The area surrounding the Dead Sea was the locus of humankind’s migration out of Africa and thus has been the home of people since the Stone Age. For this reason, understanding the climate and tectonic history of the region provides valuable insight into archaeology and studies of human history and helps to gain a better picture of future climate and tectonic scenarios. The deposits at the bottom of the Dead Sea are a geological archive of the environmental conditions (e.g., rains, floods, dust storms, droughts) during ice ages and warm ages, as well as seismic activity in this key region. An International Continental Scientific Drilling Program (ICDP) deep-drilling project was performed in the Dead Sea between November 2010 and March 2011. The project was funded by the ICDP and agencies in Israel, Germany, Japan, Norway, Switzerland, and the United States. Drilling was conducted using the new Large Lake Drilling Facility (Figure 1), a barge with a drilling rig run by DOSECC, Inc. (Drilling, Observation and Sampling of the Earth’s Continental Crust), a nonprofit corporation dedicated to advancing scientific drilling worldwide. The main purpose of the project was to recover a long, continuous core to provide a high-resolution record of the paleoclimatic, paleoenvironmental, palaeoseismic, and paleomagnetic of the Dead Sea basin. With this, scientists are beginning to piece together a record of the climate and seismic history of the Middle East during the past several hundred thousand years in millennial to decadal to annual time resolution.

Regional Setting and the Collection of Cores

The Dead Sea, located in the Dead Sea Basin, is at the lowest elevation on Earth (currently 425 meters below mean sea level), is a terminal lake that evolved from previous water bodies that occupied the tectonic depressions along the Dead Sea Transform Fault. Faults and ridges of the Dead Sea Basin are connected with the late Neogene ingress (6–3 million years ago) of the Mediterranean Sea into the valley, forming a backwater called the Sedom Lagoon. A series of terminal lakes (lakes with no outlets) filled the basin after the disconnection of the lagoon from the Mediterranean [Shen, 2001]. The lakes received their water from two major sources: calcium chloride brines that evolved from the ancient remnant solution of the Sedom Lagoon, and freshwater runoff. The limnology of the lakes was controlled by the regional hydrology, which reflects the climate conditions in the watershed [Shen et al., 1995]. The long record of the past several thousand years the lakes expanded and contracted with changing climate conditions due to the supply of freshwater. The modern Dead Sea is the latest of these series of lakes.

The location of the Dead Sea Basin, at the boundary between the Arabian-Sahara deserts and the Mediterranean climate zones, enhances its sensitivity to the starkly contrasting (arid versus temperate) climate and hydrological conditions of these regions. Moreover, because the formation of the basin is a consequence of tectonic activity along the Dead Sea Transform Fault [Ren-Art et al., 2004; Sigmund et al., 2014], it is important to hazardous assessments of the region.

Two sites were cored (Figure 1) as part of the ICDP funded venture into the Dead Sea. One was in the deepest basin in the center of the Dead Sea, at a water depth of 257 meters, and recovered cores down to about 460 meters below the sediment surface. The second site, in several meters of water, recovered cores down to roughly 350 meters below the sediment surface. For another picture of the drilling facility, see Figure S1 in the online supplement to this brief report (http://www.ags.org/journals/eo/v092/i049/2011EO490001/)

Preliminary Results and Future Plans

Opening and description of the recovered cores occurred in June and October 2011 at the C2F German Research Centre for Geosciences in Potsdam, Germany. The cores have two main sedimentary facies: (1) many sequences of millimeters-thick laminated layers of inorganic anorganic and silty detritus containing mainly of calcite and quartz and (2) sequences of rock salt and marls (see Figure S2 in the online supplement). The anorganic and silty detritus layers reflect deposition in dry (summer) and wetter and stormy (winter) seasons, respectively. Moreover, anorganic provides the potential to establish a calendar chronology, through uranium-thorium dating and oxygen isotopic stratigraphy [e.g., Haus-Schlemer et al., 2014; Thür- neis et al., 2015]. Gypsum layers are scattered throughout, indicating sustained dry periods. Provisional interpretation of the lithology of the core through time strongly indicates that the salt layers are deposited during arid interglacials and that long salt-free intervals are wetter intervals, together spanning an interval of about 200,000 years. This interval bleeds into the time frame of the interglacial labeled in oxygen isotope records of ocean sediments and marine isotopes.

