החברה הגיאולוגית הישראלית

Israel Geological Society

Abstract Book

כנס החברה הגיאולוגית

עין גדי | 2023

החברה הגיאולוגית הישראלית

מודה לחברות ולמוסדות הבאים על תרומתם לכנס
ופעילויות החברה הגיאולוגית הישראלית בשנת 2022–2023

GEOPROSPECT
Geology. Environment. Planning.

גיאו-פרוספקט בע"מ

Ory Dor PhD
אורי דור גיאולוגיה לתכנון והנדסה
Geology for Planning and Design

אורי דור – גיאולוגיה לתכנון והנדסה

גאוטופלוין
ייעוץ גיאולוגי וניטור בע"מ

מ. לוין סקרים גיאולוגים וגיאוטכנים בע"מ

am geolog
ד"ר עמיר אידלמן גיאולוגיה, חוות דעת, סביבה

ד"ר עמיר אידלמן – גיאולוג

גיאו-לוג

גיאו-לוג שירותים טכניים בע"מ

ג'ון הול

אוניברסיטת חיפה

החוג לגיאוגרפיה
ומדעי הסביבה
אוניברסיטת חיפה

המכון למדעי כדור הארץ
האוניברסיטה העברית

המחלקה לגיאופיזיקה ומדעים
אטמוספריים ופלנטריים
אוניברסיטת תל-אביב

המחלקה למדעי
הגיאולוגיה והסביבה
אוניברסיטת בן גוריון בנגב

NEWMEDENERGY

RATIO ENERGIES

רציו חיפושי נפט ש"מ

ZION OIL & GAS
ציון נפט וגז

Zion Oil & Gas Inc.

Chevron

Chevron
Mediterranean Limited

משפחת גבירצמן

משפחת גרדר

Bernard Blasband

המכון הגיאולוגי
GEOLOGICAL SURVEY OF ISRAEL
ESTABLISHED 1949

המכון הגיאולוגי לישראל

חברי ועד החברה הגיאולוגית הישראלית לשנת 2022-2023

נשיאה – רונית קסל

סגן נשיאה – אורי שטנר

גזברית – יעל אברט

אחראי סיורי עומק וסיורי כנס – איתי קורזון וגיא בן-דור

מרכזת תכנים – תמי זילברמן

אתר האינטרנט ותקשורת – יניב דרבסי

וועדת ביקורת

אבי בורג, שרית אשכנזי-פולידובה, אנטון ווקס

עריכה

רונית קסל, תמי זילברמן, יניב דרבסי

עיצוב

תרצה צברי ובת-שבע כהן

The Effect of Seagrass Halophila stipulancea's Disappearance on the Biogeochemistry of Marine Sediments

Antler G. (1,2), Soto N. (1,2)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Interuniversity Institute for Marine Sciences, Eilat 88103, Israel

giladantler@gmail.com

In recent decades, carbon dioxide (CO_2) levels rapidly increased, causing global warming and ocean acidification worldwide. Coastal ecosystems are important habitats and play a key role in mitigating climate change by carbon sequestration which is the process of capturing CO_2 and storing it in the sediment by forming organic carbon. Seagrasses are highly efficient in trapping suspended matter and store most of the sequestrated carbon in the sediment. In carbon-rich sediments, the oxidation of organic matter is the driving force behind most diagenetic reactions which affect the water column as well. The seagrass's rhizosphere (the zone of influence generated by root growth and activity) creates an oxidizing microenvironment in the sediments, greatly affecting the rates of microbial carbon mineralization, thus creating a complex and strong redox gradient. Since seagrasses profoundly affect the sediments, understating their role in the system and examining the changes they cause, hold ecological and global importance. The aim of this study is to explore how the subsurface geochemistry of marine sediments is affected by the seagrass Halophila stipulancea. We compared the porewater geochemistry from vegetated and unvegetated sediments and then incubated the sediment from vegetated and unvegetated areas and followed the changes in the geochemistry. Our results indicate that while vegetated sediments are more oxidized in the field, after seagrass removal the sediment is more reduced than unvegetated sediments. This implies that although the seagrass enriches the sediment with organic carbon, it keeps the sediment oxidized, and once the seagrass is removed the sediment quickly gets reduced.

Long-term changes in Frutarom beach groundwater table total dissolved mercury levels

Asfur M. (1), Shamir M. (1), Silverman J. (2)

[1] Faculty of Marine Sciences, Ruppin Academic Center, Mikhmoret, Israel

[2] Israel Oceanographic & Limnological Research Ltd., Tel-Shikmona, P.O.Box 8030, Haifa 31080, Israel

mustafaa@ruppin.ac.il

Haifa Bay (HB), was polluted with Hg discharged from a chlor-alkali plant (ECI) and from the Qishon River industries, for decades. Since the 1980s industrial Hg loads into HB decreased until their complete cessation in 2000. Consequently, concentrations in marine biota and sediments decreased almost to reference levels. However, during 2006–2012, total Hg (THg) concentrations increased in three commercial fish species collected in Northern HB (NHB). In 2015-16, THg dissolved in groundwater table samples collected from the Frutarom beach near the ECI were measured at unprecedented levels of up to 251 $\mu g \cdot L^{-1}$. Together with the spatial distribution of THg levels in plankton, benthic flora and fauna collected throughout HB, it was suggested that the increased discharge of highly THg enriched groundwater from Frutarom Beach following the closure of the ECI in 2003 was responsible for the observed increase of THg in commercial fish between 2006-2012 and again in 2015-16. Between 2016-2019, THg levels in commercial fish from NHB dropped to background levels (~0.001 ppm/g fish weight). During February 2020 until February 2022, groundwater table THg levels were monitored monthly in detail along the ECI beach. According to these measurements, THg varied seasonally between 50 $ng \cdot L^{-1}$ during most of the year and an average value of 350 $ng \cdot L^{-1}$ during October (2020 and 2021), indicating a 0103-4 decrease in THg compared to 2015-16. Correspondingly, THg levels in commercial fish collected at the beginning of November 2022 were high and similar to those measured in 2012 and then again in 2015-16. These observations suggest that the increasing discharge of THg enriched groundwater into NHB from Frutarom beach since 2003 may be playing a smaller role in the THg enrichment of commercial fish from NHB than previously thought.

Evaluating mechanical properties of carbonate rocks using hyperspectral remote sensing in lab

Bakun-Mazor D. (1), Ben-Ari Y. (2), Marco S. (2), and Ben-Dor E. (3)

[1] Department of Civil Engineering, SCE - Shamoon College of Engineering, Beer-Sheva 8410802, Israel

[2] The Department of Geosciences, Tel-Aviv University, Tel-Aviv 69978, Israel

[3] Department of Geography and Human Environment, Tel Aviv University, Tel-Aviv 6997801, Israel

daganba@sce.ac.il

Determining the mechanical properties of rocks is important for various civil engineering fields, including the mining of raw materials for aggregates used in the construction and paving industries. Traditionally, the mechanical properties of rocks are obtained through in-situ and laboratory tests during geotechnical surveys. However, these time-consuming surveys involve many resources. In contrast, hyperspectral remote sensing methods make it possible to identify the mineralogical composition and crystallographic structure of the rock; properties that control the mechanical properties of the rocks. In this work, we characterize the mechanical properties of carbonate rocks by using a hyperspectral sensor in laboratory conditions.

We collected about 150 cylindrical samples of carbonate rock, with a wide range of strength values from several rock outcrops in Israel. We used a point spectrometer in the range of 0.4 – 2.5 μm and a spectral image sensor in the range of 3.0 – 12.0 μm, scanning the samples to obtain the signature of their light reflections and spectral emissivity. We then measured the samples' density, porosity, water absorption, and uniaxial compressive strength (UCS). We used sophisticated data mining to find statistical relationships between the hyperspectral signatures of the samples and their mechanical properties. We used this data to identify the most dominant wavelengths for predicting mechanical properties. We found that the density, porosity, and water absorption of carbonate rocks could be confidently predicted based on spectroscopy data, while the UCS of the rock could also be predicted, but less significantly.

The results of the study pave the way for the development of measuring tools for the mechanical properties of rock, based on non-destructive tests of quarrying materials.

Investigation of the rainfall-runoff-sediment relationships in the Yamin Plain, Hazeva Formation

Balaban N. (1), Laronne J.B. (2), Adar S. (3)

[1] Negev Nuclear Research Center

[2] Department of geography and environmental development, Ben-Gurion University of the Negev

[3] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

balabannoa@gmail.com

Erosion in sandy environments is often attributed to eolian rather than fluvial processes. Although the Hazeva Formation in the Yamin Plain is characterized by a major sandy fraction, fluvial erosion is the dominant process in the local landscape. Rill, gully, and channel erosion are often the main factors taken into consideration when addressing fluvial processes. Although sheet erosion also plays a major role, it is often neglected since quantification is challenging. Assessing this portion of erosion is important especially for landscape evolution timescales of 100-1000 of years, for which high-resolution methods are required.

In our study we plan to assess fluvial erosion rates in the Yamin Plain. Channel and inter-channel processes will be considered, through the investigation of four basins of increased size (200-19,000 m^2). The southern flank of the Yamin Plain watershed - part of Nachal Yamin basin - was chosen. In this area, rapid lithological changes, characteristic of the Hazeva formation, occur and the relatively high inclinations produce defined basins.

All basins are monitored by combining onsite hydrometric monitoring and topographic structure from motion techniques. The small basin (197 m^2) is the most extensively instrumented, enabling continuous monitoring of rainfall, runoff, and sediment. In all basins digital elevation models (DEM) before and after flow events are constructed, enabling to identify erosion and deposition through comparison of pre and post fluvial DEM's. Six rain-runoff events were monitored in the small basin over the course of 2.5 years. Most events comprise multiple inter-event hydrographs, enabling, for example, to assess runoff/rainfall ratios for event segments, which at times are higher than 30%, as well as to identify specific rain thresholds as low as 0.4 mm/min for runoff initiation. A high correlation (r^2=0.97) between sediment yield and runoff was established for the small basin, thereby demonstrating the overwhelming effect of rainfall on erosion of this area.

Beachrock outcrops on the Mediterranean coast of Israel as proxy for beach build-up during the Late Holocene

Bar A. (1,2,3), Zviely D. (2), Roskin J. (3,4), Galili E. (5,6), Bookman R. (1)

[1] The Dr. Moses Strauss Department of Marine Geosciences, Leon H.Charney School of Marine Sciences, University of Haifa

[2] Faculty of Marine Sciences, Ruppin Academic Center, Emek-Hefer 40250, Israel

[3] Geomorphology and Portable Luminescence Laboratory, Leon Recanati Institute for Maritime Studies, University of Haifa

[4] Department of Geography and Environment, Bar-Ilan University, Ramat-Gan, 52900, Israel

[5] The Leon Recanati Institute for Maritime Studies, University of Haifa, Mt. Carmel, Haifa 31905, Israel

[6] Zinman Institute of Archaeology, University of Haifa, Mt. Carmel, Haifa 31905, Israel

beachrock.israel@gmail.com

Beachrock is a sedimentary rock composed of shoreline-associated sediments rapidly cemented by calcium carbonate. We report how beachrock of the Mediterranean coastline of Israel reflects coastal morphological processes and demonstrate its connection to environmental and coastal processes by using (a) petrographic and sedimentological analysis, (b) relative age pOSL analysis, (c) OSL ages, and (d) archaeological evidence. We focus on beds that formed since the sea reached its present level ~4 kyr ago, and characterize their clastic components, determine the time of their formation and explain the progression of their deposition. We report on eight in-situ beachrock outcrops between Apollonia and the Hadera River outlet. The beaches, 8–80 m wide, rest beneath 5–40 m high cliffs, and reflect natural and anthropogenic processes.

We propose that beachrock is a proxy for a specific phase of beach build-up. Beachrock diagenesis is one of the processes of beach evolution, dictated by burial of a sand- to gravel-size sediment package in the inter-tidal zone, protected from wave/wind erosion. Lithification of the package limits its erosion, when exposed, following removal of overlying sediment/sand. OSL ages provides a temporal benchmark (ca. 1,500–1,000 yr BP) for the initial diagenesis stage of the palaeo-beaches that evolved into beachrock.

Thin-section composition show that detritus clasts reveal substantial contribution from the local aeolianite escarpments. We suggest that the preservation of these palaeo-beaches was possible due to burial under a phase of sand accumulation and the lithification of the protective beachrock deposits. The exposure of beachrock outcrops is a result of later erosion of the covering upper sand due to environmental reasons, such as coastal/marine constructions, sand quarrying, wave storms and rising sea-level.

Dissolved trace metal dynamics in response to dust storms and sediment resuspension in the Gulf of Aqaba, northern Red Sea

Benaltabet T. (1,2), Lapid G. (1,2), Torfstein A. (1,2)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Interuniversity Institute for Marine Sciences, Eilat 88103, Israel

tal.benaltabet@mail.huji.ac.il

Trace metals (TM) are known to serve as critical micro-nutrients for marine primary productivity, with atmospheric dust deposition acting as a primary source of TM and nutrients to the open ocean. However, the impact of short-term environmental perturbations such as dust storms and sediment resuspension events on the oceanic water column is poorly constrained due to the low temporal resolution sampling in open ocean settings and the episodic nature of dust deposition. The Gulf of Aqaba (GoA), Red Sea, is a highly accessible deep oligotrophic water body featuring exceptionally high atmospheric deposition fluxes delivered by dust storms, which constitutes as the main terrigenous input and source of TM to the GoA surface water.

Here, we present a time series of dissolved manganese, cobalt, nickel, copper, zinc, cadmium and phosphate concentration profiles sampled in the GoA during 2017 and 2018, with a particular focus on daily time scale dust storms and episodes of sediment resuspension. We evaluate the results in conjunction with high temporal resolution measurements of airborne aerosols and sediment trap-based water column sinking particulate fluxes.

Counter-intuitively, upper mixed layer TM inventories decrease with increasing aerosol loads, with the effects of TM scavenging and dissolution associated with atmospheric aerosols peaking 5-6 days after dust deposition. Dust storms promote intense TM scavenging, abruptly driving down TM mixed layer inventories by 3-43% with scavenging rates featuring a large dependency on aerosol provenance. The effects of a sediment resuspension event, which triggered a decrease of 21-52% in TM inventories across the entire water column, resonated for ~6 weeks after the event.

The results demonstrate that atmospheric deposition in the oceans acts as a long-term source for TM while concomitantly serving as a short-term sink. The in-situ insights presented here may be used to understand and quantify the true impact of abrupt environmental events on water column chemical compositions.

Seismic anisotropy and stress field variations along the Dead Sea Fault Zone in northern Israel

Ben-Dor G. (1,2), Kurzon I. (2), Weinberger R. (1,2), Tsesarsky M. (3)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[3] Department of Civil and Environmental Engineering, Ben Gurion University of the Negev, Beer-Sheva, Israel

guybend@post.bgu.ac.il

Extensive Dilatancy Anisotropy (EDA), which is the result of dilated cracks in the direction of the maximum horizontal compressive stress is often thought to be a major source seismic anisotropy in the crust. However, a long-standing question relates to the cause of anisotropy within active shear zones, where a variety of deformation structures such as cracks, veins, and secondary faults are present. In such zones, it is difficult to determine whether the source of the anisotropy is stress-induced or structure-controlled. Here we present shear wave splitting measurements, reflecting pronounced seismic anisotropy, from local crustal earthquakes, measured along the Dead Sea Fault system in northern Israel. Our results indicate the presence of four distinct spatial domains, each with its own anisotropic properties and meso-structure orientations. In most of the examined sites, the fast S-wave directions agree with local stress-indicating structures, suggesting that stress-induced anisotropy is the dominating mechanism for anisotropy at the uppermost crust in the region.

The Fazael Formation and its potential role in the Neolithic Agricultural Revolution

Ben Dor Y. (1), Stein M. (1, 3), Goring-Morris N. (2), Erel Y. (3)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] Institute of Archaeology, The Hebrew University, Jerusalem 9190501, Israel

[3] The Fredy and Nadine Herrman Institute of Earth Sciences, The Hebrew University, Jerusalem, Israel

yoav.bendor1@mail.huji.ac.il

A series of important archeological sites related to the initial phases of the Neolithic agricultural revolution (NAR) are located in the lower Jordan Valley (i.e. Jericho, Gilgal, Netiv Hagdud and Salibiya), where soils cover much of the area. The soils comprise the Fazael Formation that was deposited in the Jordan Valley during the post Glacial period and early Holocene. The Fazael soils, which are broadly defined as clayey-silty alluvial serozems, were remobilized from the mountainous regions of the Judean-Samarian hills and accumulated on top of the Lisan Formation as lake levels declined and its shores receded (after 14 ka BP). Along with favorable climatic conditions and water availability, the Fazael soils provided the Neolithic communities with necessary resources to improve their agricultural practices.

In this study we analyzed the grain size, mineralogical composition, soil properties and the provenance of soils of the Fazael Fm. from several sites recording the PPN-A and adjacent periods including (Netiv Hagdud, Salibiya, Gilgal and Fazael) and nearby localities throughout the Jordan Valley. The results were compared to coeval sediments deriving from cores that were drilled in the Dead Sea (ICDP-DSDDP). The soils are dominated by quartz, feldspar and calcite, and their dominant clay minerals are illite-smectite with some kaolinite. Soils that were deposited during the NAR are characterized by reduced sand content coupled with increased clay and silt content, as well as increased exchangeable potassium percentage compared with pre-NAR samples.

Quantity, composition and source of major gases in groundwater systems in Israel

Ben-nun Levanon H. (1,2), Rosenberg Y.O. (2), Ganor J. (1), Reznik I. J. (2)

[1] Department of Geological and Environmental Sciences, Ben-Gurion University of the Negev, Beer Sheva, 8410501, Israel

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem, 9692100

hadas.bennun@gmail.com

The amount and composition of gases in groundwater systems is largely unknown. Subsurface gases can be sourced from an atmospheric or subsurface origin. Following the infiltration of air-equilibrated water with potential “excess-air”, the gas composition can be influenced from various sources/processes: oxidation-reduction biogeochemical reactions, adsorption/desorption of gases to solid surfaces, phase changes, dissolution into water and oil phases depending on the prevailing T and P conditions, leakages from oil and gas reservoirs, contribution from deep sources such as the crust or mantle and other thermochemical reactions. Additionally, the total amount and the state of matter of the gas (dissolved/free/supercritical) can provide valuable information regarding the extent of these processes at the subsurface as well as connectivity between reservoirs. Quantification of the amount and composition of gases in groundwater systems can provide the baseline conditions for CO2 sequestration projects as well as provide the basis for calculating greenhouse gas emissions to the atmosphere by groundwater production.

Gases were collected from various groundwater systems across Israel by separation of the gas from water in production wells using a gas-membrane and gas bags. Preliminary analysis of N_2, O_2, Ar, CO_2, C_1-C_4, H_2 and H_2S, show the following patterns: (a) Gases along the Dead Sea Rift exhibit high CO_2 concentrations (>60% vol.). (b) The fast-infiltrating Yarkon-Taninim aquifer was found to be relatively aerated with high concentrations of atmospheric gases, such as N_2 and Ar. (c) Several wells in the costal aquifer were shown to contain high concentrations of CH_4 (>60%. vol). These results suggest different hydrogeological systems can be characterized based on the major gas composition. Further research is underway in order to determine the amount of gases and composition within additional groundwater systems, their spatial variability from the upstream recharge areas to the downstream outlets and the phase of the gases at the subsurface.

Characterization and Quantification of Uranium in Soil Phosphate Minerals Using Remote Sensing Methods

Berman A. (1), Ganor J. (1), Blumberg D.G. (1), Friedlander L.R. (1)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

adiberm@post.bgu.ac.il

This study aims to identify and investigate the spectral component that characterizes U minerals as part of phosphate minerals in the Negev region of Israel, and to examine the variation of this component as a function of U concentration in the rock. Additionally, the study will investigate the potential use of this spectral component for detecting and characterizing U in soil via remote sensing.

The methods used in this study included a set of spectral and geochemical analyses on 70 rock samples collected near the Zohar Ridge, located near Arad. These samples were characterized for their chemical element and mineral composition using X-ray fluorescence (XRF) and X-ray diffraction (XRD) instruments. An average concentration of 1400 parts per million (ppm) of U was found in the various phosphate samples, which appear in the rock in four main minerals: Uranophane-beta, Carnotite, Meta-autonite, and Urano-flouroapatite.

Furthermore, the spectral signatures of these samples characterized in the visible light, near-infrared (NIR), and shortwave-infrared (SWIR) regions, ranging from 350-2500 nm, using an Analytical Spectral Devices (ASD) device. Since the identification of U-bearing minerals from a rock sample using remote sensing is a complex process due to the large number of soil components that must be taken into account, the development of the method for detecting U by means of remote sensing will include advanced data analysis and processing techniques such as Linear and Nonlinear Spectral Unmixing, which will allow the extraction of the spectral component characteristic of U minerals from the general rock signature.

This research's success can improve the efficiency and speed of locating U and other materials on the ground, forming a basis for developing future technologies, image processing methods, and dedicated satellite sensors.

Extremely fast salt shattering of gravels along the hyperarid shorelines of the Dead Sea

Boroda R. (1), Mushkin A. (1), Lensky N (1,2), Ben Moshe L. (1), Eyal H. (1,2), Rivka A. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem, 9692100

[2] The Freddy & Nadin Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

borodaronen@gmail.com

Salt shattering in arid environments is commonly considered to be one of the more effective rock weathering mechanism. However, our understanding of salt shattering rates and their drivers in their natural field settings remains loosely constrained.

The fast drop of the Dead Sea level exposes a sequence of abandoned shorelines showing extremely rapid salt shattering of gravels initiated within 1 year. These rates are in orders of magnitude faster in comparison to other locations in the hyperarid Negev desert and thus the shattering process can be followed. The aims are to define and quantify the environmental conditions triggering salt shattering specifically the source of humidity which drive salt shattering while moisture is limited.
The field site for this study is Nahal Ogg abandoned shorelines since 2004. Because of limited moisture in this extremely arid environment, we hypothesize that salt shattering of natural rocks in hyper-arid settings is linked to relative humidity (RH) fluctuations in the atmosphere and at the topsoil. The RH fluctuations trigger repeated cycles of salt deliquescence/crystallization due to the hygroscopic behavior of salts. For example, a boulder located on a shoreline that has been abandoned since 2020, features a crack that propagated ~5 cm during a 47-day period. Measurements of temperature and RH at that period revealed that deliquescence conditions were achieved >20 times during that period in which the crack in the boulder extremely fast propagated.

These extraordinary cracking rates allow us to establish for the first time quantitative empirical linkages between direct, independent observations and measurements of: a) Salt deliquescence events in cracks; b) monitoring shattering activity by time-lapse photography and Acoustic Emission measurements); c) continuously measuring environmental drivers, such as surface and subsurface temperature, and RH. This study will result in determining the environmental conditions needed for the shattering process in deserts.

Multi-scale aeromagnetic UAV based survey for detecting magmatic and tectonic features: A case study from the Hula Valley, Dead Sea Fault

Buzaglo-Yoresh E. (1), Agnon A. (1), Gavazzi B. (2)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] ENEREX, Nancy, France

eldar.buzagloyor@mail.huji.ac.il

This study focuses on the transition zone between the Hula Valley and the slopes of the Golan Heights, straddling the ‘Azaz fault. The geological features are not known at a precise local scale due to sediment coverage on the Hula side and complex extrusion-erosion history of the Golan side.

Following technological advances in recent years, drones are used for near-surface airborne magnetic surveys, filling the gap between aircraft-based and ground-based surveys. This work presents an innovative multi-scale aeromagnetic study for exploring the geological characteristics in the Nebi-Huda vicinity at the Golan foothills in the eastern Hula Valley.

