Dallas Abbott- Research and Teaching Interests

Research Interests and Career Path

My career has moved from Marine Geology and Geophysics to Precambrian Geology to Impact Geology. At present, I am passionately interested both in Precambrian Geology and in Impact Geology. I use my knowledge of marine geology and geophysics to further both of these areas of research. I am most interested in documenting the record of Holocene impacts in ice cores, bog cores, fluvial cores and tsunami deposits. Although impacts are relatively rare, some Holocene impacts were large enough to produce movement of material from equatorial regions to the poles. These larger Holocene impacts may form unique global stratigraphic markers that could tie together stratigraphies from ice, bogs, lakes and rivers. Once their sources are identified, everyone will want to learn how to identify the ejecta from these events and to use the data in their scientific studies of the Earth. My long-term goal is to take the knowledge I have acquired from Holocene sediments and to apply it to Precambrian impact events. I am also continuing to study the thermal and plate tectonic evolution of the Earth.

Recent Scientific Accomplishments.

Over the past 13 years, I have developed the microtechniques necessary to study the fine debris from oceanic impacts. Deep-sea impacts pose several problems. The first is a very restricted sample size compared to subaerial impacts. The second is a lack of large quartz grains in most settings, resulting in a reduced abundance of or no shocked quartz. My collaborators and I have developed microtechniques to study oceanic impacts. We use the scanning electron microscope and analyses of thin sections of tiny grains to find and confirm impact ejecta.

I have also learned how to separate out particulates from ice cores at ages of suspected Holocene impacts. We measured the highest concentration ever of marine diatoms in the GISP2 ice core. The diatoms are low latitude and originate from a source on a continental shelf with high biological productivity. Several other types of dust, including micrometer sized $CaCO_3$ crystals, accompany the diatoms. The latter may have caused a dust veil and climate downturn that lasted for 18 months (Feb. 536 to June 537 AD). Some dust with both substantial Ni and K may be impact ejecta. We are still developing these microtechniques but they have already yielded some important scientific results. By combining proxies for continental dust with historical accounts of unusual dust storms, we have managed to date our ice core samples to within a calendar year. This allows us to tie our scientific results into the historical record-a mix that should attract students of both Earth Science and History.

One accomplishment is documenting oldest primary native Fe ever found. We found 1.6 Ga native Fe in the Chaibasa Formation in India. This is the worlds oldest primary native Fe by over a billion years.

Courses that I can teach on the undergraduate level:

Oceanography
Marine Geology
Plate Tectonics
Introduction to Geophysics
Research Methods in Earth and Environmental Science
Energy Resources
Natural Hazards and Disasters
Case Studies in Environmental Science
Introductory Geology
The Evolving Continents (Emphasis on Precambrian Geology)
Holocene Extraterrestrial Impacts and Their Effects on Human History

The courses I would most like to teach are those in my areas of expertise. I have never had the opportunity to teach a course on the Evolving Continents nor a course on Holocene Impacts and Their Effects on Human History. I would also love to teach a course on Natural Hazards and Disasters or to help in teaching Introductory Geology. I could also teach a graduate level seminar on Geophysics of Ocean Basins or Controversial Topics in Precambrian Geology.

Courses Previously Taught

Geothermology (at Oregon State University): This graduate level course involved showing students the basic physics of heat flow: the heat flow equation, boundary value problems, and heat transfer by conduction, convection, and radiation. I also covered methods of measurement of heat flow on land and in the ocean.

Geophysics of Ocean Basins (at Oregon State University): This course was a graduate level seminar course involving a review of the most recent literature on the plate tectonics of ocean basins and subduction zones. Major subjects covered included: Age Dependence of Geophysical Behavior of Oceanic Crust, Tectonics of Mid-Ocean Ridges, Formation of Back Arc Basins and Island Arcs, and Hydrothermal Circulation. I received 6 excellents and 1 very good evaluation from the 7 students in the course.

Energy Resources (Barnard College): This course is an undergraduate level course exploring different sources of energy and methods of energy production and distribution. The course covers oil, coal, gas, wind, solar, nuclear, electrical, tidal, chemical, and hydroelectric power. We also discuss the relative environmental benefits and problems of different methods of energy production. I taught this course in 1997, 1999 and 2001. Renewable energy is a hobby of mine and I read everything that I can find on the subject.

Senior Seminar (Barnard College): This course is a two-semester course covering the senior thesis of Barnard Environmental Science majors. Each student is required to have an individual mentor and an overall mentor. I served as overall mentor to the 36 senior majors in the fall of

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1998 and served as an overall mentor to 15 senior majors in the fall of 1999. During the spring of 1999, Senior Seminar was team taught by four faculty members. I was the overall mentor for 11 senior theses totaling around 50 to 80 pages each. In spring 2000, I was the overall mentor for six senior theses. I find this work refreshing and stimulating. I enjoy working with the students, editing their theses, and teaching them about data analysis. In the academic year 2000-2001, I served as the individual mentor for a senior thesis comparing the energy use of the Black Rock Forest visitors' center and Lamont buildings. In the academic year 2001-2002, I served as the individual mentor for a senior thesis on the Ewing impact crater. In the academic year 2002-2003, I served as the individual mentor for a senior thesis on the unique characteristics of oceanic impact events and as a mentor for a student at the University of Maine who is working on a senior thesis on the Eltanin impact crater. In the academic year 2003-2004, I served as the individual mentor for a Barnard student working on the Eltanin impact event.

Environmental Data Analysis (Barnard College): This course is meant as an introduction to methods of data analysis. It covers use of Excel spreadsheets to plot scientific data, make histograms, fit curves, and calculate means and standard deviations, and other simple scientific mathematical operations. The course also involves experience in collecting data, tabulating data, and reading and interpreting graphs and tables. The students also are taught about common sources of error in databases. I taught this course in 1999 and in 2001.

Case Studies in Environmental Science (Barnard College): This course is an upper level course for juniors and seniors. We did four case studies: Endocrine Disruption by Environmental Pollutants and Naturally Occurring Substances, Mercury Pollution from Gold Mining and Rainforest Destruction in the Amazon, Rising Rates of Asthma and Their Environmental Causes, and The Arsenic Crisis in Bangladesh. These case studies reflect my own interest in medically related environmental problems. The course was taught like a graduate level seminar. Students were assigned reading and given study questions before each class. We discussed the questions during the next class.

Experience in Teaching Research Methods and in Mentoring Undergraduates and Young PhDs

Over the past 23 summers, I have personally advised 29 summer interns on a wide variety of research projects involving petrology, marine geology, marine geophysics, tectonophysics, and physical oceanography. About one third of these projects have led to published papers with the students. In recent years, I have mentored more young scientists. I find it to be extremely rewarding and satisfying. I have mentored 6 high school students. Of my former students, two won the local science fair and one won the Earth Science Category in the International Intel as well as winning or placing well in several science fairs on the way to competing in the International Intel.

Public Outreach Activities: I have given a lecture on her research to about 20 Earth Science Teachers for the past 14 years as part of the Earth to Class program. The program indirectly impacts about 2000 public school students each year. I also participate in the LDEO Open House for the public. I have appeared on three TV specials on impacts and/or tsunamis on the Discovery Channel, the History Channel and the National Geographic Channel.

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