An important discovery is a mudstone layer of rounded pebbles, possibly reflecting a beach deposit, more than 230 meters deep in the core taken from the deep basin, deposited at an age proximally to be the last interglacial. The pebble layer overlies about 40 meters of mainly salt, and

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A library of georeferenced photos from the field

A picture is worth a thousand of words, and every day hundreds of scientists, students, and environmentally aware citizens are taking field photos to document their observations of rocks, glaciers, soils, forests, wetlands, croplands, mangroves, livestock, birds and mammals, as well as important events such as droughts, floods, wildfires, insect emergences, and infectious disease outbreaks. Where are these field photos stored? Can they be shared in a timely fashion to support education, research, and the leisure activities of citizens across the world? What are the financial and intellectual costs if these photos are lost or not shared?

Recently, researchers at the University of Oklahoma developed and released the Global Geo-Referenced Field Photo Library (hereafter referred to as to the Field Photo Library: http://www.osum.edu/field/), a Web-based data platform designed for researchers and educators who wish to archive and share field photos from across the world, each tagged with exact positioning (Figure 1). The data portal is a simple user interface that allows people to upload, query, and download georeferenced field photos in the library. The idea behind this simplistic interface: Changes in land use and land cover have significant impacts on weather, climate, hydrology, biodiversity, and local security across various spa-

tial and temporal scales. Tracking land use and land cover changes through georeferenced photos gives a visual picture (ground truth) to numerical data, allowing scientists, policy makers, and the public the opportunity to monitor the evolution of landscapes at small scales. Thus, these photos are invaluable for documenting land use and land cover changes.

Using the Library

Through its privacy control feature, photo contributors to the Field Photo Library can designate whether their photos are publicly available (i.e., public mode) or available only to the owner of the photos (i.e., private mode). This privacy control feature warrants priority use of the field photos by the photo contributors for their own research activities if needed. Photo contributors with ‘private’ photos are regularly notified and encouraged to make their photos ‘public.’ An interactive graphical user interface is also available for users to interpret and classify field photos (e.g., various land cover types), to enter field notes, and to build thematic databases from the photos. Ranging from crop-specific themes (e.g., paddy rice, sugarcanes, and winter wheat) to general land cover types (e.g., forests, croplands), after selection of specific photos (e.g., by time, keywords, geographical domains, and land cover types) a user can download both photos and associated data in several formats (e.g., as comma-separated values (csv), an Excel file (xlsx), a zipped Keyhole Markup Language file (kmz), and an ArcGIS Earth file (.kmz)). These files can then be used for spatial analyses in geographical information systems (e.g., ArcGIS), for image processing (e.g., Exelis's Environment for Visualizing Images (ENVI) and Interactive Earth Resources Data Analysis System (ERDAS)), and Google Earth. The Field Photo Library was initially set up to aid the effort to track changes in land use and land cover from airborne and spaceborne remote sensing. Georeferenced field photographs are used as in situ or ground reference data for algorithm development and validation of remote sensing data products. Many research projects have carried out field expeditions, often repeatedly in the same study areas, without a means of sharing field photos data. By using the Field Photo Library, researchers can contribute to a spatially and temporally extensive database of datasets at a quality level that can be accessed from any location in the world. For example, a user can query and download thousands of georeferenced field photos.

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Field Photo Library

cost from page 435

provide scientific information of interest. The Field Photo Library is specialized for scientific applications and educational purposes. Although there are currently no quality control measures in place, except for irregular visual inspection of publicly shared photos, it is hoped that because scientists and educators contribute to the site the vast majority of photos are applicable to many research endeavors. The Field Photo Library’s data pool also differs from commercial sites in that funding is not related to advertising or the acquisition of personal data. The Field Photo Library was established using funds from NASA, the National Institutes of Health (NIH), and the National Science Foundation (NSF) and will be maintained through research grants. Scientists wishing to be featured on the site can request photos to be added to the Field Photo Library, and photos will be reviewed for quality and usefulness for a variety of applications. The continued success of this project will provide a means of documenting how Earth changes interact with societal needs, accuracy, spatial extent, and temporal scope.

Acknowledgments

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