



Atlanta Geological Society Newsletter

The January AGS pizza social starts at 6:30 pm and the meeting starts at 7:00 pm

This Month's Atlanta Geological Society Speaker

“Investigating Rare Biomineralization Structures in Trilobites”

Speaker Ms. Raya Greenberger Bio:

Raya Greenberger is currently finishing her master thesis from the University of Alabama where she earned a Bachelor of Science in geology and business management in 2014. Her experience with optical and electron microscopy as an undergraduate and graduate student led her to her role as a business development manager at MVA Scientific Consultants, an analytical microscopy and spectroscopy lab located in Duluth.

Abstract:

Trilobites, a diverse class of arthropods, inhabited a range of marine environments from Early Cambrian to Permian time, and their various morphologies are significant in the interpretation of paleoenvironments and biostratigraphy. Studying the processes, known as biomineralization, by which trilobites form their unique physical structure, can enhance our understanding of evolution and the fossil record.

The focus of this study was three *Asaphus* trilobite species displaying stalk-eyes, varying in length and diameter, and *Eldredgeops rana* trilobites displaying patterns on their shells that may serve as an additional visual system or amorphous calcium carbonate reservoirs. The internal eye structure of *Asaphus kowalewski*, *Asaphus cornutus* and *Asaphus punctatus* and the spots on the *Eldredgeops rana* trilobites were characterized using a scanning electron microscope (SEM) for imaging as well as energy-dispersive spectrometry (EDS) and electron backscattered diffraction (EBSD) mapping to obtain elemental composition and crystallographic orientation and to observe microstructural arrangements. Further analyses were done on the spots on the *Eldredgeops rana* trilobites using atomic force microscopy (AFM) and Raman spectroscopy.

SEM imaging revealed that all the stalked eyes are composed of lenses, fibers and non-structured granules. *Asaphus cornutus* and *Asaphus punctatus* have lenses that are shaped as either a cone or an elongated prism, while *Asaphus kowalewski* only has lens shaped as a truncated prism. SEM imaging and EBSD of the spots on the *Eldredgeops rana* trilobite show that they cannot be lenses; there is no pathway connecting the spots to the exterior of the trilobite and no uniform orientation in the crystalline structures. AFM and Raman analyses of the spots show inconsistency with amorphous calcium carbonate.

Overall, the results from this study show that applying old and new microscopy and spectroscopy technologies to the study of fossils can reveal new information about their unique structure and advance our understanding of biomineralization and the evolution of fossils.