The survey is based on the geological map of Mor (1987), Mount Odem. We chose to focus on the Nebi-Huda site due to the exposure of several interesting geological types, with unknown protractions with depth in the basin. The main and most prominent is the ‘Azaz fault, a secondary branch of the boundary between the Arabian and African plates. Southeast of ‘Azaz, two additional minor faults crop out on the Golan Heights.

The fault shifts the Hula block left-laterally relatively to the Golan Heights (on the Arabian plate). The fault also uplifts the cover basalt, including the Ein-Zivan basalt, on the east. The latter flowed in a ravine incised in the former, opposite the Hula-filling in the west. East of ‘Azaz Fault, the massive Ein-Zivan basalt flowed down an ancient channel (part of it still drains a runoff) and “disappears” where it meets the fault.

The study results reveal a new NS limit interpreted as a buried fault system parallel to the ‘Azaz Fault on its west. Secondary contacts within the basin suggest a complex prism-shape stepping toward the basin. Also, the magnetic maps, combined with paleomagnetic data, allow a more detailed mapping of the basaltic flows under the sediment cover in the Nebi-Huda region.

Characterizing Mg isotopes behavior in coastal aquifers in the context of groundwater flow time scales

Cohen-Peretz A. (1), Shalev N. (2), Gavrieli I. (3), Kiro Y. (1)

[1] Department of Earth and Planetary Sciences, Weizmann Institute of Science, Rehovot 7610001, Israel

[2] Department of Earth Sciences, Institute of Geochemistry and Petrology, ETH Zürich, Clausiusstrasse 25, 8092 Zürich, Switzerland

[3] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

anaelcoh@gmail.com

Although it has long been assumed that groundwater-derived solute fluxes in the ocean are static and subordinate to riverine fluxes in marine isotope budgets, recent studies have highlighted their significant role in ocean chemistry. The chemical composition of these solutes is affected by mixing between fresh and saline water bodies and water-rock interaction, which depends on intruding seawater residence time and flow paths. This study investigates the behavior of Mg isotopes governing different coastal aquifers in the context of groundwater flow and water-rock interaction time-scale using the Nitzanim coastal aquifer in Israel and the shallow aquifer at the Indian River Bay (IRB) in Delaware, USA, as case studies. The IRB is a shallow estuary on the Atlantic Coastal Plain comprised primarily of Pleistocene sands, with some silt and clay. The behavior of major cation concentrations in groundwater samples from our two study areas represents a non-linear mixing between fresh, meteoric groundwater and local saline seawater. The only noticeable difference was that Mg^{2+} concentrations in the carbonate-rich silicate aquifer at the Nitzanim Nature Reserve were conservative (Tsumi 2021).

The Mg isotope compositions ($\delta^{26}Mg$ values) of coastal groundwater demonstrate the importance of groundwater discharge for the magnitude and isotope composition of terrestrially-derived solute fluxes to the ocean. Preliminary $\delta^{26}Mg$ data from the Nitzanim study area (ranging from -1.43 to -0.82 ‰) is mostly depleted compared to the conservative mixing line. It shows values similar to seawater near the coast, while others are more negative away from the coast, towards the fresh, meteoric end member. In contrast, the $\delta^{26}Mg$ data from the IRB (ranging from -0.89 to -0.78 ‰) mostly overlaps (within a margin of error) the average $\delta^{26}Mg$ value of seawater, probably due to Mg contribution from both ^{24}Mg-enriched carbonates and ^{26}Mg-enriched silicates, bringing the freshwater end-member to a $\delta^{26}Mg$ value similar to seawater.

Multi-segment earthquake clusters in the Bet-Kerem fault system, northern Israel, as revealed from 36Cl exposure dating

Dawood R. (1,2), Matmon A. (1), Siman-Tov S. (2)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

dawoodrawi@gmail.com

The ^{36}Cl Cosmogenic exposure dating method is used to constrain fault activity over several earthquake cycles. Recovering the seismic history of multiple fault segments within a fault system provides a spatiotemporal framework for the fault activity across the system. This kind of data is essential for a better understanding of how faults interact during seismic cycles and enable better insight into how earthquakes behave in fault systems. The Bet Kerem fault system, Galilee, northern Israel, is a good example for such a system. Fault scarps, reaching up to 10-meter height, are abundant across the system. These scarps enable the recovery of the seismic exhumation history using the ^{36}Cl exposure dating method. The Holocene exposure history of Nahef-East fault, a segment located at the center of the system, was previously determined using ^{36}Cl dating method. To understand the temporal and spatial distribution of surface rupture among the neighboring segments, we sampled two adjacent fault segments, the Sajur and Deir Al-Assad segments, and remodeled the Nahf-East segment. Results indicate that the three faults were active simultaneously during 5 distinguished periods, during each a minimum of 1.2 meters of surface rupturing occurred. The synchronized activity and the total amount of surface rupture at each activity period, indicate that each period included a cluster of at least two large multi-segment earthquakes. The results show that the Bet Kerem seismic events fit the world-wide accepted rupture length-magnitude ratio. The results also indicate a recurrence interval between clusters of 3.5 – 4.5 ka. and the existence of a seismic super cycle with a recurrence interval of ~13 ka.

Seismic data processor

Dror O. (1)

[1] Geophysical Institute of Israel, P.O.Box 182, Lod 71100, Israel

ozdror@gii.co.il

Two case studies of the seismic refraction method in the South Negev, combined with other geophysical methods are shown. The aim of the projects is to investigate depth to bedrock in two different environments and scales. In the Shaharut project, both seismic refraction and electrical resistivity methods were used. In the bottle neck (Paran) project, seismic reflection and refraction were used. The results from the refraction study are discussed. Both acquisition schemes included large number of shots and consequently large amount of data. I chose the method of Travel time tomography to cope with the large data set, while other methods need an extensive selection and definition of direct and refracted wave trains, tomography can handle the entire dataset. One of the drawbacks of the method is a resulting gradual velocity profile, that can potentially miss the purpose of defining a sharp transition between layers. To increase the sharpness of the transition, a vertical scaling was used. While both projects share the same principal objective, the scales were different: Shaharut project had 6 lines of appx. 250 meters and Bottle neck (Pharan) had 3 long lines (2-3 km) and 5 short lines (200-400 m). The processing included over 150,000 manually picked first arrival times. This project also demonstrates the ability to use open-source programs, specifically PyGIMli – a python-based modeling and inversion module. The results show the structure of the bedrock and help establish drilling plans for further investigations.

BGU LaserChron: A New Laser-Ablation ICPMS Laboratory for Geochronology, Trace Elements, and Isotope Analysis

Elisha B. (1,2), Katzir Y. (1), Haviv I. (1)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Ilse Katz Institute for Nanoscale Science & technology, Ben-Gurion University of the Negev

brelisha@bgu.ac.il

A new Laser Ablation - Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS) lab was recently founded in the Department of Earth and Environmental Sciences at Ben-Gurion University. The lab incorporates an Applied Spectra RESOlution-SE 193 nm excimer laser with Nu Instruments Attom ES Sector-Field single collector ICPMS, a setting optimized for in situ analysis of solids. The RESOlution laser system enables efficient ablation of small sample areas, ranging from a few microns to several hundred microns, while the ICPMS offers high sensitivity and mass resolution for accurate measurements of trace elements and isotope ratios. Our LA-ICPMS system allows for simultaneous multi-element analysis, for example, trace elements and U–Th–Pb isotope abundances. This enables to decipher the chronological and thermal history of rocks (Petrochronology). The system can also measure nearly the entire periodic table in a fast scan mode, a capability which is suitable for many environmental and paleoclimate studies.

The use of matrix-matched standards is crucial for achieving accurate results, especially for geochronology and trace element analysis. A large set of matrix-matched standards is available in our lab for multiple petrologic and geochemical studies, including zircon, monazite, calcite, and other reference materials. Ongoing projects include (1) coupled U-Th-Pb isotope and RRE content measurements in multiple chronometers to track the thermal evolution of batholiths and metamorphic sequences with time; (2) U-Pb dating of calcite to provide insight on the timing of crystallization, diagenesis, and denudation of carbonate rocks; and (3) Mg/Ca thermometry in foraminifera to reconstruct past ocean temperatures. These case studies demonstrate the capabilities of the lab and its potential to provide valuable geochronological and geochemical information on a variety of geological processes.

New constraints on the temporal evolution of the Hatira Monocline

Fisch G. (1,2), Granot R. (1), Marconato S. (1), Eyal Y. (1), Abramovich S. (1)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

fischg@post.bgu.ac.il

The Syrian Arc fold belt comprises a ~1000 km-long series of elongated asymmetric anticlines and synclines that straddles the northeastern edge of the African continental lithosphere. Previous investigations indicated that folding was initiated in the Turonian, followed by an intense folding activity that ended in the Maastrichtian, and an additional significant phase during the Miocene. The formation of the arc was linked to the closure of the Tethys Ocean, although the closure started earlier than the Turonian and continues up until today. Despite being the focus of numerous investigations over the past century, the exact timing of folding is still clouded with uncertainties, and therefore the specific dynamic triggers that have driven the formation of the arc are thus still poorly defined.

Here we show preliminary structural and dating results from the southeastern flank of the Hatira Monocline, near Givat Mador, where a relatively complete and well-preserved section documents the formation of the monocline. We examined the geometry of the bedding planes at high resolution, from the Turonian up to the Early Eocene, and dated them based on detailed biostratigraphic examination of different micropaleontological groups. Our results suggest that folding initiated at the Late Turonian, at the latest, followed by a sharp pulse of folding that took place at the Middle Campanian, after which a gradual relaxation in folding lasted up to the end of the Maastrichtian. We identified a second folding pulse occurring between the Late Paleocene and the Early Eocene. These results, while yet to be spatially examined throughout the arc system, will be used to identify the specific geodynamic triggers that led to the formation of the arc.

Combining advanced aerial geophysical methods for mapping subsurface structures along the Dead Sea fault

Frid M. (1), Frid V. (2)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Department of civil engineering, Shamoon College of Engineering, Ashdod

geoscopegpr@gmail.com

This study aims to investigate the potential of combining aerial geophysical methods for mapping subsurface structures along the Dead Sea fault. The primary objectives of this research are to develop an efficient and accurate method for mapping subsurface structures using a combination of geophysical instruments and drones, and to assess the potential of this method for providing detailed information about subsurface structures. The research will utilize various geophysical instruments such as ground penetrating radar (GPR), magnetometer, spectrometer, and Lidar, all attached to drones for aerial underground survey. Ground penetrating radar is a non-destructive geophysical method that uses radar waves to penetrate the subsurface and produce images of the subsurface structure. It is widely used for mapping subsurface structures such as buried archaeological sites, sinkholes, and underground utilities. The magnetometer is a geophysical instrument that measures the strength and direction of the Earth's magnetic field. It can be used to locate buried metal objects and map subsurface structures such as buried archaeological sites and sinkholes. A spectrometer is an instrument that measures the spectrum of light emitted or absorbed by a substance. It can be used to identify the composition of subsurface materials and map subsurface structures such as mineral deposits and buried archaeological sites. Lidar is a remote sensing technique that uses laser light to measure the distance to the surface of the Earth. It can be used to map subsurface structures such as buried archaeological sites and sinkholes by measuring the elevation of the surface. The combination of these geophysical instruments and drones will allow for a more efficient and accurate mapping of subsurface structures. The drones will provide an aerial perspective, while the geophysical instruments will provide detailed information about the subsurface structure. This research will assess the potential of this method for providing detailed information about subsurface structures along the Dead sea fault, and will contribute to the development of more efficient and accurate methods for mapping subsurface structures.

X-ray Techniques for Whole Sample Characterization

Friedlander L. (1)

[1] Ilse Katz Institute for Nanoscale Science & technology, Ben-Gurion University of the Negev

friedlal@bgu.ac.il

X-ray Diffractometry (XRD) is a widely used technique in the geological sciences. However, advances in XRD optics, automated scan parameter settings, in-situ high temperature measurements; and the ability through high-volume data storage and analysis to combine XRD with imaging and other advanced techniques, enables XRD to anchor a suite of advanced sample characterization methods for whole sample analysis.

The expert combination of mineralogical and elemental composition along with 3-dimensional sample characterization techniques, such as computerized tomography (CT), is changing today's standards of sample characterization and investigation in geology and geochemistry. In particular, the ability to render in 3D whole, bulk samples via techniques like micro-CT (benchtop scale CT) and then, later, to characterize the samples geochemically by a cominbation of XRD, EDS, XRF and other techniques – provides a unique picture of the in-situ distribution of geochemical phases inside a sample. Understanding this provides useful insights into the processes of sample formation, alteration, and geochemical history.

I will present examples of the use of CT-generated 3-dimensional imaging for geologic, soil, and engineering samples, XRD analysis coupled with petrographic analysis in understanding ceramic technology development in archaeology, and advanced applications of XRD, including in-situ high-temperature XRD measurements, for materials analysis and the identification and quantification of unknown mineralogical samples in geochemical research. This will provide useful information for researchers wishing to know more about structuring the process of conducting advanced sample analysis, what information can be extracted from different combinations of results, and what each technique adds to the characterization of a geologic sample in its entirety.

Ichnotaxa of the Bet Zayit trace fossils

Friedman R. (1), Calvo R. (2), Mushkin A. (2), Rabinovich R. (1)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

roee1509@gmail.com

Sixty years ago, the publication by Avnimelech entitled "Dinosaur track in the Judean Hills" detailed numerous tracks which were mapped and partly assigned with known dinosaur genera, based on probable resemblance. The iconic locality described in that publication was not studied since then. We returned to the locality with new research tools in order to study the various tracks created by several Ichnotaxa (a term used to identify and distinguish morphologically distinctive ichnofossils, namely trace fossils).

In the current study Multiple High-Resolution LiDAR scans (~50 pts/m^2) obtained with a ground-based scanner (Leica BLK360) were fused together to produce a 5 mm/pixel micro-topographic model of the 200 m^2 study site at Bet Zayit. The sub-millimeter vertical accuracy of the micro-topographic surface model allowed us to identify and map at least 200 prints that align along 9 distinguishable paths. Then photogrammetry was applied on selected traces. All this was coupled with detailed field measurements and morphological observations.

While studying the locality new tracks were observed, enlarging the study area and adding to the identified Ichnotaxa. Surveys were conducted based on the reconstruction of the geological setting using GIS modeling to predict other potential similar exposure. The results were analyzed on a broader geo-geographical basis of the Albian period along the Gondwanan continent.

Finally, we will discuss the importance of Ichnology to geological-paleontological research in Israel.

A new approach to earthquake loss assessment - "Single Structure Method"

Frucht E. (1), Levi T. (1), Avirav V. (1), Salamon A. (1), Calvo R. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

eranfrucht@gmail.com

History and Previous research have demonstrated that communities residing in areas adjacent to the Dead Sea Fault are exposed to a high level of risk from earthquakes. To minimize the potential for damage and losses in future events, it is essential to establish risk models and implement advanced methods for evaluating damage and potential losses. In this study, the Hazus software, a nationally applicable standardized methodology for estimating potential losses, is utilized for estimating losses resulting from earthquake hazards.

Generally, it is common to divide areas at risk into statistical units, known as Census Tracts, and estimate loss of life and damage to buildings within each unit. This generic approach allows for statistical estimation of damage to clusters of buildings and addresses the lack of information about the characteristics of individual buildings, making it particularly useful for conducting damage scenarios at a national level or in large risk areas. However, when detailed and high-quality information about the inventory of buildings and geological conditions in a given Census Tract is available, it may be beneficial to adopt the Hazus Advanced Engineering Building Module (AEBM), a new approach that assesses damage to individual buildings.

This study introduces the use of the "Single Structure Method" in Israel, based on the AEBM model. The findings and tools developed in this work have the potential to improve preparedness for future earthquake losses.

Environmental Isotopes shed light on Ayyalon Cave's Ecosystem: The Use of Internal Energy (Chemolithoautotrophy)

Frumkin A (1), Naaman I. (1,2)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem

[2] GeoQuEST Research Centre, School of Earth and Environmental Sciences, University of Wollongong, Wollongong, New South Wales, Australia.

amos.frumkin@mail.huji.ac.il

The stable isotopic composition of chemolithoautotrophic cave ecosystems is known to differ from epigenic caves. Here we show that in addition to the stable isotopes characteristics, dead carbon (devoid of ^{14}C), is utilized and transferred throughout this ecosystem, rendering it unsuitable for radiocarbon dating. The connectivity of the Ayyalon Cave ecosystem with the surface is studied, along with its sources of energy and carbon, as well as the interconnections between its constituents. We use isotopic evidence to show that its ancient resilient ecosystem is based on an underground food web depending on rich biomass production by chemolithoautotrophic nutrient supplies, detached from surface photosynthesis. Carbon isotopic values indicate that: (1) the microbial biota use bicarbonate from the groundwater (23.34 pMC [per cent of modern carbon]) rather than the atmospheric CO_2 above the water (71.36 pMC); (2) the depleted ^{14}C signal is transferred through the entire ecosystem, indicating that the ecosystem is well-adapted and based on the cave biofilm which is in turn based on groundwater-dissolved inorganic carbon. Incubation of Ayyalon biofilm with 14C-labelled bicarbonate indicates uptake of the radio-labeled by sulfur-oxidizing proteobacteria Beggiatoa, suggesting that these sulfur-oxidizing microorganisms use the water-dissolved inorganic carbon for chemolithoautotrophic carbon fixation. Organic matter in the cave is much lighter in its stable nitrogen and carbon isotopes compared with respective surface values, as expected in chemolithoautotrophic systems. This evidence may be applicable to subsurface voids of ancient Earth environments and extraterrestrial systems.

High-resolution chemostratigraphy of the Upper Cretaceous Mancos Shale using an Itrax µXRF core scanner

Gabriel J. (1,2), Reinhardt E.G. (1), Bhattacharya J.P. (1), Turkistani M.N. (1), Genovese C. (1),

Páez A. (1)

[1] School of Earth, Environment & Society, Faculty of Science, McMaster University, Hamilton, Ontario L8S4K1 Canada

[2] The Dr. Moses Strauss Department of Marine Geosciences, Leon H.Charney School of Marine Sciences, University of Haifa

jgabriel@campus.haifa.ac.il

Sedimentary deposits of the ancient geological record are usually interpreted at greater than 50ka resolution due to limitations at the sub-sampling stage. In recent years, core scanners with the ability to measure at far higher resolution have provided an opportunity to overcome this, but also introduce new challenges with regard to handling and interpreting the large multi-component datasets that they produce. In this study, an Itrax µXRF core scanner was used to collect elemental data at 500-µm sampling resolution from marine sedimentary rocks, including long intervals (10 s of meters) of visually homogeneous dark grey mudstone, of the Western Interior Seaway of North America. The elemental data were analysed using an unsupervised, hierarchical clustering algorithm that produced distinctive chemofacies that were associated with altering depositional environments. Not only did the chemofacies showcase the elemental variability between each depositional environment, they also provided the differentiation within them, and were used to group each observation according to its proximity to shoreline (Fe/Ca), and weathering intensity (Ti/K) and redox conditions (V/Cr) at the sediment-water interface. The high-resolution chemostratigraphic profiles reflect and detail transgressive-regressive cycles of the WIS through the early Upper Cretaceous (Cenomanian-Santonian) on Milankovitch-scale frequency. Maximum regression was defined by peaks in the Fe/Ca ratio and total siliciclastic input (Ti+K+Si) while maximum transgression was defined at troughs in those proxies; the redox signal (V/Cr) was roughly 90° out of phase for these cycles. By accurately identifying the position where regression changes to transgression (i.e., a flooding surface) the cycles in these distal mudstones can be more accurately correlated to sequence-stratigraphic frameworks developed based on near-shore sandy sequences. The combination of detailed chemofacies and high-resolution chemostratigraphy will improve the ability to correlate sedimentary sequences both intra- and inter-basinally, particularly in more homogeneous mudstones, thus providing a more complete reconstruction of basin evolution.

Geology for All: Overcoming Challenges in Making Earth Sciences Accessible. A Case Study of Building a Geological Time Trail on the Rim of the Ramon Crater

Ganz N. (1), Avriel-Avni N. (1), Babad A. (1), Avraham D. (2), Finzi Y. (1), Ben-David. R (3), Avni Y. (4),

Ziv S. (5)

[1] Dead Sea & Arava Science Center, Mitzpe Ramon branch

[2] Kibbutz Hatzerim (former Ramon geologist)

[3] Roved, geology and social consultant Ltd, Givat Yeshayahu 128 P.O. 128 9982500

[4] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem, 9692100

[5] Wandering ltd., Tel-Aviv, Israel

ganzim1@gmail.com

Making the geology science, accessible to a wider audience, including non-experts and individuals with disabilities, is a challenging task. The difficulties include: the complexity of the subject matter, with emphasis on the geological time, which is considered a particularly challenging aspect for students and non-geologists. The case study of building a geological time trail on the rim of the Ramon Crater in Israel was used to demonstrate how these challenges can be overcome through interdisciplinary (geologist, educators and end-users) planning and design. The trail designed to be inclusive and accessible for all visitors. Additionally, the trail provide educational and interactive features that makes the geological information more relatable and engaging for visitors. The presentation will also discuss the potential for similar projects in other locations and the importance of making geology accessible to all.

Dead Sea Stromatolite Reefs: A testing ground for automated detection of life forms and their traces in harsh environments

Gedulter N. (1), Thomas C. (2), Ariztegui D. (2), Levin N. (3), Agnon A. (1), Ben Dor Y. (4)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Department of Earth Sciences, University of Geneva, Rue des Maraichers 13, 1205 Geneva, Switzerland

[3] Department of Geography, The Hebrew University, Jerusalem, Israel

[4] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

nuphar.gedulter@mail.huji.ac.il

The Dead Sea is one of the most saline lakes on Earth; therefore, it is an extreme environment where only a limited number of organisms manage to survive. Nevertheless, active and diverse microbial communities flourish at several locations along its modern coastline. In the geological past, similar microbial-rich environments had left their mark as fossilized reefs (i.e., stromatolites). Due to their primordial nature and ability to thrive in extreme environments, stromatolites are thoroughly investigated to understand the initial appearance of life on Earth and potentially on Mars and other planets. One of the main foci of interest with respect to these stromatolites is their possible analogies with potential microbialites and fossils on Mars. Archean stromatolites on Earth may be very similar to the ancient, heavily weathered and contentious Martian equivalent.

Pioneering studies since the 1980's have established microscopic patterns and indexes for interpreting the Dead Sea fossils in terms of biological and sedimentological processes, reflecting primitive life and their corresponding environmental record.

In this study, in-situ and hyperspectral remote sensing methods are integrated with geochemical measurements in order to characterize the inherent bio-signatures of stromatolites. We evaluate point spectroscopy and develop a spectral classification scheme with machine-learning approaches. Integrating Machine Learning models over our hyperspectral dataset have facilitated the detection and differentiation of stromatolites from adjacent bedrock rock.

Further mineralogical and chemical compositions are investigated in order to better understand the formation and preservation processes involved in fossilized stromatolites. We additionally analyzed modern microbial communities from ponds supplied with fresh-water by seepage on the retreating shores of the Dead Sea.

The observations focus on aragonite forming-microbial mats, more likely to build-up fossil stromatolites. This effort addresses questions such as: How the bioactivity of these organisms may lead to the formation and the preservation of bio-signatures and textures in fossil stromatolite reefs?

