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Title: New Seismic Monitoring Station at Mohawk Ridge, Valles Caldera

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New Seismic Monitoring Station at Mohawk Ridge, Valles Caldera

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Scientific Purpose:

Two new broadband digital seismic stations were installed in the Valles Caldera in 2011 and 2012. The first is located on the summit of Cerros del Abrigo (station code CDAB) and the second is located on the flanks of San Antonio Mountain (station code SAMT). Seismic monitoring stations in the caldera serve multiple purposes. These stations augment and expand the current coverage of the Los Alamos Seismic Network (LASN), which is operated to support seismic and volcanic hazards studies for LANL and northern New Mexico (Figure 1). They also provide unique continuous seismic data within the caldera that can be used for scientific studies of the caldera's substructure and detection of very small seismic signals that may indicate changes in the current and evolving state of remnant magma that is known to exist beneath the caldera. Since the installation of CDAB and SAMT, several very small earthquakes have already been detected near San Antonio Mountain just west of SAMT (Figure 2). These are the first events to be seen in that area. Caldera stations also improve the detection and epicenter determination quality for larger local earthquakes on the Pajarito Fault System east of the Preserve and the Nacimiento Uplift to the west. These larger earthquakes are a concern to LANL Seismic Hazards assessments and seismic monitoring of the Los Alamos region, including the VCNP, is a DOE requirement. Currently the next closest seismic stations to the caldera are on Pipeline Road (PPR) just west of Los Alamos, and Peralta Ridge (PER) south of the caldera. There is no station coverage near the resurgent dome, Redondo Peak, in the center of the caldera. Filling this "hole" is the highest priority for the next new LASN station. We propose to install this station in 2018 on Mohawk Ridge just east of Redondito, in the same area already occupied by other scientific installations, such as the MCON flux tower operated by UNM.

Station Description:

Equipment has already been procured for this new station. Instrumentation consists of a broadband seismometer and a 26-bit digitizer/recorder. These are installed in a 6-foot-deep vault to achieve good coupling to the ground and for thermal insulation of the seismometer. Figure 3 shows the open vault and instruments currently installed at station CDAB. A digital RF telemetry system sends data back to LANL in real time. The installation is powered by a 12-Volt DC solar system. Three components of ground motion (vertical, north-south and east-west) are telemetered continuously to a central recording facility at LANL, where the data are analyzed and archived. Event detection and data acquisition software are used to determine when earthquakes or other signals of interest should be archived. These signals are then used to locate and estimate the magnitudes of the events. Earthquake and volcanic seismologists can use these signals for numerous types of scientific investigations into the origins and continuing evolution of the caldera and the surrounding Jemez Volcanic Field, and for tectonic studies of the complex fault systems in the area.

Station Installation:

Installation will require digging a hole, roughly 5’ X 5’ X 5’, for the seismic vault and erecting a metal mast roughly 30 feet from the vault to mount solar panels and telemetry antenna. A backhoe is required to dig the 5-foot-deep vault hole. A plastic barrel, 64” deep by 42” diameter is placed in the hole and backfilled with dirt. Figure 4 shows the vault barrel being installed at CDAB. This is covered by a locking insulated lid, which will protrude roughly 6 inches above ground. The mast will require digging a small hole and pouring concrete around the bottom of the pole. The vault and mast are connected by liquid-tight flexible electrical conduits containing the solar panel wires and telemetry cables. The conduits are buried in a shallow trench (2 to 3 inches deep) between the vault and mast. An example of an almost-finished station is shown in Figure 5. The station is designed ruggedly enough to operate for at least 10 years with minimal maintenance. A maximum of 2 to 4 field trips per year are needed to each station if equipment is damaged or malfunctions. More typically, one trip per year is required to retrieve internally recorded backup data from the digitizer before the media fills up.

