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Thermochronological Evolution of Calcite Formation at the Proposed Yucca Mountain Repository Site, Nevada

2 year project

April, 1999 - 2001

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QUESTIONS

1. Do populations of fluid inclusions, that indicate the recent influx of thermal waters into the repository site, exist?

2. If these inclusions are present, what minimum fluid temperatures do they indicate?

3. If present, when were these inclusions trapped, i.e., when did this influx(es) occur?

4. If an influx occurred, how widespread, within the repository site, was this influx?

Phase I: Collect ~ 200 samples throughout the ESF and crossdrift.

Prepare sections and search for two-phase inclusions with consistent liquid-vapor ratios.

Phase II: Characterize each section (petrography, trace element geochemistry, cathodoluminescence, surface imaging, and oxygen and carbon isotopes) and produce a *time map* that documents the progressive growth of the calcite.

Locate all two-phase fluid inclusion assemblages, determine inclusion origins, and determine relative ages of the assemblages based their origins and locations within section time maps.

Phase III: Conduct microthermometric studies to determine minimum temperatures and salinities of inclusion assemblages.

Conduct crushing studies to determine internal pressures of vapor inclusions.

Conduct other analytical studies to identify inclusion fluid compositions.

Phase IV: Select samples for geochronological studies which will provide maximum and minimum ages for primary, two-phase fluid inclusion assemblages, and maximum ages for secondary fluid inclusion assemblages.

Prioritize samples based on inclusion origin, and inclusion location in the *younger* portion of the samples.

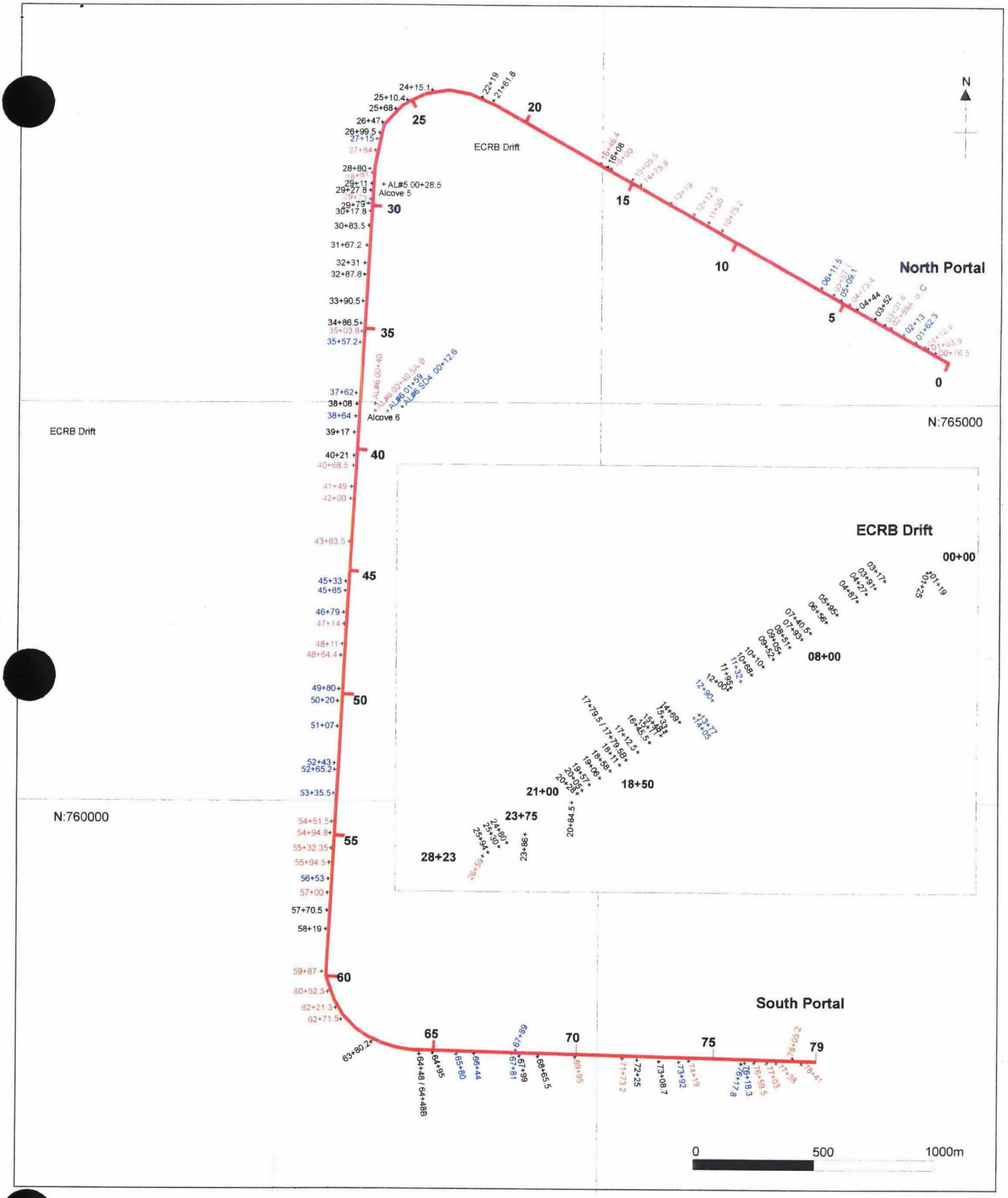
Integrate U-Pb and uranium series dates with stable isotope results to further constrain inclusion ages.

Phase V: Publish.

UNLV will hold quarterly meetings, during which UNLV scientists will present completed work to scientists representing DOE and the State of Nevada, and an independent expert advisor.

Goals for each meeting will include: 1) examining, evaluating, and reaching a concensus on work completed, 2) discussing, evaluating, and eliminating or adding viable hypotheses, 3) defining methods to test hypotheses, and 4) defining methodology for the next phase of data collection.

A major goal of this project is for UNLV, Nevada, and DOE scientists to maintain a concensus at each step during the study. If this can be accomplished, we should be in agreement, and all be aware of the strengths and weaknesses of the data and conclusions, when the project comes to a close.



116° 27' 30"

Key

+00+76.5 Sample taken from a breccia (cemented or open space).

+00+76.5 Sample taken from a fracture.

+00+76.5 Sample taken from a lithophysal cavity.

ESF 62+71.5

AL#5 00+28.5

00+28.5

Observations to date

- Different regions in the ESF and ECRB have distinct mineral stratigraphies
- 2-phase fluid inclusion assemblages (FIAs) are present in 44% of 151 samples
- Sites of samples containing FIAs are locally concentrated, but are distributed throughout the ESF and ECRB
- Most FIAs are present in calcite adjacent to the tuff