

Summary

This proposal is for support of the first five years of a new *synthesis* institute called CIDER (Cooperative Institute for Deep Earth Studies), which has no precedent in the area of solid Earth studies. The Institute will undertake a mission of educating a new generation of Earth scientists. It will also provide an environment for studies requiring a concerted effort of leading researchers from different areas of Earth sciences. The purpose is to facilitate the work of individuals, or small groups of researchers, in contrast to a "Big Science" approach. The goal is to address the most important and difficult problems that have defied solution thus far to attain the ultimate objectives of Deep-Earth/Planetary Interior research and understand the origin, evolution, and dynamics of Earth and planets.

It has been 35 years since the acceptance of plate tectonics theory, but no definitive agreement has yet been reached among geoscientists on the fundamental nature of the global dynamic processes that drive plate motions. There are still vigorous debates about the proportion of heat coming from the core versus radiogenic heating in the mantle; about the degree to which the 670 km discontinuity impedes whole mantle circulation; about the origin and even the existence of mantle plumes; the chemical/thermal nature of heterogeneity in the deepest mantle; the nature and importance of coupling between the mantle and the core. In the meantime, tremendous progress has been made in the quality and quantity of data collected, for example, in the US, through the IRIS program in seismology, through state of the art analytic facilities in geochemistry, advances in computational technology in geodynamics, or through access to advanced accelerator facilities in mineral physics. It is becoming increasingly clear that significant progress in our understanding of the fundamental global scale dynamic processes of the Earth's interior can only be achieved through an integrated, multi-disciplinary approach, combining knowledge and latest achievements in each of the relevant disciplines. Yet, truly interdisciplinary work remains a formidable challenge in solid Earth geosciences.

Such a framework can best be achieved through the creation of an institute (CIDER) modeled after some existing examples in other fields, such as the Kavli Institute of Theoretical Physics (KITP) in Santa Barbara or Institute of Mathematics and its Applications in Minneapolis. This working model, which is suited for large communities of theorists, needs to be adapted to the geoscience community, which has a significant experimental component and, at least for the initial "deep earth" focus, is not as numerous.

CIDER would complement and substantially broaden CSEDI impact, by providing common facilities and environment for integrative, cross-disciplinary "thinking" and research work planning, and providing an intellectual home for the science resulting from disciplinary infrastructure activities. CIDER activities will be organized around "long" (3-6 months) programs for resident visitors, shorter "working group" meetings, workshops and short courses. Activities will involve senior and junior scientists, post-docs and graduate students.

We propose that CIDER be located in Berkeley, however, not directly on the UC Berkeley Campus. The Berkeley location was deemed appropriate in that: the San Francisco Bay region is an attractive, easy to access area both in winter and in summer; the proximity of the Berkeley campus provides access to key facilities such as libraries, internet, laboratories and intellectual resources, so that the CIDER residents will not work in isolation.

The management of CIDER will comprise a Director and a Deputy Director, and a Scientific Advisory Committee, reporting to a Board of Directors. This structure is designed so that the community of solid earth geoscientists will have a strong strong say in CIDER.

The activities and corresponding CIDER budget will be ramped up over a period of 3 years.