Methanogenesis characterization in thawing permafrost

Gerera Y. (1), Pellerin A. (1), Russak E. (1), Sivan O. (1)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Institut des sciences de la mer de Rimouski, Rimouski, Québec G5L 3A1, Canada

yardenge@post.bgu.ac.il

Thermokarst lakes are hotspots for emissions of the greenhouse gas methane. They are formed by permafrost soils thawing in the arctic circle and contain high content of organic matter due to the freezing conditions the original soil was kept in since the last ice age (18,000 years). The thawing allows the microorganism population to grow and consume the organic matter which becomes available for methane production. The emitted methane contributes to the greenhouse effect and creates positive feedback. Today, our knowledge about the thermokarst lakes is lacking and the mechanisms, which produce the methane in these lakes are uncertain. The goal of my research is to understand what are the controls on the onset of methanogenesis and to quantify the methanogenesis rates constraining their depth distribution, pathways, and response to warming. To achieve these goals, fieldwork and experimental methods were used. Specifically, two types of thermokarst lakes in central Alaska were studied: a young, actively expanding lake and an older lake that is no longer expanding. Pore water profiles, as well as various sediment parameter profiles, were performed to gain a broad understanding of the geochemistry of the research area. Additionally, two types of incubation experiments were conducted. The first is a long-term slurry incubation experiment to study the onset of methanogenesis and its mechanisms using slurries from different permafrost thawing stages. In this experiment, I used isotopic labeling methods to follow the main pathways of methanogenesis. The second incubation experiment included sediment from different depths and spatial distributions, and the accumulation of methane with time was used to quantify methanogenesis rates. Our results indicate a higher methane production rate in the shallow part of the lake sediment, and on the edges of the lake. In addition, different methanogenesis paths were observed at different thawing stages.

Towards High Spatial Resolution Map of Grain Size Distribution Along the Israeli Continental Shelf Based on Multibeam Backscatter Data

Giladi A. (1), Kanari M. (1), Katz T. (1), Tibor G. (1)

[1] Israel Oceanographic & Limnological Research Ltd., Tel-Shikmona, P.O.Box 8030, Haifa 31080, Israel

agiladi@ocean.org.il

Grain size distribution along the continental shelf has far-reaching implications from the spread of ecological habitats to infrastructure planning and is therefore of interest to academic and governmental agencies. The spatial distribution of the grain size on the Israeli shelf is dynamic and was shown to be affected by occurrences e.g. the damming of the Nile in the mid-1960s. Conventional methods to map grain size distribution are based on sampling and interpolation for producing maps. New methods and technologies that use the backscatter intensity of multibeam mapping are developed worldwide and we are among the front runners. We apply a mathematical correction of the backscatter intensity of the RV Bat-Galim multibeam according to the grain size analysis results at known sampling locations. The resulting backscatter pattern is verified to reliably represent the seafloor characteristics to the extent that we are now able to characterize sediments in the range between silt and clay with the precision of a single Phi value and up to gravel and submerged rock surfaces. Our current goal is to apply this method to existing multibeam surveys from recent years to produce an unprecedented, detailed map of the grain size distribution of the Israeli continental shelf.

Triple PBL = place, problem and project base learning

Ginat H. (1), Avni N. (1), Keinan O. (1)

[1] Dead Sea and Arava Science Center, Kibbutz Qetura, Hevel Eilot 88840, Israel

ginathanan@gmail.com

Meaningful learning is a process in which students raise questions, research information, process information and build knowledge relevant to their personal lives and the modern age. Meaningful learning develops students' thinking capacity and creativity, teaches self-study, and encourages personal growth and social involvement. Meaningful learning occurs when it is relevant and meaningful to the students' lives. Place-based learning is an educational approach that creates meaningful learning experiences by studying the local community and environment.
Place-based learning has several advantages for students.

Students learn about their familiar and unfamiliar immediate environment, including the natural environment, in fields such as Earth sciences (landscape, water) or life sciences (fauna, flora, ecology).

Each student recognizes a problem requiring investigation, that is of personal interest. This leads to in-depth research combining field and laboratory work, and information gathering. The students acquire knowledge, skills and values relating to their local environment and community.

The chosen research project is a challenging and stimulating process that demands inquiry and perseverance. The final essay must contain components linked with place, present the existing problem and provide a solution to the issue introduced.

Research learning results in profound knowledge and improves learning and research skills. Over the past few years, our students have written research essays in a wide variety of fields in Earth sciences. For example: 1. Analysis of flood deposits in ancient copper mining caves. 2. The factors that determine the rate of growth and development of Dead Sea sinkholes. 3. Is the Southern Arava experiencing climate change?

The unique experience of the young researchers will foster their curiosity and investigatory skills. This meaningful learning experience will not only help the student in high-school but later in life as well.

Menuha Ridge in the Southern Negev: Geological aspects and unique findings

Ginat H. (1), Ragolski G. (1), Sakal E. (2), Rabinovitch R. (2), Ashckenazi-Polivoda S. (1), Avni Y. (3)

[1] Dead Sea and Arava Science Center, Kibbutz Qetura, Hevel Eilot 88840, Israel

[2] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[3] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

ginathanan@gmail.com

The Menuha Ridge lies on the western edge of the Arava Valley and rises south of the extensive ephemeral stream of Nahal Paran, acting as a dividing line between the Negev Highlands and the Southern Negev. The ridge is 17 km long and 4 km wide and constitutes a separate morphological unit from its surroundings; it is bounded in the east by the Arava Valley and in the west by Nahal Zihor.

The 1,150-meter geological cross-section exposed in the Menuha Ridge and its margins includes marine sedimentary rocks from the Lower Cretaceous (Samar Formation) to late Eocene periods (Ketziot Formation). Terrestrial sedimentary rocks and alluvium and spring sediments from the Miocene, Pliocene and Pleistocene are also exposed.

Following marine regression, the area experienced significant stream erosion, mainly during the Oligocene period. The ridge developed as an anticlinal structure during the late Oligocene, and the erosion continued until the early Miocene period. After that, faulting occurred at the edge of the ridge. Menuha Ridge is intersected by several east-west and north-south faults, some of which directly impact the area's relief and landscape. The eastward tectonic tilt that occurred during the Middle Pleistocene, formed the current channel of Nahal Paran Unique findings include: 1. Bones and teeth of a 13 m long Pliosaurus (marine reptile), signifying the beginning of an upwelling current system in the area at that time. 2. Miocene Magma chamber, probably related to the early stages of the development of the Dead Sea Rift.

Constraining the provenance of the Oligocene-Miocene siliciclastic section in the Levant Basin: detrital zircon and heavy mineral assemblage investigations in the “Tamar Sands” and other sand intervals

Glazer A. (1), Avigad D. (1), Morag N. (2), Gerdes A. (3)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[3] Institut für Geowissenschaften Petrologie und Geochemie, Goethe-Universität Frankfurt, Frankfurt am Main, Germany

adar.glazer@mail.huji.ac.il

The Levant Basin is surrounded by continental areas that were uplifted during the Oligocene-Miocene. On its southern and eastern sides, it is flanked by the wide Red Sea domal structure, whereas in the northeast it is bordered by the Tauride-Zagros orogenic belt. Coeval with the rise of its surroundings, a ~3 km-thick siliciclastic section was deposited in the Levant Basin. To constrain the provenance of the siliciclastic section we investigated detrital zircon U-Pb-Hf and heavy mineral assemblages in sandstones retrieved from Myra-1, Dolphin-1, Leviathan-1, and Karish North-1 boreholes whose stratigraphy will be unveiled in this talk. Our investigations reveal a preponderance of Neoproterozoic and older zircons with mostly negative εHf values. This U-Pb-Hf pattern indicates that the studied sediments were mainly reworked from Paleozoic-Mesozoic sandstones of Afro-Arabia with variable derivation from the juvenile basement of the Arabian-Nubian Shield. Comparison of the detrital signal in various stratigraphic levels of the Levant Basin shows that Early Oligocene and Early Miocene intervals, including the “Tamar Sands”, contain a large proportion of pre-900 Ma zircons, a small proportion of Neoproterozoic zircons with juvenile εHf signal, and abundant detrital apatite peloids. Resembling Miocene clastic sequences in Israel, these characteristics are taken by us to indicate a dominant provenance in the Arabian side of the Red Sea. Conversely, Late Oligocene-lowest Early Miocene and Middle-Late Miocene intervals contain a mild proportion of pre-900 Ma zircons, a larger proportion of Neoproterozoic zircons with juvenile εHf signal, and scarce Mesozoic-Cenozoic zircons. Resembling Nile Delta sediments, these features point to a dominant provenance in NE Africa. Overall, we suggest that the Levant Basin was fed by temporally varying proportions of sediments derived from Arabia via the Levant continental margin and from NE Africa via the Nile Delta. Detrital contribution from the Eurasian side of the Eastern Mediterranean was not recognized.

Quantifying Holocene eastern Mediterranean hydroclimate using cave and lake records

Goldsmith Y. (1), Cohen O. (1), Stein M. (1,2), Torfstein A. (1,3), Kiro Y. (4), Kushnir Y. (5), Bartov Y. (6), Ben-Moshe L. (2), Frumkin A. (1), Lenski N. (2,1), Keinan J. (1), Gonen L. (1), Enzel Y. (1)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100

[3] Interuniversity Institute for Marine Sciences, Eilat 88103, Israel

[4] Department of Earth and Planetary Sciences, Weizmann Institute of Science, Rehovot 7610001, Israel

[5] Lamont-Doherty Earth Observatory of Columbia University, 61 Rt. 9W, Palisades, NY 10964, USA

[6] Mosestro Exploration, Shilat 7318800, Israel

yonig@mail.huji.ac.il

The eastern Mediterranean region is considered a climate change "hot spot", where climate models predict a rainfall decline in the upcoming decades due to global warming. Reconstructing the long-term natural climate variability of this region over the recent past provides the basis for understanding the severity of future changes in comparison to natural variability and help identify the potential forcings that might govern these changes. Here, we combine lake-level data of the Holocene Dead Sea with $\delta^{18}O$ records from four caves in the Middle East (Jeita in Lebanon, Soreq in Israel, and Kuna Ba and Katalekhor in Iran) to provide a detailed history of water availability and precipitation dynamics in the eastern Mediterranean over the Holocene. For the Dead Sea record, we updated the lake-level history using: 1) new data pertaining to the high-stands of the lake derived from three cores collected in the southern basin of the Dead Sea, where mud is deposited during high-stand flooding events, 2) a re-evaluation and dating of the two major Holocene high-stand outcrops (Ein Gedi and Darga), 3) a new compilation of all previously dated Holocene lake status records, which contain 290 radiocarbon ages. For the four $\delta^{18}O$ cave records, we use a simple Rayleigh distillation model to quantify changes in cloud distillation during the Holocene across the Middle East. These caves and lake datasets agree remarkably on both the long-term Holocene trend and the short-term centennial to millennial changes. Both records show wet, yet highly variable conditions during the early (10-6 ka) and late Holocene (3.1 ka – ^{19}th century), and a mostly dry middle Holocene (6 – 3.5 ka). Thus, these records provide a new unified, complimentary and comprehensive view of hydroclimate variability in the eastern Mediterranean throughout the Holocene.

Boulders transport and suspended sediment amounts during large floods in Nahal Hatzera stream, Negev Desert, Israel

Greenbaum N. (1), Schwartz U. (1), Bergman N. (1), Lekach J. (2), Mushkin A. (3), Zituni R. (1), Zohar M. (1), Porat N. (3)

[1] University of Haifa, 199 Aba Houshi Ave., Mt. Carmel, Haifa 3498838

[2] Hebrew University of Jerusalem, Mt. Scopus Jerusalem 9190501

[3] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100

noamgr@geo.haifa.ac.il

Measurements of sediment transport in desert streams are rare, especially for boulders entrainment. The present study documented boulders that were transported during large documented flood and together with a 30-years record of suspended sediment accumulated in a small reservoir at a small dammed tributary (7.3 km^2), analyzes total sediment transport in the hyperarid, ungauged Nahal Hatzera ephemeral stream (45 km^2), which drains the Makhtesh Hatzera Erosion Cirque.

The 2004 flood (peak discharge 470 m^3s^{-1}, recurrence interval 120 years) transported 0.85–2.1 m concrete boulders and natural boulders. EDM and drone air-photographic surveys documented the geometry of the study reach and the location of boulders. Flood slackwater deposits established a 600-year paleoflood record of 23 floods with peak discharges range of 200–760 m^3s^{-1}. Hydraulic analysis provided discharges and hydraulics along the study reach, and velocity, shear stress and stream power for each boulder. MAX program and Pearson-3 distribution were used for flood frequency analysis. Maximum velocities of the largest boulders, 8–9.2 ms^{-1}, shear stress - 437-507 Nm^{-2}, and stream power - 4222-4972 N $m^{-1}s^{-1}$, characterize medium-large floods with return period of 20–120 years, indicating that these are the most effective floods rather than the largest floods. Boulders about 2.1 m and weighing about 15 t can be transported at least once in 120 years.

The suspended sediment measurements (1964-1994) are derived from the totally filled (23,800 m^3) reservoir, - mainly sand and silt, after which it breached. The sedimentological record included 19 flood deposits with a volume range of 50 - 7800 m^3 per event and about 580 m^3 yr^{-1} (880 ton yr^{-1}), in average. The average annual sediment yield of 120 ton km^{-2} yr^{-1}, falls within the documented range - 40-180 ton km^{-2} yr^{-1} of the arid Negev streams.

Unlocking Dead Sea lake levels and mass budget beyond 70 ka BP using deep core 5017-1-A

Guillerm E. (1, 2, 3), Gardien V. (1), Waldmann N. D. (3), Brall N. (1 ,2), Ariztegui D. (4) Schwab M. J. (5), Neugebauer I. (5), Lach A. (6), Caupin F. (2)

[1] Univ Lyon, Université Claude Bernard Lyon 1, CNRS, Laboratoire de Géologie de Lyon Terre, Planètes et Environnement ; 2 rue Raphaël Dubois, Villeurbanne, France

[2] Univ Lyon, Université Claude Bernard Lyon 1, CNRS, Institut Lumière Matière; 10 rue Ada Byron, France

[3] The Dr. Moses Strauss Department of Marine Geosciences, Leon H.Charney School of Marine Sciences. University of Haifa

[4] Department of Earth Sciences, University of Geneva; rue des Maraîchers 13, Geneva, Switzerland

[5] GFZ German Research Centre for Geosciences, Section Climate Dynamics and Landscape Evolution; Telegrafenberg, 14473 Potsdam, Germany

[6] BRGM; 3 avenue C. Guillemin, 45000 Orléans, France

emmanuel.guillerm@outlook.fr

The exceptional sensitivity to climate change and the availability of long sedimentary archives make the Dead Sea a benchmark for long quantitative paleohydrological reconstructions. However, discontinuities and chronological uncertainties in the marginal sedimentary record have hampered the reconstruction of Dead Sea lake levels beyond the Last Glacial (70 – 14 ka before present, BP). Here, we use the deep core 5017-1-A to bypass these limits. First, we apply a new method, Brillouin spectroscopy on halite fluid inclusions, to obtain the lake water density along the core; we combine it with published composition data and chemical simulation to reconstruct lake volume and level. Second, we tune the chronology of lake levels from outcrops by matching it to the chronology of the deep core. The resulting lake level reconstruction spans 237 – 70 ka BP. It shows a long-term recession of the lake down to the Holocene record low. Based on our analysis, we identify two causes for this lake level fall: 1) subsidence has outpaced sedimentation; 2) massive halite precipitation events have durably increased surface water activity and evaporation and lowered the lake level. Our analysis also suggests that the dissolution of Mount Sedom salt diapir and freshwater inflows have provided to the lake about three times the mass of solute NaCl contained in the modern Dead Sea. This massive solute influx, occurring mainly during glacial highstands, strongly contributed to lowering surface water activity and evaporation and increasing the lake volume. Our results suggest that Dead Sea lake levels can only be properly interpreted in terms of climatic change if surface water activity is taken into account.

Hunting shallow karst cavities under road tunnel excavations

Gurianov S. (1,2,3), Inbar N. (1,2), Palchan D. (1)

[1] Civil Engineering Department, Ariel University, Israel

[2] Eastern R&D Center, Ariel, Science Park, 40700, Israel

[3] Electrical Engineering Department, Ariel University, Israel

danielp@ariel.ac.il

Shallow karst cavities pose a danger to the stability of road infrastructures as they can collapse years after the road is built. This is even more true in tunnels excavated in carbonate rocks as the new roads are set in “terra incognita” rather than in a relatively stable surface, and the subsurface of the tunnel may be extensively hampered with cavities. The method used by civil engineers to identify these cavities, is to drill numerous boreholes and search for bit drops. This method is not only very time consuming and expensive, but it also depends greatly on the observer alertness. Hence, applying geophysical surveys to produce continues image of the subsurface is of value. However, such surveys must be calibrated to the lithology and geology of the studied section. Here, we examined a tunnel road section, during the excavation duration, using a boring scheme and two geophysical surveys: Ground Penetrating Radar and an Electrical Resistivity Tomography. The geophysical surveys in a semi-constructed tunnel with various disturbances posed a challenge in the data reduction step, yet we see a good correlation between the various methods. Moreover, once we had calibrated the geophysical surveys to the boreholes data and information achieved during the excavation process, the geophysical subsurface image located several cavities that were not identified by the boring scheme due to poor resolution – these cavities were between two-three boreholes. Moreover, we managed to if a cavity is empty or filled with loose material. The use of geophysical surveys is proven to be more cost effective and reflecting a continues image of the subsurface, these methods should be used in hunting shallow underground karst cavities.

Limited Mediterranean sea-level drop during the Messinian salinity crisis inferred from the buried Nile canyon

Gvirtzman Z. (1,2), Heida H. (3), Garcia-Castellanos D. (3), Bar O. (1), Zucker E. (1,2),Enzel Y. (2)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[3] Gesciences Barcelona (GEO3BCN), Consejo Superior de Investigaciones Científicas (CSIC), Barcelona, Spain

zohar@gsi.gov.il

The extreme Mediterranean sea-level drop during the Messinian salinity crisis has been known for >50 years, but its amplitude and duration remain a challenge. Here we estimate its amplitude by restoring the topography of the Messinian Nile canyon and the vertical position of the Messinian coastline by unloading of post-Messinian sediment and accounting for flexural isostasy and compaction. We estimate the original depth of the geomorphological base level of the Nile River at ~600-m below present sea level, implying a drawdown 2-4 times smaller than previously estimated from the Nile canyon and suggesting that salt precipitated under 1-3-km deep waters. This conclusion is at odds with the nearly-desiccated basin model (>2 km drawdown) dominating the scientific literature for 50 years. Yet, a 600-m drawdown is ca. five times larger than eustatic fluctuations and its impact on the Mediterranean continental margins is incomparable to any glacial sea-level fall.

Rare and REE minerals in melilite-olivine nephelinites from the subvolcanic body of Mt. Tabaat, Makhtesh Ramon, Israel

Hennig H. (1), Yudalevich Z. (1), Vapnik Y. (1), Galuskina I. (2), Katzir Y. (1)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Institute of Earth Sciences, Faculty of Natural Sciences, University of Silesia, Będzińska 60, Sosnowiec, 41-200, Poland

haranhe@post.bgu.ac.il

The melilite-olivine nephelinite subvolcanic body Mt. Tabaat is part of the Lower Cretaceous volcanic suite exposed in Makhtesh Ramon, Israel. To date, it is the only occurrence of melilite in the Levant magmatic province (Yudalevich et al., 2021). It exhibits a concentric compositional zoning, characterized by core to rim decrease in the content of melilite in the olivine mela-nephelinite rock. Pegmatoidal inclusions (globules), up to 3-4 cm in diameter, occur mostly in the intermediate zone.
The pegmatoidal globules themselves are zoned. The rims comprise micro-grained mela- nephelinite, composed of clinopyroxene, olivine, nepheline, melilite and analcime, while the cores are micro- to coarse-grained nephelinite made of nepheline, sanidine, melilite (alumoåkermanite), cancrinite, aegirine and aegirine-augite, arfvedsonite and zeolites. Using SEM and EPMA, numerous minor and trace minerals were identified in the pegmatoid globules: titanomagnetite, ilmenite, titanite, hematite, pyrrhotite, pentlandite, perovskite, diopside, fluorapatite, clinochlore, phlogopite, kinoshitalite, batisite, Ca-Sr-phosphate, barite, kaolinite, clinoptilolite-Ca, thomsonite-[Ca and Na], calcite and hydrated Mg, Fe and All silicates. Discoveries of the rare zeolite fabrièsite and of the rare multi-element oxide haggertyite were made (the latter was previously found in lamproite only). Potentially new minerals may be present, including phases from the kinoshitalite (Fe-bearing) and pyrochlore groups, as well as Ba-Ti-Fe-Nb-rich phases.

Cooling of a single batch of ultrabasic magma at its final emplacement site is suggested to have produced all the mineral diversity in the rocks of Mount Tabaat. During the deuteric stage of crystallization, water-rich melts and fluids play an important role in stabilizing minerals with a high-water content, and impelling Nb and REE mineralization.

Resolving landscape evolution trends in carbonate terrains using mineral and isotope compositions of sediment

Hagbi R. (1), Goren L. (1), Eiler J.M. (2), Ryb U. (3)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev

[2] Division of Geological and Planetary Sciences, California Institute of Technology, CA, USA

[3] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem

ravidha@post.bgu.ac.il

Knick-zones in channel profiles are often interpreted to reflect a transient landscape responding to tectonic or climatic perturbation. Alternatively, they may reflect the different erodibility of lithological units within a landscape eroding uniformly. One way to approach this ambiguity is to evaluate relative sediment fluxes between different sub-basins within the drainage system. By considering these fluxes as proxies for relative erosion rates, we can place constraints on landscape evolution trends (equilibrium vs. transient landscape), and possibly relate such trends to the tectonic and/or climatic history of the region. Here, we offer to use mineral, together with carbon, oxygen and clumped-isotope compositions as a new combined proxy for evaluating provenance and relative sediment fluxes in an otherwise homogenous carbonate terrains. The applicability of this approach is tested in the Hatrurim Syncline, southern Israel, as it is expected to comprise large variability of mineral and isotope signals, between un-metamorphosed rocks of the Judea Gr., and metamorphosed Hatrurim Fm. rocks, which have undergone different grades of combustion metamorphism. Based on mineral and isotope compositions of bedrock and sediment samples from the Morag Basin (draining the Hatrurim Syncline), we compiled a mixing model aiming to identify the compositions of end-member sources and to predict the mixing-ratio for each sediment sample. Optimal sources found by the model are consistent with typical compositions of Judea Gr., and a specific composition of Hatrurim Fm. Model-predicted mixing ratios of sediment samples agree with mixing ratios estimated based on the relative exposure areas of the Judea Gr. and the low-grade facies of the Hatrurim Fm. This consistency suggests that the Morag Basin is evolving under spatially uniform erosion conditions. The slope-break knickpoints along the river long-profile are therefore interpreted as reflecting transitions between different lithologies characterized by different rock erodibility, rather than transient signals driven by tectonic perturbations.

Detecting bedload transport by seismometers and 'smart' pebbles in ephemeral streams

Hamawi M. (1), Laronne J.B. (1), Bilek S. (2), Turowski J. (3), Goren L. (1), Johnson J.P.L. (4)

[1] Department of Earth and Environmental Science, Ben Gurion University of the Negev, Beer-Sheva, 8410501

[2] Earth and Environmental Science New Mexico Tech, 801 Leroy PI, Socorro, NM 87801

[3] Helmholtz GFZ German Research Centre for Geosciences, Telegrafenberg, Potsdam, Germany, 14473

[4] Department of Geological Sciences, University of Texas, Austin, TX 78712

hamawim@post.bgu.ac.il

The use of seismic devices to monitor surface processes has sharply increased in the past decade with main advantages being low cost, simple operation, and, importantly, the ability to sense a variety of processes at a distance from the source. Seismic sensing requires identification and characterization of the frequency range associated with a studied surface process. In seismic monitoring of fluvial processes, water turbulence and bedload flux are the main natural seismic sources captured by seismometers during flow events. Previous studies undertaken in perennial stream vicinities reported distinct frequency bands of water turbulence and bedload transport impacts. The present study uses seismometers to monitor bedload transport in five ephemeral streams in the northern Nahal Beer Sheva Basin. We deployed the seismic sensors close to the study reaches (< 20 m) to detect even small transport events and fine-grained particle movements. Additionally, we placed in the studied reaches Inertial Measurement Units (IMUs) embedded in artificial rocks to independently detect bedload transport. We found that (i) the frequencies associated with water turbulence and bedload transport overlap – at least in part, (ii) these overlapping frequencies are higher (35-80 Hz) than reported in most previous studies, and (iii) the initial stage of a flood wave generates bedload movement, even when shear stresses (as commonly computed) are well below thresholds for gravel motion.

