Taphonomic Geochemistry of Fossil Bones from Marine and Terrestrial Fossilization Environments

Cross, Emily (School: Hammarskjold High School)

Chemical differences between fossils of different species, environments, or time periods reveal information about prehistoric habitats, climate, environmental change and specimen origin. Little research exists on geochemical differences between specimens from terrestrial and marine fossilization environments. This project identified element concentrations that determine which fossils come from each environment, and identified definitive differences in physical structure unique to fossils formed in each environment. Analysis of 68 elements for five sample types used inductively-coupled plasma mass spectroscopy, inductively coupled plasma-atomic emission spectroscopy, x-ray diffraction, scanning electron and petrographic microscopy to generate several important discoveries: Marine environments form pyrite crystals, enhancing preservation of outer bone structure. Differences between present and prehistoric Li, Co, Al, Ni, and B levels may indicate environmental change or conditions that impact element deposition during taphonomic and geological fossilization processes. The mosasaur fossil was chemically distinct from either terrestrial-terrestrial or terrestrial-marine specimens, necessitating further research on marine-marine fossil geochemistry. Geochemical analysis of fossils formed in terrestrial and marine environments can be used to identify chemical differences between Late Cretaceous and present-day terrestrial (fresh water) and marine environments, generate a template of chemical signatures identifying which fossilization environment (marine or terrestrial) was present, determine ideal fossilization conditions, and better target locations for high quality fossil sites.

Awards Won:
Geological Society of America &amp
American Geosciences Institute: First Award of $1,500