available evidence favors the concept of deposition in shallow marine water, but some investigators have regarded the series as of lacustrine origin.

In the Glacier National Park region, magnesian limestone is abundant. The limestone contains stromatolites at numerous horizons, suggesting that much of the limestone was laid down in extremely shallow water. High in the series basaltic flows of submarine origin (Purcell basalt) are interbedded with the sedimentary rocks. Sills and dikes related to the flows are conspicuous, although thin, features in the cliffs of the Park. Cupriferous deposits associated with the intrusive rocks were prospected about 50 yr ago with unencouraging results.

In Montana as a whole, most of the Belt series is included by the present writer in the Ravalli, Piegan, and Missoula groups, in ascending order, with a few units such as the Prichard formation not included in these groups. The maximum thickness may be near 45,000 ft, part of which is missing in Glacier National Park.

In the Glacier National Park region, the Ravalli group is regarded as comprising the Altyn limestone, Appekunny argillite, and Grinnell argillite. The base of the Altyn limestone is not exposed. This formation is the oldest unit present and, since it has no counterpart elsewhere in the state, may prove to be of pre-Ravalli age.

As mapped during the present investigation, the sole component of the Piegan group in the Park region is the Siyeh limestone, a thick magnesian limestone, perhaps largely of algal origin. The Siyeh is itself expected to be subdivided into smaller map units when refined mapping is done.

The reddish argillaceous beds formerly included in the Siyeh by some workers are now regarded as belonging to the basal part of the uppermost group of the series, the Missoula group. This latter group has been extensively eroded in the Park. It includes red-purple and green argillaceous rocks with numerous beds of magnesian limestone, plus the Purcell basalt already referred to. Only a few of the formations comprising the group in northern Montana have been named. Within the Park limits (with minor exceptions), only remnants of Tertiary and later beds remain above the Belt series, but nearby numerous and varied formations of Paleozoic and Mesozoic ages are widespread.

Through much of geologic time, crustal activity in the region of Glacier National Park was confined to broad warping. Near the beginning of the Tertiary period, conditions changed drastically. Thrust and normal faults of the first magnitude, preceded and accompanied by folds and minor fractures, resulted from a series of violent movements that may not have entirely ceased even yet. The master structure produced is the Lewis overthrust. This thrust is thought to have originated deep in the crust and moved many miles in a direction somewhat north of east over a mass of relatively incompetent rocks that were intricately folded and broken to depths thousands of feet below present sea level. If the thrust plane emerged at the surface, it was far to the east of the present Park.

Erosion during and after the major deformation culminated in a mature surface (the Blackfoot surface) near the end of the Tertiary period. Subsequently, several stages of mountain glaciation, with an intermediate stage in which rejuvenated stream erosion cut deep gorges, have together modified and, over large