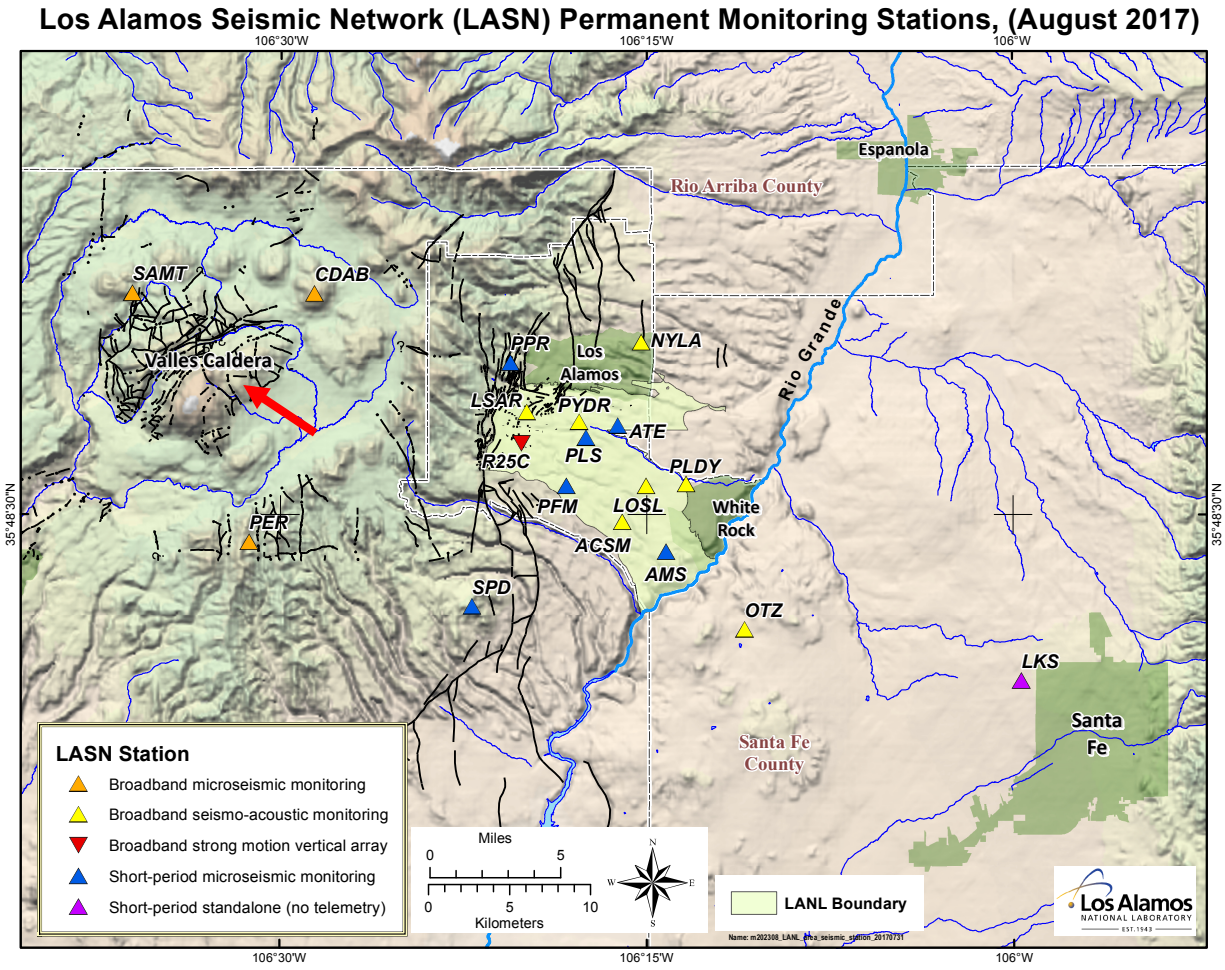

Figure 1: LASN station map showing proposed location (red arrow) for new station MOHK.

