VANDERBILT UNIVERSITY School of Engineering

DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

Seminar

Friday,

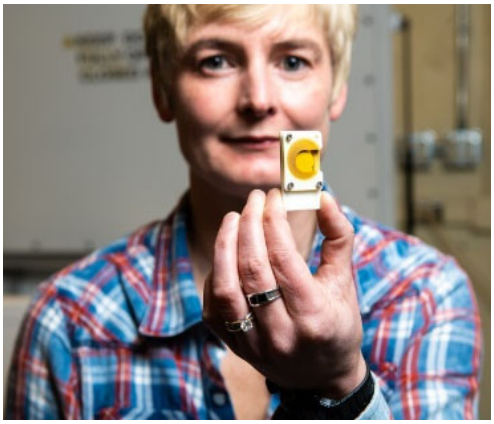
Oct. 29, 2021

12:00 pm – 1:00 pm

Via Zoom

"SURFACE CHARACTERISTICS OF ANCIENT GLASS ANALOGUES FOR LONG-TERM DISPOSAL OF VITRIFIED RADIOACTIVE WASTE"

DR. CAROLYN PEARCE



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ABSTRACT

Archaeological glasses with prolonged exposure to biogeochemical processes in the environment can be used to understand glass alteration, which is important for safe disposal of vitrified nuclear waste. Samples of mafic and felsic glasses with different chemistries, formed from melting amphibolitic and granitoid rocks, were obtained from Broborg, a Swedish Iron Age hillfort. Glasses were excavated from the top of the hillfort wall and from the wall interior. A detailed microscopic, spectroscopic and diffraction study of surficial textures and chemistries was conducted on these glasses, and compared with alteration characteristics generated with laboratory ageing tests, e.g. the vapor hydration test (VHT) and the United States Environmental Protection Agency (EPA) Leaching Environmental Assessment Framework (LEAF) pH dependent leach test (EPA Method 1313). Felsic glass chemistry was uniform, with a smooth surface showing limited chemical alteration (<150 nm), irrespective of the position in the wall. Mafic glass was heterogeneous, with pyroxene, spinel, feldspar, and quartz crystals in the glassy matrix. Mafic glass surfaces in contact with topsoil were rougher than those within the wall and had carbon-rich material consistent with microbial colonization. Limited evidence for chemical or physical alteration of mafic glass was found; the thin melt film that coated all exposed surfaces remained intact, despite exposure to hydraulically unsaturated conditions, topsoil, and associated microbiome for over 1500 years. This supports the assumption that aluminosilicate nuclear waste glasses will have a high chemical durability in near-surface disposal facilities.

BIOGRAPHY

Carolyn Pearce joined the Environmental Subsurface Science Group at PNNL in 2016 and is Director of the multi-institutional, Interfacial Dynamics in Radioactive Environments and Materials (IDREAM) Energy Frontier Research Center (EFRC). Her research focus is chemical speciation in extreme environments, exploiting synchrotron-based techniques to characterize coordination environment and local disorder in phases as they precipitate and dissolve in tank waste environments. Dr. Pearce also leads research programs for US DOE Office of River Protection and Environmental Management and has an international perspective on the science of nuclear waste processing and management. Dr. Pearce obtained her B.Sc. and PhD from the University of Leeds, UK, and is a research professor in the Department of Crop and Soil Sciences, Washington State University, and a visiting academic in the School of Earth and Environmental Sciences at the University of Manchester, UK.

ZOOM INFORMATION: https://vanderbilt.zoom.us/j/94166864521

Meeting ID: 941 6686 4521