Interplay between seismic and aseismic deformation near the tip of a creeping fault: Insights from the northern Jordan Valley and the Kinneret Basin

Hamiel Y. (1), Piatibratova O. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

yariv@gsi.gov.il

Transient aseismic deformation is observed using dense geodetic measurements across the northern Jordan Valley Fault segment of the Dead Sea Fault. The fault was creeping until 2013 at a rate of 2.7±0.4 mm/yr. It stopped creeping between 2013 and 2018 and then started creeping again at a similar rate. These transitions between the creep and locked modes of deformation correlate well with the 2013 and 2018 seismic sequences that occurred near the tip of the northern Jordan Valley creeping segment. The creep caused the accumulation of Coulomb stresses near the fault tip, which promoted earthquake nucleation in this region. The 2013 seismic sequence was probably too small to release these stresses, and they were released during the 2018 seismic sequence, which allowed the fault to creep again. We suggest that seismic activity will continue to occur near the tip of this creeping segment.

Gully Headcut Retreat in Response to Biocrust Erosion

Hanegbi I. (1), Katzir Y. (1), Laronne J.B. (2), Balaban N. (3)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Department of Geography and Environmental Development, Faculty of Humanities and Social Sciences, Ben Gurion University of the Negev

[3] Nuclear Research Center of the Negev, Negev, PO Box 9001, Beer Sheva, 84190, Israel

ilayha@post.bgu.ac.il

Biological soil crusts (biocrust) in arid areas produce extracellular polysaccharides (EPS) that both stabilize and practically seal the topsoil, thus causing runoff to occur in sandy soils. Consequent runoff events produce changing erosion processes attributed to slope, drainage area, mechanism, and soil erosional features. biocrust's EPS increases aggregate stability and resistance to slaking and surface erosion. Gully head retreat mechanisms are affected by slaking and may cause high erosion rates to concern infrastructure and hazardous waste landfill management. These mechanisms highly depend on discharge and velocity of runoff in simplified models. Deriving erodibility parameters for these mechanisms for measurable biocrust features can be useful in long term modelling for soil degradation of these areas and is a main objective of the study.

Geomorphic mapping next to Yamin Plain landfill showed high variation in geomorphic patterns in relation to biocrust's features, soil texture and slope direction. We established an experimental setup to measure and monitor the time-dependent progress of gully heads in various known plausible discharges with video recordings, and measurements of cross-section and gully head features. We plan to measure erosion rates in a few different mapped geomorphic units, considering soil texture, BIOCRUST features such as NDVi, aggregate stability, infiltration rate, and surface shear resistance. Preliminary results show gully retreat in saturated collapses cycles in frequencies attributed to gully head height, soil texture, and biocrust's features and presence.

The effects of drainage reorganization on the scaling between drainage area and valley width

Harel E. (1), Goren L. (1), Shelef E. (2), Crouvi O. (3), Ginat H. (4)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Geology and Environmental Science, University of Pittsburgh, 4107 O'Hara Street, PA 15260-3332, United states

[3] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[4] Dead Sea and Arava Science Center, Kibbutz Qetura, Hevel Eilot 88840, Israel

Elhanan02@gmail.com

The width of valleys influences a wide range of disciplines, including hydrology and landscape evolution. Measuring valley width (W) can be challenging, and it is often approximated through a power-law relation with the valley's drainage area (A) as $W=kc \bullet A^{d}$. However, drainage reorganization that induces changes in the valley's drainage area distribution could violate this relationship, particularly when the adjustment of the valley width lags behind the changes in the drainage area.

To test this hypothesis, we classified 12 valleys in the southeastern Negev based on their reorganization history as undisturbed (minimally affected by reorganization), beheaded (whose headwaters were truncated), and reversed (whose flow direction was reversed). We extracted the area and valley width of each valley from DEMs and computed the best-fit d exponents and kc coefficients through linear regressions.

We found that in the beheaded valleys, the d exponents were positive but consistently lower compared to the undisturbed valleys. In the reversed valleys, the d exponents were negative, reflecting valley narrowing with an increase in the drainage area. In one reversed valley, we compared the adjustments of the channel and valley and found that in contrast to the delayed adjustment of the valley width, the channel width had widened downstream. The flows along this incised reversed channel generated significantly higher values of stream power relative to formative flows of the wide beheaded valley across the divide. This stream power difference could generate a "width-feedback" effect that promotes divide migration and contributes to ongoing beheading and reversal.

We propose that deviations in valley width-area scaling could constitute supporting evidence for identifying reorganization. Furthermore, our findings are important for valley width predictions and models of landscape evolution in regions that have experienced recent drainage reorganization.

The isotope-geochemical composition of clays separated from sediments and rocks: Toward provenance study

Harlavan Y. (1), Morag N. (1), Berlin O. (1), Ryb U. (2)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

y.harlavan@gsi.gov.il

The importance of reconstructing sediment provenance lies in many earth sciences fields of interest. Siliciclastic rock compositions represent a complicated relationship between provenance sedimentation cycle processes. These rocks are usually dominated by quartz and may include rock fragments, feldspars, heavy minerals, and clay. Although the abundance of clays is high, second only to quartz in most siliciclastics sediments, it is hardly used as a proxy for sediment origin. The current study explores the potential use of clay for isotopic/geochemical provenance studies. The present study aims to understand magmatic rock's weathering path toward clay formation. This aim is approached by utilizing three isotopic systems (Rb-Sr, Sm-Nd, and Pb-U-Th) along with clay geochemistry, and mineralogy. Moreover, the isotopic and geochemical compositions of clays separated from key siliciclastic sequences in Israel are determined first to establish their potential origin and add to a reference data set for future comparisons.

A sampling campaign in the magmatic exposures of the Elat area yielded ca. 16 samples, including saprolite and fresh rock samples. Clay was separated from these samples, and their mineralogy and isotopic composition (partial) were determined. Here we present preliminary results.

Developing a Geomagnetic Chronology for the Holocene using Archaeological Archives

Hassul E. (1), Shaar R. (1), Ben-Yosef E. (2), Vaknin Y. (2, 1), Bar Sovik L. (1), Zemach Y. (1), Agnon A. (1)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Department of Archaeology, Tel-Aviv University, POB 39040, 69978 Tel Aviv

erez.hassul@Mail.huji.ac.il

As part of the cradle of human civilization, the Levant is scattered with archaeological sites dated from the dawn of history to the present. This vast cultural record provides a unique opportunity for archaeomagnetic research that makes use of archaeological objects carefully collected from well-dated contexts. Here we present a new archaeomagnetic intensity dataset from Israel, compiled from already published archaeomagnetic contexts in the Levant and northern Mesopotamia. We compiled all these data in order to construct the Levantine Archaeomagnetic Curve (LAC) spanning from ca. 6000 BCE to 300 CE. The curve shows significant and rapid changes in the intensity of the geomagnetic field, more extreme than those predicted by geomagnetic field models. The highest values in the LAC are more than twice the value of the field today, while the lowest values are about half the intensity of the present field. The maximum rate of change is at least twice the maximum rate inferred from direct observations collected since the 19th Century. In addition, we present a detailed dataset of archaeomagnetic directions from ~1700 BCE to ~900 CE. These, together with the archaeo-intensity curve, provide a full-vector description of the field variations. The high-resolution LAC defines a brand-new chronology, which can be used to constrain ages of archaeological and geological materials. This new approach is particularly useful for periods when other traditional dating methods are less efficient, for example, when there is a plateau in the radiocarbon calibration curve.

The State of Israel's (non) assessments of earthquakes: a significant risk to national security

Heimann A. (1)

[1] The Institute for National Security Studies (INSS), Tel Aviv University

ariel@or-heimann.co.il

A devastating earthquake in Israel is not a question of "if," but only "when." The “national scenario” estimates that an earthquake is expected to cause ~7,000 deaths, ~9,000 serious injuries, and the total destruction of ~30,000 buildings. Approximately 500,000 people will be evacuated from their homes for short periods, and ~170,000 for long periods. It is obvious that the State of Israel is not prepared for this scenario. There is no specific entity in the State of Israel that is responsible and has the authority in the field of state assessments for the treatment of a major earthquake as soon as it happens, in the following days, and in the long-term. The ministerial committee on the issue of earthquakes is chaired by the minister of defense and has not met since 2014. The "Alert" system has indeed become operational, but it is used for warning only and is not used beyond that. The Home Front Command stepped in, working hard but with very limited resources available to its rescue battalions. The required actions are clear. It is necessary to understand that an earthquake is a dramatic event for the country, and an entity with adequate authority and satisfactory budget must be established. This entity should be constructed properly, so it can educate, prepare in advance, devise plans, and anticipate the needs after the earthquake. In addition, it should strengthen the rescue forces of the Home Front Command, the local authorities, and the communities in the country. It is better and safer to deal with this acute issue today, and not wait for the future.

Variable mantle CO_2 contents and magma storage depths during intraplate volcanism, Makhtesh Ramon, Israel

Hennig H. (1), Vapnik Y. (1), Katzir Y. (1), Hazan S. (1), Elisha B. (1)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

haranhe@post.bgu.ac.il

Fluids play an imperative role in most of the geological processes that occur in the crust and upper mantle. Fluids may lower melting temperatures of rocks, control volcanic eruption styles, promote mineralization, and release gases into the atmosphere. Among the many volatile species dissolved in magmas, water and carbon dioxide are the most abundant and important ones.

The volatile contents measured in volcanic rocks and glasses deviate significantly from their initial magmatic values due to fractional crystallization, degassing and post-crystallization alteration. Nonetheless, volatile contents measured in melt inclusions and fresh groundmass glass are potentially alteration- and contamination-free and may provide insight on magma origin and evolution. Since melt inclusions are shielded by the host crystal from the changes affecting the magma during ascent and cooling, they are often the only way to characterize the initial volatile contents of magmas at depth.

Here, we apply several microanalytical techniques to olivine-hosted melt inclusions from two volcanic sequences exposed in Makhtesh Roman, the Ga'ash Hill volcano and the Saharonim basalt, in order to quantify pre-degassing concentrations and mantle source contents of CO_2 and H_2O. These sequences erupted ~100 My apart and differ in composition from alkaline (Ga'ash) to sub-alkaline (Saharonim). We further constrain magma storage depth using various CO_2-H_2O solubility models. Our results indicate mid-lower crust melt storage depths (5-7 kbar) with average CO_2 concentrations of 5500 ppm and up to 11,000 ppm for both localities. However, ratios of CO_2 and highly incompatible trace elements (Rb, Ba, Nb) suggest some change in mantle source composition between the Triassic and Cretaceous magmatic events. Observed variations in other volatiles and solids (N_2, CO, CO_3, graphite, and C-H species) may also support heterogeneity in the mantle.

The Origin of the Base Cretaceous Unconformity along the Levant Continental Margin and its Relation to Inland Tectonics

Hirsch S. (1,2), Sagy Y. (1), Gvirtzman Z. (1,2)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

Stephanie.Hirsch@mail.huji.ac.il

Unconformities in continental margins are associated with two main processes. The first and more common is global sea-level fluctuations (eustasy), and the second is the tectonic uplift of the inland region leading to a steepening of the continental margin. The unconformity at the base of the Cretaceous section along the Levant margin is a prominent feature in the stratigraphic record of Israel, extending from the southern Negev through central Israel up to Mount Hermon; however, its origin is still poorly understood. In this study, we document and reconstruct the erosional event along the continental margin using seismic interpretation and well (borehole) data. In addition, we will estimate the relative contribution of the global sea level change and tectonic uplift to the resulting unconformity. Our initial findings show substantial erosion along the Jurassic shelf edge that extends on the entire slope and deepens up to 800 meters. We combined our results with previous findings from the central Negev that discovered the 150 - 200 km wide area that was uplifted and eroded, removing nearly 1000 m of sediments. We examine the main factors controlling this unique differential erosion within the continental margin and how it relates to eustasy and tectonic tilting.

A virtual reality (VR) tour to the wall in Nahal Ramon

Israeli Y. (1), Levenson Y.(1)

[1] Department of Natural Sciences, The Open University of Israel, Ra'anana, Israel

yoniis@openu.ac.il

Virtual reality (VR) technologies allow us to learn and teach geology interactively and excitingly. As a pilot for introducing VR into the geology courses at the Open University, we prepared an assignment in which the students will virtually visit the wall in Nahal Ramon. Nahal Ramon is the main stream that drains Makhtesh Ramon, revealing a natural wall that contains one of the richest and most diverse rock outcrops in Israel. The wall is literally a field school for geology. In the wall, geology students can be exposed to sedimentary, magmatic, and metamorphic rocks and textures, faults, and geomorphological phenomena - all this over a few hundred meters. We used a drone, a 360° camera, video and image editing software to prepare a VR assignment on the wall in Nahal Ramon. The assignment is developed to enhance the understanding of the geological concepts covered in the course. By using VR Headset, computer or smartphone, students can look around and see the wall from all angles, zoom in on interesting areas, mark on the virtual space, explore and interact in a new, unconventional way. Students can virtually walk along the wall to reveal geological phenomena and rocks of all kinds, cross and graded bedding, ripple marks, faults, magmatic intrusions, metamorphic aureole, xenoliths, and more. Students will explore how these rocks and formations were created and will try to explain how they have been formed and shaped by the forces of nature over time. The use of VR technology in this assignment serves as a model for incorporating immersive, interactive experiences into geology education. In the upcoming year, we plan to introduce interactive virtual tours to the geology courses at the Open University that will give students a more complete understanding of geology and an innovative and exciting experience.

Soil Development in Archaeological Stone-Wall Bench Terraces: Case Studies from NE Spain (Catalonia)

Itkin D. (1, 2), Poch RM. (3), Monger HC. (4), Shaanan U. (5), Bolòs J. (6), Crouvi O. (5), Ben Hagai N. (7), Goldfus H. (1)

[1] Department of Bible, Archaeology and Ancient Near East, Ben-Gurion University of the Negev, P.O.B. 653 Beer-Sheva, 8410501

[2] Soil Erosion Research Station, Ministry of Agriculture & Rural Development, P.O.B 30, Bayit Dagan, 5025001

[3] Department of Environment and Soil Sciences, University of Lleida - UdL, C. de Jaume II, 67 bis 25001 Lleida, Spain

[4] Department of Plant and Environmental Sciences, New Mexico State University, PO BOX 30001 Las Cruces, NM 88003, USA

[5] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem, 9692100

[6] Department of History, University of Lleida - UdL, C. de Jaume II, 67 bis 25001 Lleida, Spain

[7] Zemach E. Agriculture technologies, Zemach Regional Industries, Emek HaYarden, 1510501

itkind@post.bgu.ac.il

Agricultural terraces are the most common archaeological landforms. Despite their extensive prevalence, archaeological soils in terraces ('terrace soils') are barely studied and poorly defined. We examined soils at the front of five previously OSL dated (1200-1810 CE) terraces in northeastern Spain (Catalonia). Local natural soils are Entisols and Inceptisols in the relatively drier areas and Mollisols in the moister areas. Methods applied are field survey, standard physico-chemical analyses, and soil micromorphology. $CaCO_3$ content, P, OM and CEC show irregularly trending values throughout the profiles. Micromorphology shows abundant content of charred components throughout the profiles and slight discontinuous carbonate recrystallization, mostly biogenic. The main parent material was found to be local soil that was anthropogenically mixed and redeposited as fill material for terracing. We interpret that pedogenesis mostly involved structure development under the effect of anthroturbation and bioturbation, inheritance of aggregates from the parent (ex-situ) soil, reaggregation with little occurrence of organic matter, and low levels of lessivage and $CaCO_3$ redistribution. We suggest that pedogenesis in the inspected terraces starts chaotically, considerably faster than in natural soils, primarily influenced by terracing, the maturity of the inherited parent soil material, and relatively large depth. Thus, the early stages of terrace soil development can differ significantly from known soil maturation models, questioning paradigms of pedogenic 'time zero' and 'maturity' in terrace soils. We propose a model for the state of entropy and development of terrace soils and classify the studied soils as Archaeo-Anthroportic Xerorthents and Archaeo-Anthroportic Typic Haploxerolls, both overlying buried Inceptisols. We further argue that terrace soils should be separately classified and mapped by treating terracescapes as distinct morpho-stratigraphic units; the age of the terrace soils is the same as the age of their geomorphic surface.

Observations of turbidity currents and sediment transport in a small submarine canyon in the Eastern Mediterranean Sea

Jaijel R. (1, 2), Biton E. (1), Weinstein Y. (2), Ozer T. (1), Katz T. (1)

[1] Israel Oceanographic & Limnological Research Ltd., Tel-Shikmona, P.O.Box 8030, Haifa 31080, Israel

[2] Department of Geography and Environment, Bar-Ilan University, Ramat-Gan, 52900, Israel

roijiel@gmail.com

Up to date, most in-situ studies and observations of turbidity currents were conducted in submarine canyons that are either, large, shelf incising or adjacent to big perennial rivers, or a combination of these features. Little if any observations have been made in the numerous, small submarine canyons (<20 km) that are confined to the continental slope and located far offshore smaller and often ephemeral streams, which are far more common globally. In this study, measurements were collected from October 2019 until June 2020 in a small (5 km long) submarine canyon located offshore Haifa, Israel, in the Eastern Levantine Basin (southeastern Mediterranean) where only minor, ephemeral streams reach the sea. This was performed using two similar mooring stations, positioned at depths of 350 and 710-meter along the canyon, which carried an array of measuring instruments, set between 2 and 50 meters above the canyon thalweg. Our data shows that the small Bat-Galim canyon is an active conduit for significant sediment transport to the deep-sea, much of it via turbidity currents that flow down the canyon during winter storms. The characteristic values of the turbidity currents in the Bat-Galim canyon were similar to those reported in much bigger submarine canyons. In addition, we observed temperature inversions during these events, wherein the sediment-laden warm surface water plunged and flowed underneath the colder, and otherwise denser, canyon water. This temperature inversion may lead to sediment lofting and upward convection through the water column for hundreds of meters, once sediment settling relieves the warm water of some of its ballast. These unique findings highlight the need to investigate the importance of small submarine canyons on continental slopes worldwide as water and sediment conduits to the deep-sea.

Dynamic Fragility of Rock Pillars – Bridging Rock Mechanics and Seismology

Jbara, A. (1) Tsesarsky, M. (2)

[1] Department of Structural Engineering, Ben Gurion University of the Negev, Beer-Sheva 84105, Israel

[2] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

michatse@bgu.ac.il

Earthquakes are the deadliest natural disasters. In the 21st century only, while affecting only 3% of the total number of people harmed by natural disasters, they count for 58% of deaths and 21% of recorded economic losses. Over the past 40 years, the global population exposed to strong earthquakes has increased by 93%. Probabilistic seismic hazard analysis (PSHA) is the standard method used to assess the hazard of a potentially damaging earthquake. PSHA currently lacks a quantitative approach to use empirical data to validate and refine the estimates of ground-motion intensities for return periods that exceed the timescales of instrumental or historical observations. Fragile geologic features (FGF) have been previously identified as potentially useful for validating un-exceeded ground motions estimated from PSHA models. The most common FGF in practice is the precariously balanced rocks (PBR), mainly due to the relative simplicity in determining their fragility. However, the dynamic behavior of other types of FGFs is fundamentally different from the rocking dynamics of PBRs.

We present initial results of a research aimed to study the dynamic fragility of freestanding rock pillars in the Negev Desert and develop a methodology to quantify the seismic hazard of earthquakes with long return period. We focus on a 42 m high pillar located along the northern rim of Makhtesh Ramon. The pillar was scanned using UAV photogrammetry, and based on the scan a FE model was built. We performed modal and fully dynamic analysis of the pillar using the FE package ABAQUS. The results of the modal analysis favorably compare with in-situ measurements of pilar free vibrations.

Automatic monitoring of water velocity in flash flood streams for determining discharge and roughness coefficients

Kaholi T. (1), Halfi E. (2), Babad A. (2), Laronne J.B. (1)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Dead Sea and Arava Science Center, Masada National Park, M.P. Dead Sea, 8691000, Israel

eran@adssc.org

In arid regions such as Israel, surface hydrology is characterized by flash floods which are usually intensive, rapid and responsible for most fluvio-morphological changes. Water discharge (Q) is one of the key parameters required for understanding the dynamics of the stream environment. Q can be calculated by multiplying the wetted cross-sectional area by the mean flow velocity. Using direct and intrusive measuring instruments for determining the flow velocity. However, these instruments are required to be inside the flow, hence safety and logistic issues limit their applicability of measuring intensive flows. Consequently, discharge estimation is based mainly on hydrological models. These models, such as Manning, have a significant inaccuracy derived primarily from the velocity component and the difficulty in accurately determining the roughness coefficient (n). Our research objective is to improve both the accuracy of discharge estimation and the ability to monitor flash floods. Surface water velocity has been determined by a remote sensing method termed Large Scale Particle Image Velocimetry (LSPIV). This method is based on video recording of the flow and determination of the displacement of natural objects floating on the water surface using a unique software. LSPIV produces a two-dimensional velocity field of the water surface and its significant advantage is the ability to measure automatically, continuously and during all flow conditions. Two among several LSPIV stations deployed in channels: the Ramon and Arugot, Israel. During the winters of 2020-2022, three flood events were captured at our LSPIV gauging stations. The documented video frames were analyzed to calculate surface water velocities and in two events were validated with Surface Velocity Radar measurements. Based on these surface velocities, average cross-sectional velocities were obtained to determine water discharge. This allowed construction of event hydrographs as well as the variation of the roughness coefficient with water depth.

Flood Characterization and Hydrological Modeling in the Ze'elim Basin

Kallush A. (1), Halfi E. (2), Cadol D.(3), Zoccatelli D. (4), Haviv I. (1), Laronne J.B. (5)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Desert Floods Research Center, Dead Sea and Arava Science Center, Masada branch, Masada 86935, Israel

[3] Earth and Environmental Science, New Mexico Institute of Mining and Technology, Socorro, NM, USA

[4] Luxembourg Institute of Science and Technology, Esch-sur-Alzette, Luxembourg

[5] Department of Geography and Environmental Development, Ben Gurion University of the Negev, Beer Sheva 84105, Israel

amitkall@post.bgu.ac.il

Flash floods are decisive and devastating phenomena in which ephemeral channels flow due to rainstorms generating steep hydrograph rises. The slower recessions are altogether of short duration. Due to the required high temporal resolution and information on many relevant variables, there are considerable uncertainties in modelling and forecasting flash floods in arid environments. This study uses a network of rain gauges and water level sensors deployed in Ze'elim basin tributaries in the hyper-arid Judean Desert. The rain gauges are used to verify and calibrate radar backscatter data that will be tapped to determine the spatial and temporal variation of rain intensity as well as input for a physically distributed rainfall-runoff model. Data from the water level sensors in the main tributaries will be utilized to calculate water discharge. In conjunction with topography, geological background, and land use, the rainfall-runoff database will be exploited to understand the dominant rainfall-runoff processes, estimate transmission losses, and evaluate radar backscatter performance. The available database will be sourced to calibrate and evaluate the extent of validation of the KINEROS2 model with the objective of improving existing knowledge and processes of flash flood forecasting.

