Development of a problem-based, service-learning environmental field geochemistry course

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Geoscience undergraduates need to develop a holistic understanding of complex environmental systems, yet there is a surprising lack of literature regarding student conceptions about such systems. For example, few studies have probed naïve conceptions of broad ideas, such as biogeochemical cycling, or more specific problems, such as eutrophication. Furthermore, most geoscience students would benefit tremendously from the cultivation of practical skills, e.g. learning to design rigorous field data collection and analysis protocols in spatially and temporally heterogeneous systems. Students also need to learn to effectively communicate scientific research results to the general public. However, traditional geoscience coursework provides little or no hands-on training regarding low-temperature environmental system field and laboratory methods, and few opportunities to communicate science to the general public. To address these gaps, we have developed a problem-based, service-learning undergraduate course. In the initial offering of the course, 16 students worked collaboratively to assess water quality in a local urban lake. They learned to use a range of tools (e.g. colorimetry, field probes, IC, corers, water samplers), designed their own field sampling protocols, and presented their study results to local community members in an open-house poster presentation held in a local brewpub and via a witten 40-page report submitted to local neighborhood associations. The course was rigorously evaluated using a preinstruction experience survey, pre/post knowledge and attitude surveys, a postinstruction course evaluation, and a series of interviews with four students enrolled in the course. Students made remarkable gains on the multiple choice eutrophication knowledge survey (pretest mean 5, posttest mean 19, out of 25). Interestingly, in spite of these gains, attitude surveys indicated a slight increase in cognitive novelty, perhaps indicating that students became cognizant of significant gaps in their knowledge of complex systems as they completed their study. Analysis of the interviews suggest that students did develop more sophisticated conceptions of environmental systems as a result of this course, but that a few naive conceptions remained.

Organic geochemical characteristics of the Aptian aged lacustrine bituminous limestone in the Kale (Gümüşhane) area, NE Turkey

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Jurassic-Lower Cretaceous aged carbonate sequence is widely exposed in the Eastern Pontides, NE Turkey. The black colored bituminous limestone of Aptian age is located in the upper part of this carbonate sequence. The bituminous limestone contains a fauna that indicate freshwater / lacustrine depositional environment. The aim of this study is to investigate the source rock potential and organic geochemical characteristics of bituminous limestone.

The bituminous limestone samples have total organic carbon (TOC) values ranging between 0.11 and 1.30 % with an average TOC value of 0.54%. The hydrogen index (HI) values of limestone samples vary between 119 and 448 mg HC/gr TOC (average HI 298). These HI values indicate that limestone contain gas- and oil-prone organic matter. Pyrolysis data indicate that the organic matter content in the bituminous limestone consists of Type II kerogen. Average T_{max} value for bituminous limestone samples is 438°C (434-44°C). The T_{max} values indicate that bituminous limestone samples contain early mature-mature organic matter.

In the gas chromatogram of bituminous limestone, n-alkanes with high carbon number (C_{26}-C_{30}) are dominant. Pr/Ph ratio is 1.34 and this Pr/Ph ratio indicates that bituminous limestone deposited in suboxic environment. C_{29} is the dominant sterane in the bituminous limestone samples and the general ranking is C_{29}>C_{27}>C_{28}. The bituminous limestone samples have low C_{22}/C_{21} and higher C_{24}/C_{23} tricyclic terpane ratios. The $C_{31}R/C_{30}$ hopane ratios for bituminous limestone is very low (<0.25). The high 22S/(22S+22R) homohopane ratios and low moretane/hopane ratios indicate that the bituminous limestone contain early mature-mature organic matter.