SELENOCENE — A SOFTWARE TOOL TO TRACK THE PROCESSING HISTORY OF SAMPLES ANALYZED IN THE MID-ATLANTIC NOBLE GAS RESEARCH LABORATORY. Bissaka I. Kenah1,2, Cameron M. Mercer3,3, Barbara A. Cohen1, 1University of Maryland College Park, MD (*E-mail: bkenah@terpmail.umd.edu), 2CRESST II/The Catholic University of America, Washington, D.C., 3NASA Goddard Space Flight Center, Greenbelt, MD.

Introduction: The Mid-Atlantic Noble Gas Research Laboratory (MNGRL) at NASA Goddard Space Flight Center focuses on geochronology of extraterrestrial materials and developing instruments for in situ geochronology on other planetary surfaces. One of the challenges that we face as a lab is tracking all of the processing events for the samples that we analyze, from the time we receive the samples in the lab to the time that data are published and archived. We are working to develop new cyberinfrastructure for MNGRL by creating a software tool, named Selenocene, to solve this challenge. With sufficient community interest Selenocene could be developed for use in other labs, following the example of other cyberinfrastructure developed to support the EARTH-TIME initiative [e.g., 1–5].

The specific intention of Selenocene was to be able to provide a database that can assist in answering a variety of geological questions. Examples of these questions include: “where did a sample come from?” “What is a sample composed of?” “What can a sample tell about its origin?” Furthermore, pertaining to the MNGRL, Selenocene is designed to track the processing steps that laboratory personnel have performed on samples as a way to answer the questions above.

Application Design and Implementation:
Design requirements. This project first involved defining the properties of geologic samples and processing activities in the lab for which information needs stored in a central database. In addition, we wanted multiple users to be able to access the database simultaneously, so we chose to create an SQL database as the back end, and a stand-alone application with a graphical user interface (GUI) as the front end (Fig 1). This made it possible to isolate the specific parts of the application and design their individual functionalities. We allow samples to be associated with specific users, projects, and sample collections, record all laboratory processing details for each aliquot of a sample, and all aliquots deriving from a parent sample preserve information of their ancestors. To implement these functionalities, we used PostgreSQL for the backend database, Java and JavaFX for the GUI, and D3.js to represent the graph of aliquots for each sample (Fig 1).

Front-End Application. After separation of the application into front end and back end, the first focus was on designing how the user would interact with the front end GUI application. This involved coming up with properties of the samples and what could potentially be necessary for future geologists who may be using the program and creating an intuitive layout of controls (buttons, text fields, drop-down menus, etc.) through which the user interacts with the database. The primary windows of the GUI include: (1) the main window, which will show a filterable list of samples with high-level sample information (Fig. 2) displayed in tabs (e.g., collection/ receiving info, sample type, bulk chemistry, etc.); (2) an arbitrary number of aliquot windows, showing information for all aliquots of a particular sample, most importantly including processing information; and (3) a series of manager windows accessible from the main window to manage preferences, projects, sample collections, and users.

SQL Backend. Controls in the front end GUI allow the user to interact with corresponding data in the SQL back. We designed the database tables to support sample associations with users, projects, and sample collections while maximizing searchability on a variety of geologic criteria (rock type, chemistry, etc.). All of the components of the application are also well documented for future usability. The main functionalities of the database portion of the application, are the abilities to connect root samples to their corresponding aliquots (pieces cut from the root) and to track sample manipulations performed in the laboratory.

The database represents root-to-aliquot connections as a graph (aliquots as nodes with links representing parent-child relations; we chose to store this information in an adjacency list implementation), and tracks sample manipulations through a processing log where events are associated with a particular aliquot. There are tables for each of these functionalities in the SQL backend of...
the application, as well as user input locations in the user interface portion of the application.

**Progress:** Currently, *Selenocene* has a functioning SQL database initialization, which allows database tables to be automatically generated in the SQL backend. Along with this, it has an “About Selenocene” window (Fig. 2), a connection manager, and the main window (Fig. 3). The “About” screen gives details about *Selenocene*, including which version of the application is running. The connection manager sets up a connection between the user interface and the SQL backend database, along with a “connection profile” which can be saved for the user so they do not have to repeatedly log in. Finally, the main window is where samples are created, their properties are defined, where they are represented in D3.js (Fig 4), and where samples can be searched by project, collection, etc.

**Ongoing Work:** We are implementing additional dialogs to the GUI, such as sample managerial functions, including project, sample collection, institution, and investigators managers. We are also open to adding any other managers that help compartmentalize the program and provide ways to increase the usability of the application. We are currently developing the aliquot graph visualization that will be the primary means for users to recall information about a specific aliquot of a sample.

**Additional Information:** We would love your feedback on Selenocene and its development as it is a new application. If you do have any feedback, please email me, Bissaka Kenah at bkenah@terpmail.umd.edu

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**References:**