Evaporation characteristics and corresponding subsurface water phase and flow as potential drivers for transport in deep vadose zone profiles with underlying aquifers under arid environments

Kamai T. (1), Assouline S. (1)

[1] ARO Volcani Institute, Israel

tamirk@agri.gov.il

Arid and hyperarid deserts are usually considered for subsurface waste disposal, as they are low populated and are characterized by having deep groundwater and negligible recharge by precipitation. Considering that water feed to groundwater is from localized streams during short periods of flows and floods, water loss from the aquifer is to the surface by evaporates to the atmosphere. Loss of groundwater by evaporation occurs almost continuously and governs the water distribution and flow in these deep vadose zone profiles. Although associated water flow is very slow, it may play a critical role in transport of hazardous materials, with liquid and vapor phases interplaying in different regions. However, although the need for knowledge and understanding of the evaporation process and associated subsurface water flow under such conditions, very little is known, mainly because acquiring quantifiable measures is very challenging.

For modeling evaporation under such conditions, we consider steady-state water flow, with liquid-phase flow from the water table and vapor-phase flow towards the surface, separated into two distinct regions of liquid- and vapor-phase flow by an evaporative front that is located within the subsurface. The driving forces for evaporation an water flow are pressure head gradients for Darcian liquid flow and vapor concentration gradients for Fickian diffusive vapor flow, with the latter determined by temperature and relative humidity. We demonstrate how evaporation predictions are affected by water table depth, atmospheric conditions, and the hydraulic properties of the media, and present the partitioning between liquid and vapor phase flows for the different evaporation rates and conditions. As part, we study a special case of opposite flows, with water upward vapor flow that condenses and flows downward in liquid phase, as a potential transport mechanism.

Lithosphere deflection on a juvenile oceanic detachment during seafloor spreading promoted the exposure of the mantle section of the Troodos ophiolite – inferences from gabbro paleomagnetism

Kamhaji L. (1), Abelson M. (2), Shaar R. (1), Agnon A. (1)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

meira@gsi.gov.il

The domal structure in the core of the Troodos ophiolite exposes lower crustal (gabbro suite) and mantle rocks (ultramafic province). This structure is part of a fossil ridge-transform intersection (RTI), where an extinct spreading axis meets the fossil oceanic transform, namely the Arakapas transform. A major feature in the RTI system is the Troodos Forest-Amiandos Fault (TAF), an off-axis and axis parallel fault that was active during the Cretaceous seafloor spreading. Here we investigate the deformation across the TAF by measuring paleomagnetic vectors from 34 sites in the gabbro suite around the domal ultramafic core. Special emphasis was given along an E-W transect that crosses the TAF south of the sheeted dike complex and north of the ultramafic province. A compilation of dike dips along an E-W strip (6 km wide) north of the gabbro suite complements our measurements. All results were compared to previous paleomagnetic studies from the sheeted dikes and the gabbro suite. Accordingly, rotations in the gabbro are very similar to those in the sheeted dikes, suggesting coupling of the upper and the lower oceanic crust during axial deformation of seafloor spreading. All rotation axes were horizontal and parallel to the dike strikes, i.e., parallel to the extinct spreading axis. Rotations increase gradually towards the TAF from both sides, eastward in the footwall and westward in the hanging wall. The most plausible scenario is an upward and downward deflection in the footwall and the hanging wall, respectively, as described theoretically for the early stages of detachment development. The orientations of the rotation axes of all paleomagnetic vectors indicate spreading-related deformation. This suggests that the relative uplift of the deep-seated rocks occurred by the development of a young detachment during seafloor spreading rather than serpentinite diapirism. The detachment occurrence in the outside-corner is explained here by the shift from orthogonal to curved axis, inferred from sheeted dike orientations and magnetofabrics in the gabbro.

Spatial mapping of seafloor comet structures at LGM-time coastal zone along the Israeli shelf reveals trends in the sediment transport system

Kanari M. (1), Giladi A. (1)

[1] Israel Oceanographic & Limnological Research Ltd., Tel-Shikmona, P.O.Box 8030, Haifa 31080, Israel

mor.kanari@ocean.org.il

Multibeam and backscatter bathymetry from several sites covering ~110 km along the Israeli shelf at water depths 90-120 m reveal over 90 comet structures: exposed sandstone rocky knolls surrounded by unstable soft-sediment scouring at their base, providing conditions for hard bottom insular habitats, proven to host diverse ecological niches and unique faunal communities. They form comet-like 'head and tail' structures, ranging in diameter between 15-140 m, with relative elevation from their surroundings varying up to 36m and distinct tail orientation of 8-12 degrees. We observe a correlation between latitude and diameter, as they become smaller in size to the north. However, there is a relatively constant ratio between their tail length and their diameter. We suggest that the constant orientation shows single dominant sediment transporting force in the North direction, which matches well with the Levant Jet System (LJS) currents detailed in literature to diminish northward. The study supports previous suggestions about the LJS having a dominant direction from south to north in these water depths. The reduction in exposed knoll diameter northward leads to infer that the LJS current is stronger in the south and goes weaker with the latitude further north. However, direct measurements for that are yet to be obtained. A comparison of the above set of comets to a set of dozens of recently mapped comets in the southernmost Israeli shelf shows differences in their spatial appearance and geometry, and is related to the bathymetric difference in shelf width and morphology between south and north.

Located at the zone of coastal shoreline/cliff at LGM times, we suggest these structures were exposed to subareal fluvial systems during sea-level lowstand periods. In highstands, when the shelf is submerged, the persistent current transports sediment from south to north, forming distinct comet structures in the dominant direction of the LJS.

Nonuniform Stress Distribution within a Constrained Soil Sample

Kashtan, N. (1), Kamai, R. (2)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Department of Civil and Environmental Engineering, Ben-Gurion University of the Negev, Beer-Sheva 84105, Israel

rkamai@bgu.ac.il

Arching and nonuniform stress distribution can develop when soil is constrained between rigid walls, due to friction and differential straining at the soil-wall interface. In this study, the non-uniform stress distribution and its sensitivity to the problem geometry as well as loading and frictional boundary conditions, are studied, using experimental, numerical, and analytical tools.
A series of one-dimensional compression tests is conducted, using cylinders at different height-to-diameter (H/D) ratios and different loading conditions. For each experiment, the load at the bottom of the specimen is measured, using an apparatus which was especially designed for this study, such that the stress loss due to friction can be determined.

Next, an axisymmetric numerical model is designed and validated against the entire experimental dataset. The numerical model allows us to study the full spatial distribution of the vertical load within the soil specimen, as well as its sensitivity to loading and boundary conditions.
Finally, an analytical model is developed, which describes the spatial distribution of vertical stress within the soil sample as a simple function of sample geometry, external load, and location within the sample. The results indicate that the single parameter with the greatest effect on the stress distribution is the problem geometry, and that an H/D ratio of 1.4 leads to 40% stress loss at the center of the sample and up to 60% stress loss near the wall.

Evolution of sediment grain-size profiles on a sheltered, continental shelf following intermittent flashfloods

Katz T. (1), Katsman R. (2), Kalman A. (1,2), Goodman-Tchernov B. (2)

[1] Israel Oceanographic & Limnological Research Ltd., Tel-Shikmona, P.O.Box 8030, Haifa 31080, Israel

[2] The Dr. Moses Strauss Department of Marine Geosciences, Leon H.Charney School of marine sciences. Un

timor@ocean.org.il

Following significant rainfall, ephemeral coastal rivers may flood and deliver large quantities of fine sediments to the continental shelves. The preservation of these deposits offshore river mouths is determined by the dynamic relationship between punctuated discharge events and post-deposition processes that are not well understood. In this study, we devised an observations-based model for investigating the sediment profile evolution in northern shelf of the sheltered, hyper-arid Gulf of Aqaba-Eilat, where infrequent floods from ephemeral rivers occur ~ yr^{-1} and physical perturbation in between the floods owing to currents and waves is minor. The model shows that in between floods mixing and winnowing shape grain size profiles in the seafloor, causing the sediment to coarsen from the top down and shape a subsurface peak of the fine flood-sediments. Over longer time periods, without additional floods, mixing and winnowing gradually expunges the peak of fines, coarsening the entire mixed layer thus nulling the flood layers' chances of preservation. This important role of winnowing near the sediment surface is missing in previous studies. Concurrently, our modelling suggests that long-term positive sedimentation, usually estimated on the years' time-scale, is comprised of a series of short-term, steep sediment deposition events brought by the punctuated floods (lasting hours to days) and followed by a gradual (months to years' time-scale) winnowing of finer sediments (erosion).

Improving measurements of stable isotopes in water using Cavity Ring Down Spectroscopy

Keinan J. (1,2), Goldsmith Y.(1), Lensky N.(2)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

jonathan.keinan@mail.huji.ac.il

Accurate stable isotopic measurements lie at the foundation of isotope geochemistry. Up until a decade ago isotopic measurements of water relied solely on isotope ratio mass spectrometers (IRMS). Recently, an alternative technology has been developed: Cavity Ring Down Spectroscopy (CRDS). The working principle behind it relies on the fact that water vapor is a greenhouse gas, which absorbs infra-red radiation. Instead of looking at different masses, a CRDS system differentiates the isotopologues of water vapor by their slightly different absorption wavelengths within the near infra-red spectra and quantifies their decay time. This development has allowed measurements of triple oxygen and hydrogen isotopes in both liquid water and vapor without the need to extract it from the air while achieving similar, or arguably better precision than conventional IRMSs. Despite their numerous advantages their accuracy is reduced due to a sample-to-sample carryover, known as the memory effect. Most of the literature today deals with this method by data correction algorithms.

In this presentation, we will demonstrate the working principle and potential behind this new technology and present a characterization of the memory effect and the accuracy problems it creates. The presentation will focus on a new method that we have developed that physically removes the memory effect by flushing the system with extremely depleted water vapor. This method, which is simple, not time consuming and is readily available, results in systematic improvement of instrumental accuracy. Validation of our method was done by constructing a normalized calibration curve and testing it against international standards. The results show that our method can be used to easily and routinely measure all 4 main isotopologues of liquid water and vapor at higher accuracy and reproducibility than are presently described in the literature.

Study of the world's long-record tide gauges

Klein M. (1)

[1] Department of Geography and Environmental Studies, University of Haifa, Mt. Carmel, Haifa 3498838, Univrsity of Haifa

mklein@geo.haifa.ac.il

The data bank of the PSMSL tide gauges based in London presents the tide gauge results of about 2000 tide gauges. Only few measuring stations have a continuity of over 150 years. The importance of the length is important. The shorter the length of the series, the more sensitive it is to a year or years in which there was a notable deviation from the trend. In relation to the tide-gauge it is desirable that the length of the sequence be over 60 years. Long tide gauges began measuring in the 18th century.

The analysis of the record shows that the rise in sea level has been steady since the end of the Little Ice Age, and the rate of rise in the last 150 years is about 1-1.5 mm/year.

Characterization Borehole the western Yamin Plain – main findings

Klein-Ben David O. (1), Gilboa P. (1), Balaban N. (1), Calvo R. (2)

[1] Nuclear research center Negev

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

ofrak1@gmail.com

The IAEC is evaluating the feasibility of implementing geological disposal of spent nuclear fuel in the Yamin Plain (YP), which holds the national radioactive waste disposal site. Specifically, the suitability of the Ghareb Fm., of the Mount Scopus Group, residing within the vadose zone in the Yamin Plain, is being evaluated. During 2022 a characterization borehole was drilled in the western Yamin Plain, very close to the syncline axis. The whole Mount Scopus Group section was cored and in-situ logging and testing methods were applied.

The transition between the Mount Scopus and the Judea groups is deeper than initially estimated (deeper than 321.5 m – bottom-hole depth) and was not penetrated. Top Menuha Fm., was reached at 296m and the top Mishsh Fm. at 243m below surface. The unconformity between Ghareb and Hazeva formations is at 133.5m. The Hazeva Fm. is composed of the Zefa (133.5-75 m) and Rotem (75-0 m) members. Both Mishash and Menuha formations are ~20% thicker than initially estimated. Mount Scopus carbonate formations are all bituminous and the Mount Scopus rock mass quality was defined as “Very Poor”. Hydraulic conductivity was found to be low in the top ~40m of the Ghareb Fm. (<10-6 cm/sec). However, notably higher hydraulic conductivity was measured at the bottom of the Ghareb and in the Menuha Fms. (10-4-10-5 cm/sec) due to significant increase in the number of fractures (open and closed), together with the evidence for karst in the Menuha Fm. Two major joint systems were measured: NE 60° -70° and NW 60° -70°. P wave velocity varies with formation transitions, where the P wave velocities in the, Mishash, Ghareb, Zefa and Rotem were 2600, 2000, 2500 and 1000 m/sec respectively. P wave velocity was not measured for Menuha due to technical limitation.

Microseismic revelation of the Jericho fault

Klinger A. (1), Kurzon I. (1), Sagy A. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

adam_klinger@hotmail.com

The Jericho Fault has caused significantly large earthquakes, such as the 6.25 M_L magnitude earthquake in 1927. It is presently considered a locked fault by many researchers as it is seismically quiet. Previous studies have estimated the locking depth using geodetic measurements at 16.6 ± 7.8 km; other studies have traced the fault structure using field mapping and reflection seismic profiles. However, details about the nature of the fault remain unclear, such as: how is deformation portioned between aseismic creep and brittle deformation? What is the structural relationship between the Jericho Fault segment and the segments South (Dead Sea) and North (Faria)? To provide insights into these questions we have deployed a temporary micorseismic network for a minimum duration of 24 months. In doing so, we can extend the magnitude of completeness. Our initial results show evidence of microseismic events that are not previously captured by the national network. Short S-P times for some of these events suggest local seismic activity on the Jericho Fault. We also find guided waves which likely expresses a damage zone that allows trapped waves to propagate along. We plan to compile a catalogue, locate the seismic events and calculate source parameters.

Foraminiferal shell geochemistry as a new tool for monitoring heavy metal contamination along the Mediterranean Coast of Israel

Krekova V. (1), Abramobich S. (1), Herut B. (2), Torfstein A. (3,4)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Israel Oceanographic & Limnological Research Ltd., Tel-Shikmona, P.O.Box 8030, Haifa 31080, Israel

[3] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[4] Interuniversity Institute for Marine Sciences, Eilat 88103, Israel

vasilisa@post.bgu.ac.il

Heavy metals (HM) pollution has a critical impact on the sustainability of the marine environment, particularly in coastal areas, yet direct monitoring of water chemistry is logistically difficult and analytically expensive. Here, we present systematic monitoring of the HM pollution of the Israeli Mediterranean coast using the compositions of benthic foraminifera shells, which act as "living data loggers," recording pollution levels. Combined with their diversity and their presence in most marine habitats, benthic foraminifera are ideal recorders of environmental HM pollution.

The study was carried out in eight stations spread over 150 km, between Achziv in the north and Palmahim in the south. Some stations located in pristine environments (e.g., nature reserves), while others, such as Haifa Bay and Jaffa Coast are proximal to industrial or urban areas and are suspected to be polluted. Samples were collected from each station and three species were selected to demonstrate variability among foraminiferal calcifications. These include Lachlanella sp., Amphistegina lobifera, and Pararotalia calcariformata. Samples were collected seasonally between November 2021 and September 2022 to evaluate temporal variability. The samples were stained with Rose-bengal solution to mark living specimens at the time of sampling. Living specimens were picked and rigorously cleaned in a clean laboratory to remove organic matter and other external contaminants. The samples were subsequently digested, and the HM content of group of specimens of each species was measured using ICP-MS.

The study found that the HM content was higher near Haifa Bay and the coast of Jaffa, but no clear geographic trend was observed in other areas. The results will be further analyzed using a principal component analysis to identify the different factors influencing the distribution of HM in the samples. These results provide the first documentation of the distribution of HM pollution along the Mediterranean coast of Israel and illustrate the benefits of using benthic foraminifera as environmental monitors.

Enhancing the Seismic Catalogue of the Dead Sea Fault

Kurzon I. (1), White M. (2)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] Massachusetts Institute of Technology, Boston, Massachusetts, USA

ittaik@gsi.gov.il

This study presents the re-processing of seven years of waveforms data, 2013-2019, resulting in a seismic catalogue, with significantly more events than the existing catalogue of the Israel Seismic Network (ISN). The data range consists of (1) a lower time limit, defining the year in which stations' metadata is well documented and reliable, and (2) an upper limit defining the year in which 85% of the TRUAA seismic network upgrade has been completed. Therefore, this time period represents significant upgrades and modifications, that have increased the quantity and quality of the acquired seismic data. In our efforts to produce a more robust seismic catalogue, we have tested several approaches, beginning with customizing Signal-to-Noise-Ratio (SNR) detectors, and finally converging into Transfer Learning. The latter is a Machine Learning approach, in which several datasets of phase arrivals (P and S) have been tested for refining phase detection. It also requires that the datasets used for the learning process, have passed quality control tests prior to their usage. Our results show significant enhancement of the catalogue by a factor of 2 to 3. The P and S arrivals produced with this method are rather good, within 0.2 s of manual accuracy, and with no false arrivals. As we haven't finalized yet the magnitude calculation, we speculate at this stage that the magnitude of completeness has been reduced. The increase in the number of seismic stations due to the deployment of new TRUAA stations, also captured by the increase in seismicity in the ISN catalogue, is shown to be more prominent in the new generated catalogue. Therefore, it is not a surprise that our results emphasize features and structures along the Dead Sea Fault that have not yet been observed.

New chronological constraints on the history of the Kalahari Group from the Upper Ugab Valley, Namibia

Kuzmenko A. (1), Matmon A. (1), Torfstein A. (1,2)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Interuniversity Institute for Marine Sciences, Eilat 88103, Israel

alyona.kuzmenko@mail.huji.ac.il

The sedimentary fill of the Kalahari Basin records tectonically- and climatically- driven landscape evolution processes, as well as archeological evidence of early hominid occupation. However, due to limited access to natural outcrops in the flat Kalahari topography, the chronology of the sequence is not well constrained.

We report here new chronological constrains on Kalahari Group units from the “Base Camp” outcrop, on the margins of the Ugab Valley, northern Namibia, using a combination of cosmogenic ^{26}Al and ^{10}Be model dating, and U-Th dating of carbonate cements and tufa.

The study site is comprised of a sequence of ~20 m of cemented conglomerates overlain by 20-25 m of carbonate duricrusts. The cosmogenic model results indicate an initial burial depth of at least 80 m for at least 3.8 Ma, followed by an erosional phase that lasted up to 300 ka, and which resulted in the removal of at least 60 m of sediment. Then, duricrust deposition lasted for about 800 ka resulting in accumulation of a 20 m thick unit above the conglomerate. Tufa deposits indicating the beginning of incision through the duricrust layer were dated by U-Th to 67.6+35.0/-26.2 ka. Top of the conglomerate samples show simple cosmogenic exposure ages of 32±3 ka and 39±4 ka, though the model suggests a more gradual exposure, with at least two different erosion rates over time.

Our results present the oldest directly dated sedimentary unit in the Kalahari Group, with evidence of at least one erosional event since the beginning of deposition. Both deposition and removal of alluvial sediments require high-energy fluvial systems suggesting greater relief and possibly wetter climatic conditions during the Pliocene and early Quaternary relative to present-day climate.

A new approach to analyzing thermal subsidence in divergent margins: implications for the formation of the Eastern North American Margin

Lang G. (1), ten Brink U. S. (2), Hutchinson D.R. (2), Mountain G.S. (3), Schattner U. (4)

[1] The Dr. Moses Strauss Department of Marine Geosciences, Leon H.Charney School of marine sciences, Univrsity of Haifa

[2] U.S. Geological Survey, Woods Hole Science Center, Woods Hole, MA, USA

[3] Department of Earth and Planetary Sciences, Rutgers, The State University of New Jersey, 610 Taylor Road, Piscataway, New Jersey 08854-8066, USA

[4] Department of Geography and Environmental Studies, University of Haifa, Mt. Carmel, Haifa 3498838, Israel

guylaang@gmail.com

The accumulation of thick sedimentary sections at passive continental margins is driven by thermal subsidence which follows lithospheric thinning. The traditional approach for investigating thermal subsidence includes a sequential peeling of the sedimentary column while correcting for compaction and isostatically restoring the basement depth through time (i.e., backstripping). This approach yields the basin's subsidence curve. The curve is compared with predicted subsidence curves, calculated from specific amounts of lithospheric thinning (β factor) to derive the degree of crustal extension and thermal input during rifting. Although the use of this approach is widespread amongst both industry and academia, its underlying assumptions (e.g., pure-shear uniform-stretching) pre-determine the processes that induce subsidence. We propose an alternative procedure that includes plotting observed, dated post-rift sedimentary thicknesses against the underlying crustal thicknesses. The scatter plot is then compared to a modeled thermo-isostatic subsidence curve which is a function of the crustal thickness. Deviations of the observed sedimentary thicknesses from the modeled curve are quantified and their origin is assessed. Applying this technique to the Eastern North American Margin led to the recognition of 1) heterogenous subsidence patterns along the strike of the margin, and 2) anomalous early post-rift subsidence which is more than twice as fast as the predictions of the uniform-stretching model. The excess subsidence may have resulted from a combination of syn-rift magmatic additions to the crust, elevated mantle temperatures and mantle dynamic topography. Considering the present abundance of geophysical and geological data at continental margins and other extensional basins, a similar approach could be used to explore the mechanisms driving basin subsidence.

Carbonate to apatite replacement by insectivorous bat guano: unique cave development mechanism

Langford B. (1,2), Vaks A. (2), Kutuzov I. (1), Keinan J. (1,2), Goldsmith Y. (1), Frumkin A. (1)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

boaz.langford@mail.huji.ac.il

The formation and expansion of carbonate karst caves in the vadose zone are often associated with rock dissolution by aggressive (acidic) solutions. This study describes a mechanism of carbonate weathering under the presence of insectivorous bat guano. This mechanism has hardly been studied, especially in the context of cave expansion and large-scale carbonate weathering. This study examines the significance of insectivorous bat guano erosion in expansion and reshaping of caves in the 4.2 km long Chariton Cave, which is a relict maze cave system of hypogenic origin. The cave is located in a semi-arid climate region, with no classic karst activity (i.e. dissolution by aggressive percolation water). XRD, XRF, and thin-sections, indicate that the interaction between the guano and the carbonate rock leads to calcium carbonate replacement predominantly by apatite, alongside the appearance of additional minerals. The humidity cycle associated with the cave host-rock weathering is a condensation of humidity on the cave walls, which later drops to the guano-covered cave floor. During percolation within the guano, the water pH decreases from ~7.0 to ~3.5. This enables weathering of the rock below the guano cover, resulting a key-hole cross-section of cave passages, as well as typical apatite crust that covers the bottom of the passages. Measurements of the cave passages' dimensions show that ~30% of the cave volume is related to this guano weathering, rather than to the original rock dissolution.

The importance of sophisticated visualization of remote sensing derived geospatial data as a tool for decision making in research, teaching and the private/public sectors.

Laugomer B. (1), Shicht I. (1)

[1] Enso Geospatial, Private Company, En Vered Israel

ben.laugomer@mail.huji.ac.il

The process of decision making in research, teaching and the private/public sectors with regards to the natural environment requires all parties involved to “be on the same page” in relation to what they are imagining. This often requires that all people involved either have met on site, or have enough prior experience in similar sites to be able to conduct a discussion on the same level concerning the area of interest.

Recent years have witnessed the democratization of remote sensing via the fast devolvement of Unmanned Aerial Vehicles (UAV) as well as the lower costs of sensors. Coupled with this democratization of hardware, is the development of software capable of analyzing and visualizing the vast amounts of detailed data generated.

We will show examples of the importance of visualizing data of this nature in different ways to different stake holders in the realms of teaching, research and private/public sectors with regards to decision making processes.

