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Development of a rotational Drickamer apparatus (RDA)

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Many major developments in the study of deformation of Earth materials occurred based on the developments of new techniques. They include the contributions from UCLA lab (Griggs) based on the development of a solid-medium deformation apparatus, and the contributions from ANU lab (Paterson) based on the development of a high-resolution (but low pressure) deformation apparatus. Surprisingly (or embarrassingly), there was a large hiatus in the development of new technology between ~1980 and ~2000 and until very recently reliable experimental results on rheological properties were limited to ~0.3 GPa (~10 km).

Recognizing this, a group of scientists in USA started a serious effort of developing new techniques of quantitative deformation experiments. The developments include the design and operation of new types of deformation apparatus and the development of synchrotron-based techniques of measuring stress and strain. In this presentation, I will review the development of RDA (rotational Drickamer apparatus) and a theory of stress measurements performed in my lab. The advantage of RDA include (i) the capability of conducting high-P (and T) deformation experiments (compared to D-DIA), and (ii) the capability of large-strain deformation experiments. A brief description of RDA deformation experiments and some recent results will be presented including the results of deformation of a mixture of bridgmanite + ferro-periclase at the lower mantle conditions.

Keywords: high pressure, deformation experiments, synchrotron facility, lower mantle, RDA