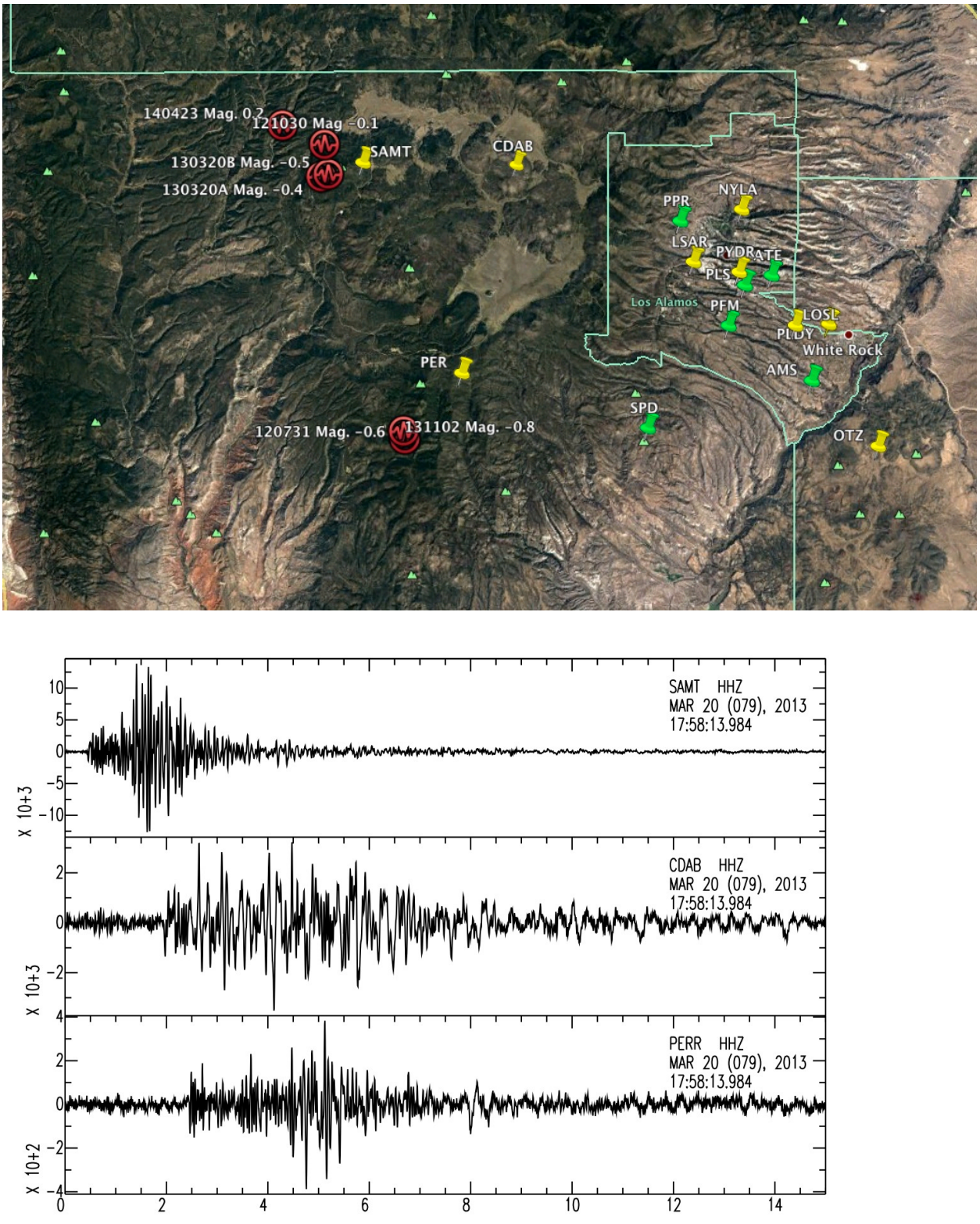

Figure 2: Map (top) of recent small earthquakes west of station SAMT and example 3-component (v, n-s, e-w) seismograms (bottom) recorded there.