Air Water Interactions Along the Dead Sea Rift

Lensky N.G. (1,2), Tau G. (1,2), Abir S. (1,2), Mor Z. (1,2), McGowan H. (3)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[3] School of Earth and Environmental Sciences, The University of Queensland, Brisbane, Australia

nadavl@gsi.gov.il

Rifts, tectonic depressions, stretches along continents and typically collect a wide variety of waterbodies, including wetlands, lakes, terminal lakes and locked seas. Here we exploit the waterbodies along the Dead Sea Rift, which vary by geo-climatic settings (from humid Mediterranean to hyper-arid), water depth, water salinity, etc., by simultaneously measuring surface heat, gas and momentum fluxes using Eddy Covariance towers. These waterbodies are subjected to similar radiative forcing. We show that in the two desert waterbodies differ significantly by surface heat flux partitioning: In the Gulf of Eilat (extension of the Red Sea), the evaporation rate is three times larger than in the Dead Sea (a hypersaline terminal lake), this is due to the effect of water salinity in reducing water vapor pressure. In the two northern water (Lake Kinneret and Agmon Hula), which resides in the more humid, Mediterranean region, the evaporation rate is suppressed by humidity, in comparison to the Gulf of Eilat. These two waterbodies differ by their depth, which determines the dynamics of evaporation, surface heat fluxes and thermoregulation. We analyze the role of the timing of the Mediterranean Sea Breeze on evaporation rate. This observational setup, of concurrent measurements of air-water interactions along the gradients within the Dead Sea Rift provides a rare opportunity to quantify various aspects of water management policies, the formation of rocks within these waterbodies, the effect of local micrometeorology and synoptic scale circulation on the waterbodies and their surroundings.

Foraminiferal assemblages in the continental slope of the southeastern Mediterranean indicate a decrease in cross shelf sediment transport between the LGM and the early Holocene followed by re-intensifying in the last millennia

Leshno Afriat Y. (1), Hyams-Kaphzan O. (1), Zolotarevski S. (1), Kitin M. (1), Jacobi Y. (1), Katz O. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

odedk@gsi.gov.il

Cross-shelf sediment transport in the southeastern Mediterranean continental margins is responsible for conveying sediment toward the upper-slope, yet it has been relatively understudied compared to the longshore transport of Nile-derived sediments along the Levantine southeastern coast. In order to evaluate the cross-shelf vs. longshore component of sediment transport for geohazard assessment, we analyzed four sediment cores: HRZ500 and AM058 from the middle (500 m water depth) and lower slope (1100 m) of the Apollonia landslide offshore Herzliya (6.5 and 2 m long each), and AM007and AM113 from the middle (482 m) and lower (848 m) slope of Goliath landslide offshore Ashkelon (3 m long each). These represent two east-west transects at submarine landslides to the north (Apollonia) and south (Goliath) of the Palmahim Disturbance. Sedimentological and geochemical parameters, radiocarbon dating and benthic and planktonic foraminiferal assemblages were studied in high resolution along these cores.

Glacial deposits were sampled only in the lower parts of AM058 and AM113, with allochthonous (shelf) benthic foraminifera as Ammonia spp. found only in AM058. These are overlain in both cores by Holocene hemipelagic sediment (including sapropel S1 interval), where allochthonous foraminifera are rare. Likewise, Holocene sediment in HRZ500 and AM007 shows rare allochthonous foraminifera. The top ~1 m of this Holocene sediment in HRZ500 is finely laminated with a high percentage of poorly preserved allochthonous foraminifera dated to the last millennia and interpreted as shelf-origin turbidites.

We conclude that the observed transport of allochthonous benthic foraminifera to glacial but not Holocene deposits suggests that cross-shelf sediment transport decreased following the post-LGM transgression and widening of the shelf, no longer reaching beyond the upper slope. However, the cross-shelf sediment transport renewed in the last millennia north of the Palmahim Disturbance resulting in intensified turbidite activity.

Virtual Reality (VR) in Geological Teaching: Enhancing the Learning Experience

Levenson Y. (1), Israeli Y. (1)

[1] Department of Natural Sciences, The Open University of Israel, Ra'anana, Israel

yaellev@openu.ac.il

Virtual reality technology is revolutionizing the way we teach and learn about geology. It enables immersive and interactive learning experiences that are much more engaging than traditional methods. It also provides access to geological sites and environments that are difficult or impossible to visit in person. This can include remote, inaccessible, or dangerous locations and sites that have been destroyed or altered since they were originally explored.

One of the ways in which VR technology is used in teaching geology is through 360-degrees imagery. These images allow students to explore geological sites in a virtual environment as if they were there. During a one hour virtual "field trip", students can visit the Grand Canyon, view desert shaping in the Sahara, fly over an active volcano in Iceland, go into a sinkhole next to the Dead Sea and more geological points of interest. In contrast to traditional field trips, the teacher can insert informative layers on top of the landscapes.

Virtual reality can also improve the understanding of geological processes over geological time scales. For example, we can reconstruct paleoenvironments and demonstrate the deposition of various sedimentary rocks one on top of the other. Moreover, we can illustrate how the layers undergo compaction, deformation, faulting, and folding given different strains. The talk will cover various applications of VR in geological teaching, such as field trips to remote locations, visualizing complex geological structures and processes, and exploring subsurface environments.

As metaverse technologies become more convenient and attainable, it is worthwhile to take advantage of their great potential for teaching and making earth sciences accessible.

How to develop your own scientific hardware?

Levi E. (1)

[1] Geophysical Institute of Israel, P.O.Box 182, Lod 71100, Israel

eldad@gii.co.il

Many scientific studies suffer from insufficient data acquisition due to limited budget and high cost of instrumentation.

The maker culture is a contemporary subculture representing a technology-based extension of DIY culture. The development of the Internet provided easy access to information, and the rapid progress of technological production led to the low cost of products such as electronic cards and 3D printers. These opened up new opportunities for the development of custom-made equipment for the use of the scientific community too.

This work aims to open new prospective for data acquisition within the geological community and will open the gate to anyone who wishes to use it.

An example of custom made time-lapse geoelectrical measurements (ERT) equipment made for monitoring subsurface resistivity changes, caused by water salinity changes, water saturation and sea water intrusion dynamics. It uses Arduino platform which is an open source hardware and software with common printed circuit boards (PCB), which are available anywhere.

Effect of geochemical factors in phosphorites from the Negev, Israel, on foam generation during phosphoric acid production.

Levy A. (1,2), Gelman F. (1), Schneider-Mor A. (1), Kamyshniy A. (2)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

bensamit@post.bgu.ac.il

Phosphorites are important natural resources and are the main source for phosphoric acid production and phosphorous fertilizers. During the attack of phosphorite by sulfuric acid, phosphoric acid is produced, a process that may result in stable foam formation and acid losses when the acid overflows from the reactor. Due to the adverse effects of organic matter and other impurities on foam formation during the production of phosphoric acid, phosphorite resources have limited industrial applications. Since there is a rapid depletion in the natural resources of phosphate rocks, it is essential to increase the efficiency of the industrial processes toward more effective usage of the phosphate reserves. In the present study, phosphorite samples from various phosphate basins in southern Israel were analyzed for their major chemical constituents, particularly their $CaCO_3$ and organic matter contents and composition, to investigate their possible effect on foam formation and its stability. This study evaluates that the phosphorite foaming responses can be divided into three main groups: short-living foam, unstable foam, and stable foam based on their maximum foam volume and decay time. The result of this study indicates that even though the foam formation is dependent on the $CaCO_3$ content in the phosphorite, the foam stability depends on its organic matter speciation. The current study confirmed that the removal of the CaCO3 prior to the industrial process of phosphoric acid production could significantly reduce or eliminate foam formation.

A new data processing method framework for identifying erroneous stable isotope measurements: Case study for fluid inclusion water $\delta^{18}O$ and $\delta^{2}H$

Levy E.J. (1,2), Markowska M. (1), Schröder J. (1), de Graaf S. (1), Vonhof H. (1)

[1] Max Planck Institute for Chemistry, Mainz, Germany

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

elanlevy27@gmail.com

The calculation of stable isotope values from raw measurement data is commonly carried out by software with a minimal degree of human interference, however, in some cases, controlling data processing can be highly beneficial. Here we present a new calculation method and procedure for measuring and detecting erroneous stable isotope data from fluid inclusion water entrapped in cave speleothems (stalactites, stalagmites and flowstones). Stable isotope ratios of fluid inclusion water are proxies for reconstruct paleoclimate. Using a speleothem from Scladina Cave (Belgium), fluid inclusion oxygen ($\delta^{18}O$) and hydrogen ($\delta^{2}H$) was analyzed by crushing samples in a continuous standard water background line connected to a commercial cavity ring-down spectrometer (Picarro L2140-i analyzer). Two fundamentally different calculation methods were then implemented: 1- a peak integration method and 2- a linear regression method. Comparing the calculated isotope values from these two methods reveals cases of similar and divergent values. In most cases, $\delta^{18}O$ and $\delta^{2}H$ of samples with divergent values from the methods also deviate from their predicted values. These results emphasize that relying on a single data processing method alone may lead to the inclusion of erroneous results resulting from sample, measurement, or acquisition problems. Detecting erroneous values using this relatively simple cross-comparison procedure helps both validate and prevent the unnecessary explanation of artificial data.

Temperature calibration for enriched Mg-calcite planktic Foraminifera shells from the Gulf of Aqaba

Levy N. (1,2), Torfstein A. (1,3), Schiebel R. (2), Chernihovsky N. (1,3), Jochum K.P. (2), Weis U. (2), Stoll B. (2), Haug G.H (2,4)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Max Planck Institute for Chemistry, Hahn-Meitner-Weg 1, 55128 Mainz, Germany

[3] Interuniversity Institute for Marine Sciences, Eilat 88103, Israel

[4] Department of Earth Sciences, ETH Zurich, Sonneggstrasse 5, 8092 Zurich, Switzerland

noy.levy2@mail.huji.ac.il

Hypersaline, oligotrophic seas have been shown to accommodate planktic Foraminifera (PF) with enriched Mg/Ca in their calcareous shells, compared to other marine environments. Although Mg/Ca is a widely used proxy applied as a paleothermometer, its systematics in extreme hypersaline systems is not well understood.

We measured element ratios using LASER ablation ICP-MS on the tests of the two abundant PF species, Globigerinoides ruber albus and Turborotalita clarkei, obtained from monthly resolved time series sediment traps at various water column depths in the northern part of the GOA.

Globigerinoides ruber albus shows a positive relationship between Mg/Ca and surface water temperatures of the surface mixed layer down to 60 m water depth. Although T. clarkei does not show the same positive relationship, it exhibits high Mg/Ca during water column mixing (March–April) possibly reflecting the movement of two water masses in the water column.

Using common calibration equations, the high-Mg (5-25 mmol/mol) provided higher than measured in-situ (IS) ambient seawater temperatures (TMg/Ca and TIS, respectively). The high salinity at the GOA (>40) is assumed to be the main reason of the high shell-bound Mg.

Comparing surface dwelling G. ruber albus versus subsurface dwelling T. clarkei may facilitate reconstruction of the absolute and relative seasonal development temperature and surface water stratification. We suggest that species specific Mg/Ca-T calibrations for the GOA provide more accurate regional palaeoceanography and paleoclimate reconstruction of hypersaline environments.

Late Cretaceous Calcareous Nannofossils from the SE Tethys Upwelling Belt, Israel

Marconato S. (1,3), Abramovich S. (1), Thibault N. (2), Rosenberg Y.O. (3), Ashckenazi-Polivoda S. (4)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] IGN, University of Copenhagen, Øster Voldgade 10, Copenhagen, DK-1350, Denmark

[3] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[4] Dead Sea and Arava Science Center, Central Arava Branch, Hatzeva 86825, Israel

saramarc@post.bgu.ac.il

During the Late Cretaceous, the Levant area was under the influence of an extensive upwelling zone, as witnessed by the organic-rich sediments of Negev, Central and Northern Israel.

Extensive research has been done on these formations: Aderet core was drilled in the depocenter of the Shefela basin, Central Israel. So far, reconstructed tropical sea surface temperatures encompassing the late Santonian to early Maastrichtian are uniquely derived from Tex86 data of Aderet core. The stratigraphically expanded Aderet core thus requires an improved stratigraphic framework and age-model. However, the biostratigraphy and age-model for this core were solely based on planktic foraminifera (PF) and some regional benthic foraminifera events.

Here we present the calcareous nannofossil (CN) biostratigraphy of Aderet with a resolution of 5 m. Due to the high percentages of total organic carbon (TOC between 5-20%), we adopted a protocol to oxidize the organic matter prior to the preparation of nannofossil slides that significantly improved the abundance and observation of nannofossils.

The core can be ascribed to zones CC20 to CC25a sensu Perch Nielsen (1985) and from UC14b^{TP} to UC19 sensu Burnett (1998, revised by Thibault, 2016). Our study allows us to revise the previous age-model by the integration of calcareous nannofossil and planktic foraminifera biohorizons. Accordingly, the age of the core extends from 79.2 Ma to 69.4 Ma. The position of the Campanian-Maastrichtian boundary is revised to an interval situated between the Lowest Occurrence of PF *Pseudoguembelina palpebra* at 361 m the Highest Occurrence of CN *Uniplanarius trifidus* at 332 m. This position contrasts with previous studies that placed this boundary at 452 m and consequently points at a significant revision of the age model for the core. In addition, preliminary palaeoecological results confirm the constant presence of eutrophic to mesotrophic calcareous taxa and a well-delineated response to the global cooling trend of the late Campanian-early Maastrichtian.

Yammouneh fault and the structural link between Red Sea and the Anatolian tectonic domains

Mart Y. (1)

[1] Leon Recanati Institute for Maritime Studies University of Haifa, Mount Carmel, Haifa 3498838, Israel

yossimart@gmail.com

The Levant is a geographic province that is deformed by two distinct, but clearly simultaneous, tectonic provinces – the final closure of the central NeoTethys seaway from the north and the incipient continental breakup of the northern Red Sea from the south. The rifting of the Red Sea occurred in the middle Miocene, due to the oblique tectonic collision between the Arabian Peninsula and the Iranian – Anatolian tectonic block. A shift in the extensional stresses in the northern Red Sea diverted the continental breakup from the Suez to the Levant rift during the late Miocene, where the edge of the Red Sea tectonic separation still prevails. The punctiform breakup of the northern Red Sea prevails also in the Levant Rift, with the development of the structural basins of Gulf of Elat ('Aqaba), the Dead Sea, The Sea of Galilee and the Lebanese Baqa'a. The closure of the NeoTethys since the Miocene led to the subduction of its oceanic lithosphere under the Hellenic domain, which pulls Anatolia southwestwards at a fast rate, generating the displacement along the North and the East Anatolian faults since the late Miocene. Of the by-products of the westwards migration along the East Anatolian fault are the breakup of the Hatay Valley and the faulting of El-Ghab Rift, which propagated southwards. Structural analysis suggests that the northern edge of Yammouneh was captured by the southern edge of the Missyaf fault, the eastern boundary fault of el Ghab.

Diurnal to weekly variations in halite precipitation from the hypersaline Dead Sea: The role of evaporation, water cooling, and freshwater plume stability

Mor Z. (1,2), Noy G. (1,2), Eyal H. (1,2), Sirota Z. (1,3), Ezraty R. (1,2), Morin E. (2), Lensky N. (1,2)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[3] GFZ-German Research Centre for Geosciences

ziv.mor@mail.huji.ac.il

Thick halite layers were commonly deposited in perennial, deep, and wide hypersaline water bodies. Continuous accumulation of halite layers requires extreme aridity where evaporation is greater than inflows. Halite deposit is governed by the degree of brine saturation with respect to halite and is expected to be influenced by net evaporation (i.e., evaporation-inflows), and temperature variations. Despite the arid origin of halite units, freshwater or diluted brines typically discharge into the evaporitic basin, forming diluted water masses that have the potential to modify the active halite accumulation. Here, we present observations from the only modern deep and saturated water body, the Dead Sea, showing how the hydroclimatic forcing and their changes over the daily cycle (i.e., evaporation, water temperature, and, diluted plume dynamic) are translated to the evaporitic record. We measured, for the first time, sub-daily in-situ halite accumulation on the lake floor using novel methodologies, together with meteorological and limnological conditions. This enables us to link the accumulation of halite in high resolution with the hydroclimatic forcing. We studied two fundamental environments: the diluted plume located off large springs, and far from the water inflows effect. To link the observed halite accumulation to the hydroclimatic forcing, we calculated the hourly halite accumulation by applying the mass and heat balance model. We found hourly variation in halite accumulation. Far from the freshwater inflows, these variations dictate mainly by the evaporation course, while the calculated halite thickness as a result of evaporation from the lake surface is similar to the observed one. In the diluted area, the diluted plume stability dictates the relation between evaporation and halite accumulation; to accumulate a certain thickness of halite on the lake floor from a relatively stable diluted plume, 4 times more evaporation is required.

Production. Research. Operations. Seismology division 2023: past, present and future.

Navon H. (1), Gorstein M. (1), Avirav V. (1), Aizenshtat-Soffer E. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

hilan@gsi.gov.il

In the past 5 years, the seismology division has undergone many changes. In 2017 the construction of the first stations of the new network TRUAA has begun. The Israeli network up until that time consisted of less than 30 stations broadcasting in low sampling rate with up to 9 seconds delay. By 2020, the new dense network consists more than 100 stations, using high quality sensors and fast communication. At the same year, the division changed its location from the Geophysical institute in Lod and joined the Geological Survey of Israel in Jerusalem. A new control room monitoring all the network and seismic events, including alerts of Earthquake Early Warning and Tsunami is working 24/7 providing almost all the information needed to manage an emergency event.

These many changes have increased the interest in the division’s activities and set the ground for new collaborations and new projects.

U-Pb dating of Neoarchean carbonates

Neagu N. (1), Kylander-Clark A. (2), Fischer W. W. (3), Ryb U. (1)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Department of Earth Sciences, University of California, Santa Barbara, CA, USA

[3] Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA,USA

nathalie.neagu@mail.huji.ac.il

The >2.5 Ga Campbellrand platform (South Africa) is one of the best-preserved carbonate archives for studying Neoarchean marine environments. These carbonates contain abundant evidence of early microbial life forms, such as microbialites encased in herringbone calcite or dolomitized stromatolites. The latter are fabric-retentive dolomites that preserve both stromatolitic mesostructures, as well as fine micro-textures (e.g., peloids), and are thus considered a product of early dolomitization. Of particular interest is herringbone calcite - a syndepositional marine precipitate that filled primary voids in the microbialite framework. Due to its apparent primary origin and unique petrographic characteristics, geochemical signals measured in herringbone calcite are often thought to reflect Precambrian marine environments. However, the ability of herringbone calcite to retain primary compositions is based mainly on petrographic evidence, and post-depositional alteration of chemical or isotope signals in these fabrics cannot be ruled out.

Here, we use fabric-specific laser-ablation ICP-MS U-Pb dating of carbonate minerals from the ~2590 Ma Reivilo Formation (section W1) and the 2521±3 Ma Gamohaan Formation (section W2). U-Pb ages of dolomite fabrics from sections W1 (n=19) and W2 (n=5) scatter over ranges of 1569±214 to 3032±295 Ma and 1636±315 to 2513±235 Ma, respectively. Most dolomite ages are younger than their expected stratigraphic age, indicating that the U-Pb system in dolomites had to open long after deposition. Unlike the adjacent W2 dolomites, W2 herringbone calcite fabrics (n=4) cluster around a mean U-Pb age of 2402 (±84) Ma, demonstrating that despite the expected sensitivity of calcite to alteration, herringbone calcite has remained closed with respect to U-Pb throughout most of its history. Our results support previous interpretations of herringbone calcite as a primary recorder, emphasizing its exceptional value as a window to the shallow marine environments of the Neoarchean.

Modeling the Controls on Microbial Iron Reduction in Methanogenic Sediments

Neumann Wallheimer R. (1), Halevy I. (2), Sivan O. (1)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Department of Earth and Planetary Sciences, Weizmann Institute of Science, Rehovot 7610001, Israel

rachelineu10@gmail.com

Previous studies have presented indications for dissimilatory microbial iron reduction in the methanogenic zone in lakes and in the ocean, sometimes accompanied by a deep-methane sink. This observation is surprising, since iron reduction is expected to occur only above the methanogenic zone, according to the classical model for respiration in sediments. Our research provides thermodynamic and kinetic insights regarding iron reduction in methanogenic sediments, in order to better understand what specific biogeochemical processes and microbial functional groups are the most dominant in the methanogenic sediments of both lakes and the ocean.

Here we address two case studies, the methanogenic zones of Lake Kinneret (LK) and the Mediterranean Sea (MS). Given the temperatures, cell counts of archaea and bacteria, and porewater concentrations of relevant compounds in the methanogenic zones of those sites, we calculate both metabolic and growth rates of key functional groups of iron reducers. The considered iron reduction half-reactions are coupled to acetate, hydrogen, methane and ammonium oxidation. In calculation of the (bio)reaction rates, both thermodynamics and kinetics are considered.

We have found that in the MS only amorphous iron oxides (FeOOH) and ferrihydrite ($Fe(OH)_3$) reduction can support cell growth, with free energies generated from the net redox reactions of at least ~20 kJ/mole e-. Oxidation of either acetate, hydrogen, methane and ammonium can generate cell growth. We have also shown that in both LK and the MS the flux of amorphous and low crystalline iron oxides and iron sulfide above the methanogenic zone is higher than the sulfate flux. Thus, it is possible that amorphous iron oxides from the oxic zone reach the methanogenic zone.

TRUAA Earthquake Early Warning System - Operational Stage and the Public perspective

Nof R.N. (1), Yagoda-Biran G. (1), Zwebner Y. (2)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] Arison School of Business, Reichman University, 8 Ha'universita Street, Herzliya 4610101, Israel

rann@gsi.gov.il

Following an earthquake swarm south of the Sea of Galilee, Israel (max Mw 3.6) in January 20, 2022, The Israeli national Earthquake Early Warning System (EEWS), named TRUAA, has been declared operational on January 27, 2022. The Geological Survey of Israel has upgraded and expanded the national Israeli Seismic Network (ISN), with currently 116 stations country-wide with high station density (5-10 km) and fast telemetry (~1 sec latency). The stations are distributed mainly along the main fault systems, the Dead Sea Transform, and the Carmel-Gilboa Fault System, which may potentially produce Mw 7.5 earthquakes. The underling EEW algorithm of the system is the US west-coast Shake Alert EPIC algorithm, adjusted and implemented to Israel.
Alert are disseminated to the public by the Israeli Defense Forces' Home Front Command via sirens or mobile phone app. for earthquakes Mw 4.5 - 6 alerts are distributed to an area with a radius around epicenter estimated to exceed peak ground accelerations of 5 cm/s^2 (0.5 %g). For Mw >= 6, alert will be delivered nationwide.

We will present the ISN, TRUAA and its performance metrices a year before and a year after its operation on a national level and the considerations for the alerting policy. A survey, conducted for the first time in Israel, following the January 2022 swarm, reveal the public reaction and expectations to the EEWS. These results are aligned with surveys conducted in Mexico, US and Japan and the survey results should be used by the decision makers to optimize the alerting strategy for Israel.

