fessor R. Brinkmann of Bonn. Dislocation of joint systems in the country rock, gradation of damage to rock from complete pulverization at the rim to largely loosened blocks farther out, the degree of disturbance showing radial symmetry, identification of literally hills of rocks as ejecta many kilometers outside the crater rim, and the radially oriented slickensides produced by these masses as they skidded to a halt are indicative of the approaches used and available. Gravity and seismic surveys have also been used to determine basin symmetries and to estimate the depth of shatter beneath the visible structures. Magnetic surveys generally yield negative results if the expectation is to find a consolidated mass or even high concentrations of an "iron" meteorite of large size. Drilling to depth for sampling and for obtaining profiles of the true crater anatomy is an expensive and difficult method, borne out by the experience in the Arizona Crater. Drilling also has been done in the Hudson Bay and in the Gulf of St. Lawrence, the Ries and other sites. (Professor E. Preuss of Munich informed the writer, during a field trip in the Ries, that another but more extensive drilling program is planned to study the Ries in detail. Such "dissection" should contribute greatly to the phenomenology of impact craters).

The point of all this is that the list of craters definitely and probably of impact origin shown in Table I makes a good start toward the "250" expected to have survived normal geological processes. Research of the next ten years should add significantly to the present list and perhaps add to the range of sizes beyond the 440 km Hudson Bay Crater to include those as large as the maria on the moon. It may be found, for example, that arcuate coastlines[8] or great continental plains surrounded by mountain ranges (Hungarian plain–Carpathian mountain complex[11]) are in fact remnants of old collisions.

Potentialities of Collisions

How big were the meteorites causing the larger accepted craters, the earth-equivalent now-hypothetical maria? How frequently do they fall? What happens to them? Aside from the formation of craters what else do they bring about? All these questions may find some answers in a consideration of collisions of very large meteorites.

An appropriate perspective for results of large collisions may be gained from the data of Table II, where values of high energy phenomena are listed. This is an aid to think big! That the earth has been struck by large meteorites is clear from the data already accumulated. It is believed most students should be convinced of this force of nature, a veritable *primum mobile*, even before the list grows to the estimated "250."

The most obvious results of collisions are quite simple. A hole is formed, ridges are thrown up and rays of ejecta are thrown out.