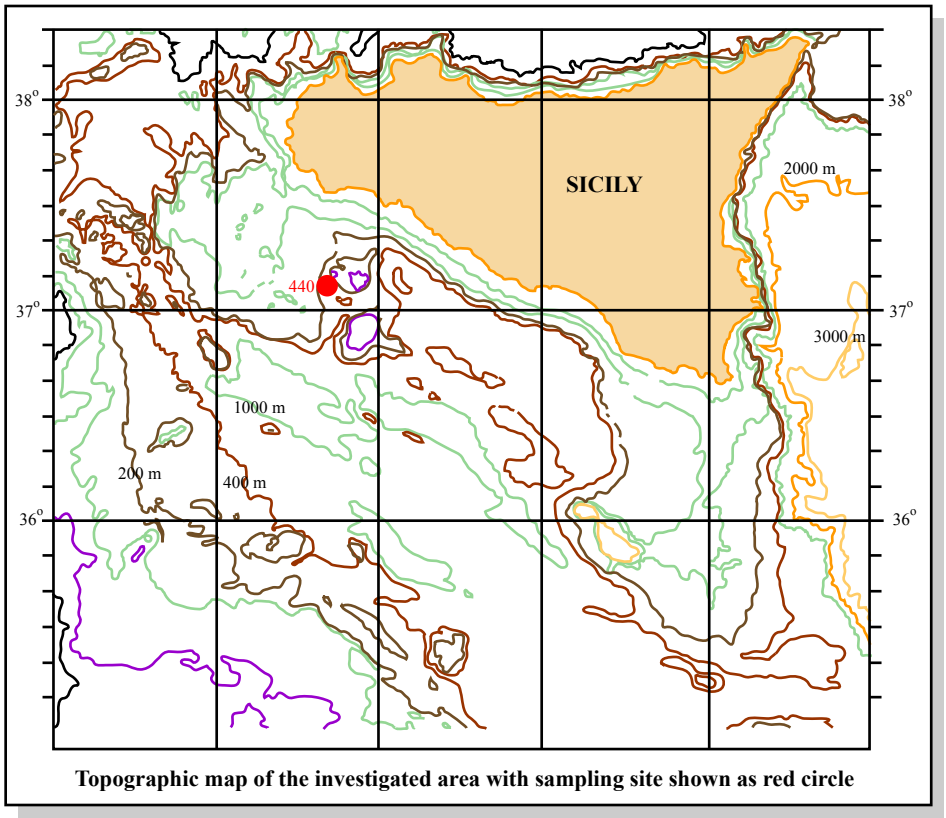
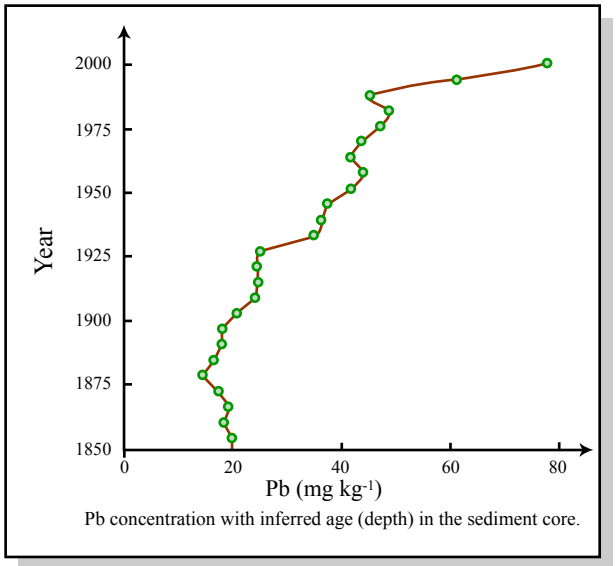
Analytical Techniques for Studying Environmental and Geologic Samples

Introduction: This is a laboratory course supplemented by lectures that focus on selected analytical facilities that are commonly used to determine the mineralogy, elemental abundance and isotopic ratios of Sr and Pb in rocks, soils, sediments and water.

The analytical techniques used are those available in the Department of Earth, Atmospheric, and Planetary Sciences at MIT. Each semester the class focuses on characterizing and interpreting the mineralogical and geochemical characteristics of a selected sample suite. The most recent study (2006) was a 26 cm sediment core from the Mediterranean Sea southwest of Sicily (Sicily map). This core was selected because preliminary analyses of Pb content by Georgio Tranchida (Italy) showed a marked increase in the uppermost part of the core, inferred to be from 1930 to the present .



Topographic map of the investigated area with sampling site shown as red circle



Pb concentration with inferred age (depth) in the sediment core.

Figures by MIT OCW.

The objectives of the class were to:

(a) Determine how elemental abundances vary in this core as a function of depth (age) by analyzing samples in 2 cm increments.

(b) Determine temporal variation of Sr and Pb isotopic ratios in these samples.

(c) Infer the causes of geochemical variability within the core; specifically to use Pb isotopic ratios to evaluate the origin of the rapid increase in Pb content.

Pertinent Reference books are:

1) Modern Analytical Geochemistry, Longman Publishing, 1994, R. Gill (ed.).

2) A Handbook of Silicate Rock Analysis, Blacke and Sun (Chapman and Hall in USA), 1987, P. Potts.

Also of interest are:

1) An Earth Scientist's Periodic Table of the Elements and Their Ions, by L.B. Railsback, Geology, 31(9), 737-740, 2003.

2) Elements, An International Magazine of Mineralogy, Geochemistry and Petrology, Vol. 1, Number 4, September 2005, Toxic Elements in The Environment: The Role of Surfaces.

Both a Periodic Table of the Elements and a Nuclide Chart showing isotopic abundances are essential for the course. It is also useful to have a knowledge of the composition of the continental crust (e.g., Rudnick and Gau, (2004) Composition of the Continental Crust, Chapter 3.01 in vol. 3 of Treatise On Geochemistry, (ed. H. D. Holland and K. K. Turekian, Elsevier) and seawater (e.g., Bruland K. W. and Lohan M. C. (2004) Controls of Trace Metals in Seawater in *Treatise on Geochemistry* (ed. H. D. Holland and K. K. Turekian, Elsevier).