Financial vulnerability to an earthquake in the Dead Sea Fault, Israel: The role of seismic parameters

Osipov A. (1,2), Calvo R. (1), Aviv R. (2), Haber S. (2), Levi T. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] Department of Mathematics, Bar-Ilan University, Max and Anna Web St. Ramat-Gan

alexandra.osipov@biu.ac.il

Designing a financial strategy that addresses financial losses from earthquakes in high-risk countries is crucial for risk management and disaster risk financing. As a part of this effort, we studied the importance of an earthquake's parameters on earthquake-induced financial losses in the Hula-Kinneret, a high-risk seismic zone in northern Israel, by creating earthquake scenarios using HAZUS-MH software. This course will allow us to explore appropriate disaster risk transfer strategies in the next stage, focusing on financial instruments such as Catastrophe Bonds and Parametric Risk Transfer. Our findings indicate that damages and losses caused by moderate-strong earthquakes may spread to distant cities such as Haifa. The results show that the earthquake magnitude is the most important parameter, followed by the epicenter's spatial location and focal depth. As the magnitude increases, the importance of the epicenter's location and focal depth on financial losses also increases. Therefore, we recommend an appropriate disaster risk transfer strategy that is split into two components: (1) for magnitudes up to 6.5, financial losses are primarily driven by magnitude, and (2) for magnitudes above 6.5, all three physical parameters should be considered to estimate financial loss more accurately. We outline a robust procedure to determine the importance of earthquake parameters on financial losses that can be adopted in designing a financial strategy (e.g., Catastrophe Bonds), considering also other high-risk seismic areas.

Calcareous nannofossil biostratigraphy of the Judea Group of Israel (Jerusalem area)

Ovechkina M. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

saccammina@gmail.com

Biostratigraphy of the Judea Gr. has been based on ammonites, ostracods and foraminifera. Despite a rather good knowledge of the Mt Scopus Gr. nannofossils, the Judea Gr. is the least studied and new paleontological and biostratigraphical studies of the latter are much needed.

The Cretaceous Kefira, Soreq, Bet Me'ir, Moza and Kefar Shau formations (Jerusalem area; limestones, marls and clayey marls) were analyzed. The Giv'at Ye'arim, Kesalon, Aminodav and Weradim formations, consisting predominantly of dolomites, were excluded from the study. The total of 43 samples were taken at 0.3–10 m intervals.

Rare and poorly preserved nannofossils from the Kefira Fm. (coords. 2090/6368) estimated the age of this formation only in a wide interval from the Aptian–Campanian. The microfauna dates this formation in a wide interval from the Barremian–Albian to Middle Cenomanian, whereas the macrofauna estimates it as the Cenomanian–Turonian.

Nannofossils of the Soreq Fm. (coords. 2067/6377) are extremely rare; isolated records prevent identification of its exact age. The benthic foraminifera date this formation as the Cenomanian.

The Beit Me'ir Fm. (coords. 2105/6313) yielded only rare Cenomanian benthic foraminifera and no nannofossils.

Based on rich nannofossil assemblages in the Moza Fm. (coords. 2105/6307), the age of this formation is interpreted as the Early – early Middle Cenomanian (UC2) and possibly the Early Cenomanian (UC1) for the lowest sample. This significantly clarifies the position of the formation, compared to the previous dating by macro- and microfauna (Cenomanian–Turonian).

The rich and very representative nannofossil assemblage of the Kefar Shaul Fm. (coords. 2067/6377) date this formation as the early Middle–early Late Cenomanian (UC3), which is a significant improvement compared to the previous macrofaunal dating (Cenomanian) and is slightly older compared to microfaunal data (Upper Cenomanian).

The project was supported by the Ministry of National Infrastructures, Energy and Water Resources.

Safety distances from a speleothem cave for construction: Soreq cave Israel

Palchan D. (1), Aksienko T. (2), Coddington J. (3), Ben-David R. (3), Reshef-Schwarz G. (4), Kurzon I. (5)

[1] Civil Engineering Department Ariel University, Israel

[2] Engineering Seismology & Geophysics, Israel

[3] Roved Geology and Social Consulting Ltd., Israel

[4] Israel Nature and Parks Authority, Israel

[5] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

danielp@ariel.ac.il

Soreq Cave is a unique speleothem cave that is also a nature reserve in Israel. Its speleothems hold values both in an educational and research perspectives, as thousands of pupils and travelers venture inside. Hence, it is vital to take precautionary measures for the safety of these speleothems before commencement of construction with heavy machinery adjacent to the cave. Following studies that had been done in France, we had designed a study that assess ground acceleration in the cave due to various machinery that are expected to work during the construction. We installed four accelerometers in proximity to soda straw fields and to unique speleothem features. The accelerometers recorded the vibrations caused by an excavator and a press machine as well as two explosions from a nearby quarry. The results from these vibrations were translated to peak values of ground acceleration, particle velocity, and ground displacement. These values were compared with known values from the literature and used as foundation to determine the response spectrum. The response spectrum was used to evaluate the vulnerability of the speleothems, where a value of 1% fracture in the speleothems was adopted here. We found that, for the machinery that had disturbed the ground during the experiment, the safety distances are 4m from the boundary of the cave for the press, and 25m from the boundary of the cave for the excavator. These distances are then projected to the surface using LIDAR scan and are used as boundaries for the construction period.

Testing the feedback between divide migration and waterfall retreat along the sinuous Ovil Cliffs, southern Negev

Porat O. (1), Goren L. (1), Shelef E. (2), Qu T. (2)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Department of Geology and Environmental Science, University of Pittsburgh, Pittsburgh, PA 15260, USA

omripo@post.bgu.ac.il

The Ovil Cliffs in the southern Negev show highly sinuous morphology. The drainage divide runs roughly parallel to the cliff, albeit the distance between the cliff and divide varies. This variation is expressed in exceptionally large divide-cliff distance in locations of deep embayments in the cliffline, where channels flowing across the cliff form steep waterfalls. While the association between embayments, divide and waterfall locations are apparent, the processes that formed this morphology remain obscure.

The classic model states that as waterfalls retreat upstream, their drainage area shrinks with time because divides are temporally fixed. This simplistic view is at odds with the cliff's morphology, mainly because the location of deep embayments, marking significant waterfall retreat, is not associated with exceptionally small drainage areas. Here, we evaluate an alternative model of coupled divide-migration and waterfall-retreat. When a waterfall retreats along a horizontal lithologic contact, the average slope between the divide to the waterfall steepens. This, in turn, increases the slope asymmetry and erosion imbalance across the divide, leading to divide migration away from the waterfall, thus increases the waterfall's drainage area, facilitating its ongoing retreat and cliff embayment.

Field- and morphometric-analyses support the feedback model over the fixed-divide model: (1) Slope- and chi-asymmetry across divides indicate that they are unstable and tend to migrate inland. (2) Longitudinal valley profiles parallel to channels draining to the cliff show remnant surfaces that grade opposite to the channel and toward the highlands, indicating that they were part of the highland drainage system before the divide migrated inland. (3) Assuming fixed divides, the morphology of the channels across the divide should not affect the morphology of the channels that drain from the divide to the cliff. Nevertheless, we identify such effects, indicating that there is a morphometric communication across the divide, necessitating a mobile divide.

The effects of global warming on flood properties in small-medium Mediterranean catchments

Rinat Y. (1), Armon M. (2), Morin E. (3)

[1] The Hydrological Service, The Israel Water Authority, 7 Bank Israel, Jerusalem, 9195000, Israel

[2] Institute for Atmospheric and Climate Science, ETH Zurich, Zurich, Switzerland

[3] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

yair.rinat@mail.huji.ac.il

Climate change impact on floods and water resources is crucial for planning adaptation strategies. This is especially true in Mediterranean regions where a decrease in precipitation and an increase in extreme rain rates are expected. Global climate models and standard hydrological models are often too coarse to represent rainfall properties and hydrological processes in these regions. Therefore, the impact of climate change on hydrological regime in Mediterranean catchments is not well understood.

To resolve this, we utilize a high-resolution (1 km^2) weather research and forecasting (WRF) model, producing reliable rainfall data for 41 pairs of heavy precipitation events in historic (end of ^{20}th century) and future (end of ^{21}st century; RCP 8.5 scenario) climate conditions. Ensembles of spatially-shifted rainfall data were input to a distributed hydrological model (<60 s, 100 m^2 GB-HYDRA) representing 4 small-medium-size basins (18–69 km^2) in the eastern Mediterranean (Ramot Menashe).

We found that in the future a significant decrease is expected in (a) basin average precipitation (-24%), (b) maximal 10 minutes rain rates on the runoff contributing area (-22%), and (c) the hillslope area that results in stream runoff in a given moment (-25%). As a result, there is a substantial decrease in the outlet peak discharge (-20%, non-significant), and a significant drop in the total flood volume (-27%). On the other hand, small sub-basins (< 5 km^2) present an opposite behavior, where their local maximal rain rates (averaged over the basin concentration time) and the flood peak discharge are increasing in the future.

We currently expand this research and account for expected changes in future soil moisture and land use. However, the preliminary results of this study suggest that ongoing climate change in Mediterranean regions is expected to have a considerable impact on the flow regime, and thus, practical actions should be taken.

Authigenic Magnetite in the Southeastern Mediterranean Continental Shelf Methanogenic Sediments

Rivlin A. (1), Bosco-Santos A. (2), Boyko V. (1), Sivan O. (1)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Institute of Earth Surface Dynamics, UNIL University De Lausanne, Lausanne, Suisse

adirivli@post.bgu.ac.il

In a traditional view of organic carbon degradation in sediments, methanogenesis is the terminal process, transforming organic matter to methane. However, in many sites around the world intensive microbial iron reduction was observed in the deep methanogenic sediments. Here, we focus on the potential for authigenic magnetite precipitation during this process. In a study site in the Eastern Mediterranean, 20 km east of Acre offshore at a water depth of 90 m, an association was found between geochemical profiles and magnetic parameters, suggesting authigenic magnetite formation in these sediments. In the current study we test this suggestion using a geochemical approach. This is by performing incubation experiments with these sediments and labeled iron oxides and following their reduction and precipitation as magnetite. Preliminary results suggest authigenic magnetite precipitation, but further work is needed to quantify its significance. The results have implications for better understanding of diagenetic processes in sediments and the use of marine sediment in paleomagnetic dating.

Late Quaternary aeolian-fluvial palaeoarchives record landscape evolution along dunefield margins

Robins L. (1,2), Roskin J. (1,2), Bookman R. (3), LuPeng, Y. (5), Greenbaum N (4)

[1] Geomorphology and Portable Luminescence Laboratory, Leon Recanati Institute for Maritime Studies, University of Haifa

[2] Department of Geography and Environment, Bar-Ilan University, Ramat-Gan, 52900, Israel

[3] The Dr. Moses Strauss Department of Marine Geosciences, Leon H.Charney School of Marine Sciences. University of Haifa

[4] Department of Geography and Environmental Studies, University of Haifa, Mt. Carmel, Haifa 3498838

[5] Luminescence Laboratory, School of Resources and Environmental Sciences, Linyi University, Linyi, China

lotem.robins@oranim.ac.il

We studied aeolian-fluvial processes of two middle-sized basins (< 100 km^2) that were dammed by vegetated linear dunes (VLDs) during the late Pleistocene at the southern edge of the northwestern Negev desert dunefield. Easterly moving VLDs, encroaching parallel to the Negev highland sourced fluvial systems, formed seasonal dune-dammed water-bodies. A series of vertical and lateral wadi-bank sequences of fine-grained deposits of these water-bodies which overlapped and truncated VLDs were analyzed along transects of the dunefield margins.

At the Raviv-Ruth basin, in the southwestern dunefield margins, VLDs encroached during the Heinrich-1 and the Younger Dryas events. At the Atadim basin, at the southern fringe of the central sand incursion of the dunefield, VLDs encroachment began during the LGM, and continued until the Heinrich-1 event.

Thick, massive, silty-loam deposits at basal sections of dune-dammed water-bodies, infilled the fluvial accommodation space upstream the dune-dam. The loam resembles loess and probably reflect enhanced availability of eroding loess from the upstream Negev highlands. During the early Holocene reduction in the availability of this source material and in the accommodation space upstream the dune-dam, led to depositions of fine sand – loam couplets that appear to discretely record seasonal to single flood events. These finds may also demonstrate enhanced hydrological activity when stabilized VLDs were still maintained as dams. This last stage of early Holocene dune-dammed water-bodies extended further upstream over larger areas than earlier ones. Altogether, the environmental transitions of the LGM-early Holocene time span characterized by aeolian domination and dune-damming led to amplified aeolian-fluvial sediment archives recording the landscape evolution along the dunefield margins.

Allostratigraphic analysis of linear dunes without visible erosional boundaries using cluster analysis of portable OSL signals

Robins L. (1,2), Roskin J. (1,2), LuPeng Y. (3), Greenbaum N. (4)

[1] Geomorphology and Portable Luminescence Laboratory, Leon Recanati Institute for Maritime Studies, University of Haifa

[2] Department of Geography and Environment, Bar-Ilan University, Ramat-Gan, 52900, Israel

[3] Luminescence Laboratory, School of Resources and Environmental Sciences, Linyi University, Linyi, China

[4] Department of Geography and Environmental Studies, University of Haifa, Mt. Carmel, Haifa 3498838

lotem.robins@oranim.ac.il

The internal structure of dunes often lacks clear internal boundaries and other structure which complicates allostratigraphic analyses and correlation with adjacent dunes. Furthermore, several dune studies involved hand-drilling, which exclude constructing any stratigraphy at all. Here, high-resolution bulk sand sampling from two linear dune sections and a hand-drilled linear dune at the northwestern Negev dunefield were performed and were used for allostratigraphic analysis by Portable Optically Stimulated Luminescence (POSL) device. The samples were clustered by a Mean-shift unsupervised cluster analysis, applied on the Infra-Red and Blue counts, previously found to vary according to the time of burial, mineralogy and luminescence properties. OSL ages and particle size distribution were performed according to the cluster analysis results.

The POSL cluster analysis were found to reliably outline dosimetric breakpoints between units along a single stratigraphic section and between adjacent dune sections. The clusters document a distinct depositional period when the POSL clusters OSL age ranges match. Textural and mineralogical differences, generated by mechanisms such as post-depositional processes, dune degradation followed by nearby alluvial sand aggradation, pedogenesis, and shrub root penetration can also account for dosimetric breakpoints and need to be considered.

Detection of subsurface lineaments

Rochlin I. (1,2), Landa E. (1,2), Shemer K. (1)

[1] Geophysical Institute of Israel, P.O.Box 182, Lod 71100, Israel

[2] The Department of Geosciences, Tel-Aviv University, Tel-Aviv 69978, Israel

itayrochlin@gmail.com

The use of diffracted waves enables the imaging of sub-wavelength features in the subsurface such as small cavities, faults, fractures and stratigraphic pinchouts are rapidly gaining momentum in the oil and gas industry as well as in the fields of engineering, archeology, and homeland security. Most of the proposed methods are based on the Huygens-Fresnel principle, which states that at a given instant, every point on a wavefront acts as a source of outgoing spherical waves. Based on this principle, imaging algorithms treat each point in space as a potential location of a point diffractor. Imaging of the diffractors is based on the coherent summation of the wavefield along precomputed traveltime surfaces. The summation focuses the diffraction energy onto point diffractors which appear at the diffraction images as prominent diffraction anomalies. Using a point-diffractor-based algorithm will be a good choice in cases when the shape of the imaging target is unknown. However, in a more specific case, where shape of the target is well defined (faults, fractures, tunnels, and elongated caves) a more efficient method can be constructed. We present a new approach for the detection and characterization of linear elements of the subsurface using a linear-diffractor operator. We will demonstrate the benefits of using a linear-diffractor operator-based algorithm when detecting linear objects in the subsurface the additional advantages it offers when 3D multicomponent data is available.

The influence of mixed convection and dispersive fluxes on CO_2 dissolution in saline aquifers

Rosenzweig R. (1), Tsinober A. (2), Michel-Meyer I. (2), Shavit U. (2)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] Civil and Environmental Engineering, Technion, Haifa 32000, Israel

rravid@gsi.gov.il

One of the most important trapping mechanisms immobilizing the CO_2 is convective dissolution. When CO_2 is dissolved, it slightly increases the brine density, resulting in unstable conditions leading to the development of natural convection in the form of dense fingers. In most previous studies, natural groundwater flow and the associated hydrodynamic dispersion were neglected. In this work, we study the impact of hydrodynamic dispersion and natural and forced convection (mixed convection) on CO_2 dissolution.

We combine laboratory-scale experiments and numerical modeling to study the effect of background flow and hydrodynamic dispersion on the fingers morphology and dissolution flux. The results suggest that background flow and dispersion affect the dissolution rate in a complex non-monotonic manner while reducing the fingers wavenumber and velocity. Based on the simulated results, new scaling laws that predict the dissolution rate and wavenumber in the presence of dispersion and background flow were developed. These new laws show that the available predictions in the literature overestimate the dissolution rates in potential storage sites.

Intensity-duration-area-frequency of extreme precipitation using weather radar data

Rosin T. (1), Morin E. (1), Marra F. (2)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Institute of Atmospheric Sciences and Climate (CNR-ISAC), National Research Council of Italy, Bologna 40129, Italy

talia.rosin@mail.huji.ac.il

Extreme precipitation is the main trigger of hazardous phenomena such as floods and flash-floods, that pose a serious threat to human beings and livelihood worldwide. Knowledge about the probability of occurrence of extreme precipitation at the spatial-temporal scales most relevant for the catchment response is crucial for an improved understanding of flood-related risks. Here, we use the simplified metastatistical extreme value (SMEV) framework to estimate extreme return levels at multiple spatial and temporal scales directly from weather radar observations. This approach is based on 'ordinary' events, rather than annual maxima only, allowing the use of relatively short archives such as the ones typical of weather radars (11 years in our case).

Intensity-duration-area-frequency (IDAF) relations are derived at a range of scales (10 min – 24 hours, 0.25 km^2 - 500 km^2), using ellipses of varying axes and orientations to account for the spatial component of storms. The study focuses on an area in the south-eastern Mediterranean characterized by sharp climatic and orographic gradients. Our results indicate that, within the uncertainties of the method, estimates of return levels previously derived for the pixel scale can be safely extended for areal scales as large as 500 km^2, producing IDAF curves comparable with those derived from spatially-averaged rain gauge data where dense gauge networks are available. We examine differences in multi-scale extreme precipitation over coastal, mountainous and desert regions, discussing the possible effects of orography and distance from the coastline.

Additionally, analysis of the obtained IDAF relations reveals that at the pixel scale rainfall intensity decreases with duration following closely a power-law relation, as assumed by simple scaling approaches. However, this relation breaks down for larger areas, with return levels decreasing less sharply. This finding is most significant in mountainous and coastal regions than in desert regions.

Response Concept of the Geological Survey of Israel to Earthquakes and Tsunamis in Israel

Salamon A. (1), Amit R. (1), Avirav V. (1), Begin Z.B. (1), Biton Y. (1), Bordman H. (1), Calvo R. (1), Gavrieli I. (1), Gvirtzman Z. (1), Cohen B. (1), Crouvi O. (1), Kurzon I. (1), Levi T. (1), Malik U. (1), Mushkin A. (1), Nahmias Y. (1), Navon H. (1), Nof R.N, (1), Siman-Tov S. (1), Slater Z. (1), Rivlin Yeshayahu A. (1), Sagy A. (1), Tzuberi T. (1), Wetzler N. (1), Yagoda-Biran G. (1), Yechieli Y. (1), Zakosky D. (1), Zitronblat S. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

salamon@gsi.gov.il

The Operational Concept (OC) of the Geological Survey of Israel (GSI) in response to earthquakes and tsunamis in Israel was formulated in light of the joining of the Seismological Division and activation of "TRUAA" earthquake early warning system. For this purpose, the GSI was appointed as an Essential Unit by the Ministry of Welfare and Social Affairs had a state of emergency is declared in Israel. The OC addresses four response levels, including in case the GSI is impaired due to severe manpower deficiency and physical damage to its structure, as follows:

A - Routine and weak seismic activity: Refers to earthquakes that are detected at any magnitude and distance from Israel, but not felt neither caused damage in Israel.

B – Felt earthquakes: Refers to earthquakes that are felt in Israel, usually M > ~3.5, but still lower than "TRUAA" warning threshold, i.e. Mw > 4.5.

C - "TRUAA" threshold and above, that is an Mw ≥ 4.5 earthquake within the Israeli network and up to a distance of 200 km away, to the point of minor damage in Israel, without damage to the GSI structure. In such case, an automatic response is conducted according to a pre-defined procedure.

D - Medium and higher damage in Israel and / or possible damage to the structure of the Geological Survey. Here as well, the GSI responses automaticity in a pre-defined procedure.Tsunami response is handled by "Mayim Adirim" tsunami early warning center located in the Seismology Operational Center, in accordance with a pre-defined decision matrix that sets the level of tsunami threat on the base of the location, depth and magnitude of the occurring earthquake. Mw ≥ 6 earthquakes in Israel are potentially tsunamigenic and thus considered tsunami alert by definition.

Sources and formation of iron minerals in eastern Mediterranean coastal sandy soils – A HRTEM and clay mineral study

Sandler A. (1), Taitel-Goldman N. (2), Ezersky V. (3)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] Department of Natural Sciences, The Open University of Israel, Ra'anana, Israel

[3] Ilse Katz Institute for Nanoscale Science and Technology, Ben-Gurion University of the Negev, Beer-Sheva 8410501

amir.sandler@gmail.com

The suggested sources of iron for the formation of pedogenic iron oxide minerals were inherited iron oxide minerals, primary iron-bearing minerals, and phyllosilicates. Reddening of soils is caused by the addition of neoformed pedogenic hematite from the source minerals under favorable conditions. The sources and pedogenic processes of reddening in sandy coastal plain soils have not been studied. The current study attempts to fill two gaps: 1. exploring reddening of coastal sandy soils in relation to iron sources, accumulation of dust, and soil evolution; 2. revealing the role of clay transformation in the release and secretion of iron. For this purpose, mineralogical compositions of bulk samples and clay fraction, as well as bulk chemical composition, were determined. High-resolution transmission electron microscopy, coupled with energy dispersive spectrometry and selected area electron diffraction, was used for visual observation, point chemical analysis, and crystal structure designation of nanoscale particles. The study documents hematite and goethite as the dominant iron minerals in dust, beach sand, and coastal sandy soils, as well as in mountainous soils in Israel. The hematite content is higher than that of goethite in all types of samples, except in Pale Rendzina (Calcaric Cambisols), where goethite is dominant. Iron-bearing minerals in dust are transformed in the soil environment to form pedogenic hematite, goethite, and ferrihydrite; the scarcity of the latter indicates that the transformation processes are rather rapid. Ilmenite is found, apparently for the first time, as an important source of iron. Dust clays start transformation in the sandy soil environment immediately after deposition, during which adsorbed and structural iron is released and used to form pedogenic iron minerals. The pedogenic processes of iron mineral formation are similar in mountainous and coastal plain soils but are more intense in the latter due to the higher permeability of the sandy substrate.

Extreme events in the Earth system – bug or feature?

Schattner U. (1), Shatner M. (2)

[1] Department of Geography and Environmental Studies, University of Haifa. Mt. Carmel, Haifa 3498838, Israel

[2] Adelson School of Entrepreneurship, Reichman University, 8 Ha'Universita st. Herzliya 4610101, Israel

schattner@univ.haifa.ac.il

The significant increase in extreme events occurring in recent years challenges the predictability of existing models since they exceed the known prevalence and intensity. Recent studies redefine extreme events as part of a larger system, laying down a new scientific foundation for enhanced model predictability. This major and systematic shift in scientific approach has a significant and direct impact on economic, geopolitical, and strategic decision-making due to the growing need to prepare for the direct impact of extreme events and the potential conflicts they might initiate. We present a new approach to extreme events and their implications for scientific research and decision-makers.