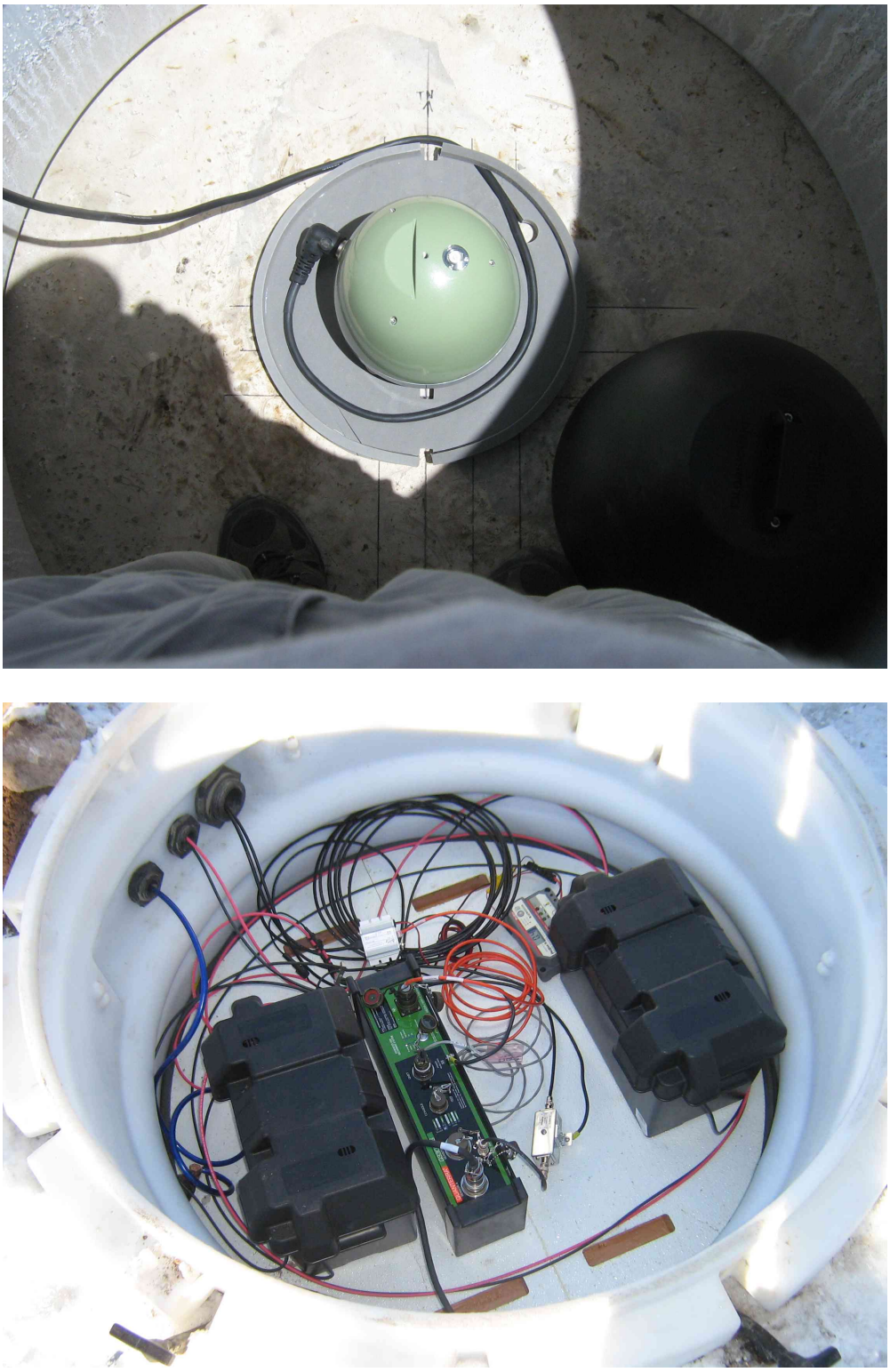

Figure 3: Instrument vault at station CDAB. Top shows 3-component broadband seismometer installed on concrete at bottom of vault. Bottom shows digitizer/recorder, batteries, etc. installed on shelf at top of vault.

Figure 4: Plastic vault barrel being installed in excavated hole at station CDAB.

Figure 5: Typical almost-completed LASN broadband seismic station. Seismic vault is in foreground and solar panel/telemetry mast is in background. Electrical conduit connecting them is buried to complete the installation.