New paleoeredox markers in the Late Cretaceous phosphate rocks of Israel – analysis of CO_3 and $\delta^{18}O$ in the francolite carbonate phase

Schneider-Mor A. (1), Bar O. (1), Levy A. (1,2), Berlin O. (1), Yasur G. (1), Zilberman T. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

ayas@gsi.gov.il

The Israeli phosphates are part of a large phosphorite belt stretched between Turkey and Morocco, deposited from the mid-Cretaceous to Eocene. The Israeli phosphorite records in synclines are composed of repeated alternation between pristine and reworked (economic) facies. The pristine phosphorite deposition occurred under high productivity and sedimentation rates, whereas the reworked phosphorite deposits occurred under a high-energy environment. However, the redox conditions and the consequential paleogeography were not compared between the different synclines. Here we use the collected isotope and content data of the francolite carbonate phase to compare phosphogenesis deposition conditions between different synclines. The study focused on three representative sites from Zin, Rotem, and Oron synclines. The Ce values that reflect the redox state of the synclines showed that the Rotem syncline is the most reduced and the Zin syncline the most oxidized. The carbonate phase content (CO_3 wt%) in the pristine layers showed variability between the synclines and has a robust reverse correlation with the Ce anomaly showing that the CO_3 content decreased under reducing conditions. The reverse correlation can be explained by low pH porewater that reduced the precipitation of the CO_3 phase in the francolite and can result from enhanced OM degradation. Hence the CO_3 phase has the potential to be used as an indicator for the redox state during phosphogenesis. $\delta^{18}O$ values vary significantly between the synclines but show no correlation with Ce anomaly. Eliminating other factors, $\delta^{18}O$ of the pore water seems to be connected with organic matter degradation intensity, where lower values suggest intensive OM mineralization, which can indirectly be affected by the redox state. Rotem syncline, with a reducing condition, also presented the lowest $\delta^{18}O$ and CO_3 values. This way, we established the CO_3 and $\delta^{18}O$ as direct and indirect indicators, respectively, for the redox state during phosphogenesis.

U-Pb geochronology of metamorphosed phosphorites in the Hatrurim Basin: Implications for the Mottled Zone pyrometamorphism

Segall Z. (1), Vapnik Y. (1), Elisha B. (1), Haviv I. (1), Katzir Y. (1)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

zoharsega@post.bgu.ac.il

Previous dating of the Mottled Zone (MZ) pyro-metamorphism in Ma'ale Adumim and Hatrurim Basin exposures (Israel) yielded apatite fission track and whole rock $^{40}Ar/^{39}Ar$ Miocene and Pliocene ages, respectively (Kolodny et al., 1971; Gur et al., 1995). Phosphorites of the uppermost Mishash formation, underlying MZ rocks in the Hatrurim Basin, are also locally metamorphosed, exhibiting recrystallized apattie clusters in calcite matrix. Neo-formed metamorphic minerals in the phosphorites indicate that they were heated to 800^{o}C at least, in agreement with peak temperature estimates in the MZ clalc-silicate rocks (Kolodny and Gross, 1974). U-Pb dating coupled with trace element analysis of apatite from the meta-phosphorites may provide insight on the age of metamorphism and the nature of metasomatic and alteration processes that affected the MZ rocks.

In-situ LA-ICP-MS analyses of both bioclastic and pelletal apatite clusters were performed in non-metamorphosed, high-T metamorphosed, and low-T altered phosphorite from several outcrops in the Hatrurim Basin. We found that apatite from high-T metamorphosed samples is Pb, V and Ba depleted, relatively to apatite from non-metamorphosed samples. Post-metamorphic Pb depletion is correlated with V enrichment and further Ba depletion. Thus, apatite clusters with Pb<0.1 [ppm] and V/Ba<100 potentially best fit for U-Pb dating of the metamorphic event.

On inverse concordia diagrams, spot analyses of apatite of each sample plot along specific mixing lines between common and radiogenic lead, all converging to common lead 207/206 ratio of ~0.2, indicating ~60-70 My long accumulation of radiogenic lead in U-rich closed system. High-T metamorphosed phosphorite yielded ages of 3.70±0.48 My and 4.46±0.51 My and a low-T altered sample yielded older metamorphic age of 11.44±1.03 My, both from N. Abuv outcrop. This may be interpreted in terms of multiple pyro-metamorphic events occurring in the same locality, representing repeated ignition of high-calorine energy source.

The northern Dead Sea fault segment in Israel and its intersection with the Irbid rift – architecture, evolution and magmatism

Segev A. (1), Schattner U. (2)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] Department of Geography and Environmental Studies, University of Haifa, Mt. Carmel, Haifa 3498838

schattner@univ.haifa.ac.il

This study re-defines the Dead Sea fault (DSF) structural architecture in northern Israel, emphasizing the Kinneret-Kinarot Bet She'an basin (KKB) through integrating geologic, geophysical, and tectonic evidence, and tightens its timing estimation based on the integration of all volcanic units. Gravity data highlight the complex architecture of the KKB and its surrounding structural blocks. The sharp transition along the eastern KKB boundary represents the DSF Eastern Marginal fault (EMF), which dissipates toward the extensional Yehudiya graben at the northeast KKB. The Western Marginal fault (WMF) appears more dominant along the border between Sirin and the KKB blocks. This fault represents strain partitioning due to the NW branching DSF into the Gilboa-Carmel fault system through the Harod Block and subsidence of the Lower Galilee basins (grabens) along this trend. Low residual Bouguer values, which appear only north of Sirin Block, emphasize the dominant structural role of the WNW-trending Migdal graben as a separator between the Lower and Upper Galilee, conveying DSF branching to the WNW. We show that DSF displacement along the WMF formed a NNE-trending diagonal fault that confined the KKB into a narrow sliver during the Miocene-Pliocene transition. The principal displacement continued along the N-trending Jordan fault and formed the NW-trending Hula diagonal fault. Meanwhile, Pliocene volcanism covered the Korazim Block and parts of its WMF, marking its inactivity. The new structural architecture suggested here explains many of the unresolved structural debates concerning seismically active regions and faulting patterns in the Kinneret basin. We show that in contrast to the prevailing paradigm, the DSF architecture hindered magma ascent and prevented on-transform volcanism. In contrast, ongoing Harrat Ash-Shaam sources and Irbid rifting promoted off-transform volcanism, some of which have descended over the steep topography into the DSF valleys. These conclusions are a game-changer in understanding the DSF evolution.

Induced seismicity by groundwater extraction at the Dead Sea Fault, Jordan

Shalev E. (1), Wetzler N. (1), Shatanawi A. (2), Rödiger T. (3,4), Kurzon I. (1), Lyakhovsky V. (1), Lutzky H. (H), Salameh E. (5), Siebert C. (3,4)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] Earth and Environmental Sciences Department, Al al-Bayt University, Al-Mafraq, Jordan

[3] Helmholtz-Centre for Environmental Research UFZ, Theodor-Lieser Str. 4, 06120 Halle/Saale, Germany

[4] H3 GmbH, Carl-Blomeyer-Str. 65, 07749 Jena, Germany

[5] National Center for Agricultural Research NARC, Jordan

eyal@gsi.gov.il

The earthquake sequence, with a maximum earthquake magnitude of MW 3.8, that occurred during January – February 2022 at the northern Dead Sea fault, is shown to be induced by extensive groundwater abstraction in Wadi Al-Arab basin. Wadi Al-Arab basin, which is bordered in the west by the Dead Sea fault, has been overexploited by extensive groundwater abstraction causing significant drawdowns. Relative earthquake relocation indicates an elongated S-N sequence subparallel to the Dead Sea fault. We simulate the three-dimensional hydraulic head changes in the past 40 years at Wadi al Arab basin. Results show that the drawdowns at the Dead Sea fault wells reached a value greater than 180 m. We use these results to further model the poroelastic effects of the drawdown on the stability of the Dead Sea fault using a typical fault architecture including fault core surrounded by damage zone. Upward groundwater drainage through the permeable damage zone leads to compaction and strengthening. Failure on the Dead Sea fault is expected to occur on the impermeable fault core or at the protolith where weakening is expected. Groundwater abstraction in Wadi Al-Arab basin cause changes of a few MPa in the Coulomb Failure Stress (ΔCFS) and trigger seismicity in these sections. This is the second location along the Dead Sea fault where groundwater abstraction was shown to recently induce earthquakes. With growing demand for water and long-lasting droughts in the Middle East, seismicity induced by groundwater abstraction might reoccur in the near future.

A Hydrogeological model of two-levels perched leaking aquifers feeding numerous springs

Shalom O. (1), Livshitz Y. (2), Lev O. (3), Gvirtzman H. (1)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Israel Hydrological Service, Israel Water Authority, Israel

[3] Casali Center of Applied Chemistry, The Hebrew University of Jerusalem, Israel

ohad.shalom@mail.huji.ac.il

This study presents the modeling of a dual perched aquifer system in the Jerusalem Mountains area. Perched springs emerge from these aquifers, which lay on aquitards within the unsaturated zone. We used daily rainfall recharge series for different surface covers, thereby creating hydrographs for the different springs. Spring hydrographs measured in the 1990's were used to calibrate the springs' coefficient, the hydraulic conductivities of the different layers and the karst characteristics. With calibration, the overall calculated mass balance fits the spring discharges and infiltration to the regional aquifer below the modeled system. The model results show a unique type of regional perched aquifers. In contrast to a local aquifer with a single spring, where the water-table fluctuates uniformly throughout the aquifer, the resulting regional water table is divided into partially connected sub-regions that vary independently. These sub-regions were found to be defined both by geological structure and surface cover. The degree of saturation indicates that the saturated lenses are spread not only throughout the perched aquifer that feeds the springs, but also throughout the aquitard from which water seeps into the unsaturated layer below. In addition, under those saturated lenses, there is increased wetness through central faults which partially allow the two aquifers to be hydrologically connected. In the local saturated lenses, positive pressures are obtained which depend on the thickness of the saturated horizon. In the unsaturated areas where the water is under capillary tension, a negative pressure is obtained whose value varies according to the seepage rate. High flow velocities were obtained within the saturated aquifer (mainly horizontal flow) and in the capillary zones adjacent to it (mainly vertical flow). The numerical model defines the extent of the catchment basins for the various springs, as well as the typical residence time of a water molecule in the hydrological system. These assessments are crucial for the understanding of past pollution events in the region and future restoration processes of the aquifers.

Variations of the seismic b-value along the Dead Sea transform

Sharon M. (1, 2, 3), Kurzon I. (1), Wetzler N. (1), Sagy A. (1), Marco S. (2), Ben-Avraham Z. (2)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] The Department of Geosciences, Tel-Aviv University, Tel-Aviv 69978, Israel

[3] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

matty.sharon@mail.huji.ac.il

The frequency-magnitude distribution of earthquakes follows the Gutenberg-Richter empirical law, in which the scaling between small and large earthquakes is represented by the b-value. Laboratory experiments have shown that the b-value is related to fault mechanics with an inverse dependency to the differential stress, as was also inferred from observational datasets through relations with earthquake depth and style of faulting. In this study, we aim to obtain a better understanding of the geological structure and tectonics along the Dead Sea transform (DST), by examining relations of the b-value to three source parameters: the earthquake depth, the seismic moment release, and the predominant style of faulting. We analyzed a regional earthquake catalogue of ~20,300 earthquakes that were recorded between 1983 and 2020 in a regional rectangle between latitudes 27.5°N−35.5°N and longitudes 32°E−38°E. We convert the duration magnitudes, Md, to moment magnitudes, Mw, applying a new regional empirical relation, by that achieving a consistent magnitude type for the entire catalogue. Exploring the variations in the b-value for several zones along and near the DST, we find that the b-value increases from 0.93 to 1.19 as the dominant style of faulting changes from almost pure strike-slip, along the DST, to normal faulting at the Galilee, northern Israel. Focusing on the DST, our temporal analysis shows an inverse correlation between the b-value and the seismic moment release, whereas the spatial variations are more complex, showing combined dependencies on seismogenic depth and seismic moment release. We also identify seismic gaps that might be related to locking or creeping of sections along the DST and should be considered for hazard assessment. Furthermore, we observe a northward decreasing trend of the b-value along the DST, which we associate to an increase of the differential stress due to structural variations, from more extensional deformation in the south to more compressional deformation in the north.

Simulating drylands cliff evolution in response to extreme rainstorms

Shmilovitz Y. (1), Matthew R. (2), Tucker G. (2), Campforts B. (3,4), Pederson J. (5), Morin E. (1), Armon M. (6), Enzel Y. (1), Haviv I. (7)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] University of Colorado, CIRES, Boulder, U.S.A

[3] University of Colorado, INSTAAR, USA

[4] Vrije Universiteit Amsterdam, Department of Earth Sciences, Amsterdam, the Netherlands

[5] Utah State University, Geosciences Department, Logan, USA

[6] ETH Zurich, Department of Environmental Systems Science, Zurich, Switzerland

[7] Ben-Gurion University of the Negev, Department of Earth and Environmental Sciences, Be'er Sheva, Israel

yuval.shmilovich@mail.huji.ac.il

Cliff bands are common in drylands and their evolution is often influenced by hydrogeomorphic processes. It has been previously suggested that cliff retreat patterns and morphology are affected rainstorms frequency-magnitude relations and properties. However, basic questions on this topic persist because landscape evolution models typically do not account for the surface processes like runoff generation and sediment transport that occur under short-duration (sub-hourly) intense rainfall. Here we test the hypothesis that changes in rainstorm properties can systematically alter cliff retreat patterns and morphology. We developed a novel numerical model that simulates the response of cliffs and associated sub-cliff slopes to various rainstorm regimes to (1) identify dominant cliff morphologies, and (2) examine if extreme rainstorm properties are encoded in the topography.

Our model results agree well with analytical predictions for cliff morphology under a control case of no transport on the sub-cliff slope. Sensitivity analyses on cases where sediment transport is explicitly included show that cliff evolution is highly dependent on both the grain size of sediment derived from the cliff and the rainfall intensities. Numerical experiments based on rainfall and field measurements from the central Negev demonstrate that including the dynamics of high-intensity rainfall and sediment grain size can help explain observed topographic trends. In addition, for a given imposed storm depth, we find that the rainstorm intensities pattern strongly influences both the cliff retreat and its morphology. Short rainstorms with higher intensities are much more erosive than longer storms with lower intensities. This latter case frequently triggers cliff burying. Taken as a whole, our results demonstrate that cliff evolution and morphology are significantly affected by storm-scale sediment transport dynamics and thus highlight the importance of incorporating high-resolution rainfall forcing into landscape evolution models of dryland landforms.

Land abandonment and soil erosion following Late Antiquity in the northwestern Negev, Israel

Shtober-Zisu N. (1), Brook A. (2), Zissu B. (3)

[1] Department of Israel Studies, University of Haifa, Haifa, 31905, Israel

[2] Department of Geography and Environmental Studies, University of Haifa, Mt. Carmel, Haifa 3498838

[3] The Martin (Szusz) Department of Land of Israel Studies and Archaeology, Bar Ilan University, Ramat Gan

nshtober@research.haifa.ac.il

During the 5th and the 6th centuries, the economic hinterland of Christian Gaza included villages that provided agricultural merchandise to the city residents. The houses in these settlements were built of unfired mud-bricks, while water was collected into underground cisterns. The cisterns were cylindrical, with a base diameter of 3-4.5 meters and a maximal depth of ca. 6-8 meters. While almost nothing remained of the flourishing above-ground settlements, soil erosion exposed the cisterns, which now serve as well preserved indicators of the presence and location of Late Antique villages. This study aims to examine to which extent the abandonment of agricultural fields in the late Byzantine - early Muslim period caused significant soil erosion and landscape change. We mapped ca. 150 water cisterns, typical of the period. Most cisterns are located north of the Nahal Gerar channel and along the lower catchment of the Nahal Besor. Mean annual precipitation (1980-2010) in the area is 300-350 mm/year. At present, the abandoned water cisterns protrude above the surface and may enable us to calculate the erosion rates since the settlement collapsed. Study results indicate that the abandonment of agriculture intensified soil erosion: rates of erosion along the steep (10-20%) river banks are up to 2.5 m (1.7 mm/yr), while along the low-angle slopes (2-5%) erosion reach 1.2 m (0.8 mm/yr).

Soil properties were also affected by human activity: in the Horvat Gerarit area, soil results from mud-brick degradation. Field identification is based on (1) relatively increase of fine fraction (clay and loam) within the village's sites, while median values changes from loam within the mud-bricks, to medium-sand over the agricultural fields; (2) mulch, that was added to the bricks to reduce cracking and increase tensile strength is incorporated into the soil; (3) direct observations of several degraded bricks into the soil.

High-resolution mapping of active faults in the Zurim escarpment area, central Galilee

Siman-Tov S. (1), Rosensaft M. (1), Swaed I. (1), Dawood R. (1), Rotberg R. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

shalevst@gsi.gov.il

The Zurim escarpment is one of the steepest slopes in Israel, separating the Upper and Lower Galilee. The normal fault scarps along its base hint at both, the slope evolution mechanism and the degree of fault activity. The area is highly populated and the growing villages expanding toward the escarpment, placing many inhabitants at risk. As a result, we led in this region a high-resolution mapping project that includes landslide susceptibility mapping and an update of the map of active and potentially active faults. Here we will focus on our findings concerning faults. Nahf-East fault, which is located in the middle of the fault system, was considered the only defined active fault in central Galilee. As a result, many of the Zurim escarpment faults that are connected to this segment were defined as potentially active. We combined fieldwork, analyses of high-resolution topography models, and a geophysical survey, aiming to better understand the faulting patterns and their last period of activity. As a first step, we accurately mapped the traces of faults and defined their cross-cutting relations. We found that the Nahf-East fault (trending NW-SE) is younger compared to the Nahf fault (trending E-W). North of the village of Sajur, two parallel faults were marked as potentially active faults. We inferred that only one fault is clearly observed in that area, while the second topographic step that was marked as a fault is most likely an erosional feature. In order to determine if the studied faults are active, we looked for relatively young slip markers. The only relatively young sediment that was found in the study area is a Pleistocene red breccia that was sheared by the normal faults. Finally, we present the up-to-date map of active faults in the project area.

Air-water Interactions Regulating Water Temperature of Lakes: Direct Observations (Agamon Hula, Israel) and Analytical Solutions

Tau G. (1,2), Enzel Y. (1), McGowan H. (3), Lyakhovsky V. (2), Lensky N.G. (1,2)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[3] Atmospheric Observations Research Group, The University of Queensland, Brisbane, Australia

guy.tau@mail.huji.ac.il

Air-water interactions regulate lake-water temperature by balancing the rate of change of water temperature (stored heat) with the incoming and outgoing heat fluxes, which are functions of water temperature and external forcing. Yet, there is a large knowledge gap in quantifying the thermoregulation of a lake, and especially managed lakes, which is hypothesized to be related to both external environmental forcing and management decisions on the lake depth and water discharge. Here we explore the thermoregulation of a restored and managed Mediterranean lake (Agamon Hula, Israel), by direct measurements of all major heat fluxes and interpret the results with a rigorous analysis of the energy balance equation. We provide general solutions of (i) the steady-state water temperature under given constant external conditions and show that it is unrelated to water depth, (ii) the time response of the lake's temperature to reach a steady state following an abrupt change in various environmental conditions and show its relation to water depth and thermal properties of water, and (iii) the response of the lake's temperature to a pre-defined oscillation of the environmental forcing (diurnal, seasonal or other cycles). The amplitude of water temperature fluctuations and the time delay from steady-state are functions of the environmental conditions oscillations and the ratio of the forcing's time period over the thermal response time of the lake. The summertime measured CO_2 fluxes of Agamon Hula revealed the lake acts as a CO_2 source to the atmosphere, overpassing similar water bodies from different climates.

Development of a Model of Fine Particle Deposition in Sandy Streambeds

Teitelbaum Y. (1), Hansen S. (1), Arnon S. (1)

[1] Zuckerberg Institute for Water Research, Ben Gurion University of the Negev, Sde Boker, 84990, Israel

ytbaum@gmail.com

Along the bottom of a sandy streambed, bed load sediment tends to arrange itself into ripples known as bedforms. Flow over bedforms creates a pressure gradient, driving exchange between the water column and the porewater (known as Hyporheic Exchange Flux, or HEF), as well as porewater flow within the bed. HEF influences rates of nutrient cycling, biogeochemical processing, and contaminant removal in streams. Hyporheic flow may be restricted by fine sediment particles originating in the water column that are transported by HEF into the sediment bed and subsequently deposited. Under fast flow conditions, bed load sediment is constantly eroded and redeposited, causing the bedforms to migrate downstream.

We conducted experiments and developed models to better characterize the dynamics of fine sediment deposition under moving bedform conditions. We observed that under stationary bed conditions, fine sediment deposits in a layer on top of the sediment-water interface, but under moving bedform conditions, the fine sediment deposits in a horizontal layer several centimeters deep in the bed sediment. To better understand this phenomenon, we developed a 2D computational framework for modeling fine particle deposition under moving bedforms of arbitrary, time varying shape. In this framework, porewater motion is modeled as quasi-steady via the groundwater flow equation, and particle transport is treated with a Lagrangian advection-dispersion-reaction model that treats deposition as a first-order decay process parametrized by a filtration coefficient. We found that increases in either bedform propagation speed (celerity) or filtration coefficient lead to reduced particle deposition and a more compact sediment layer, and that celerity and filtration coefficient interact in a nonlinear fashion. The same model formulation may be applied to deposition of any type of fine particle.

Environmental Assessment of Coal Fly Ash for Beneficial Use in Infrastructure Applications

Teutsch N. (1), Curpen S. (1,2), Kovler K. (2), Spatari S. (2), Goretsky Y. (3), Berlin O. (1), van der Sloot H. (4) and Kosson D. (5)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] Faculty of Civil and Environmental Engineering, Technion – Israel Institute of Technology, Technion City, Haifa, 3200003, Israel

[3] System Advanced Labs, Yavne, Israel

[4] Hans van der Sloot Consultancy, Hoorn, The Netherlands

[5] Department of Civil and Environmental Engineering, Vanderbilt University, Nashville, TN 37215, USA

nadya.teutsch@gsi.gov.il

Coal fly ash (CFA) disposal is controversial since constituents of potential concern can be released to the ground and reach aquifers, which may pose risks to communities and the environment, whereas thoughtful CFA utilization may result in economic and environmental benefits. A potential safe application of CFA is geotechnical use as fill material in embankments. This work aimed at characterizing leaching properties of compacted Israeli CFA using the Leaching Environmental Assessment (LEAF) approach, and evaluating the environmental effects of utilizing CFA versus sand through life cycle assessment (LCA).

Two CFAs representing COPC-wise worst-case scenario, with different lime amounts were compacted and aged under exposed and sealed conditions in order to mimic the embankment's surface and inner part, respectively. The CFAs and the compacted material after different aging periods (28 days, six months, one year) were characterized by USEPA leaching methods and mechanical tests.

Leaching under percolation indicated initial high leaching for As, B, Mo, Sb and Se, which declined rapidly after initial wash off. Significant differences in leaching were observed between exposed and sealed conditions, mainly a result of pH changes due to carbonation. From the mass transport test, exposed samples demonstrated higher leachability than sealed samples due to carbonation; leachability also increased for both exposure conditions with aging time.

Geochemical modelling of CFAs provided insight into solubility controlling minerals and redox state of elements (e.g., CrII vs. CrVI) and provides means to assess changes in release behavior over long terms.

The LCA showed a net reduction in the impact categories for CFA used in embankments compared to landfilled. Sand impacts were mostly attributed to sand mining. Environmental impacts from utilizing CFA as fill material in an embankment were from CFA truck transportation and leachate emissions. The calculated breakeven distance for transporting CFA as opposed to sand was 115 km.

Organic carbon accumulation and stability in reconstructed wetland, Agmon Hefer

Tolkin A. (1), Rosenberg Y. (2), Golan R. (3)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[3] Institute of Soil, Water and Environmental Sciences, Agricultural Research Organization - The Volcani Institute, 68 HaMacabim Road, Rishon LeZion, 7505101 Israel

tolkin@post.bgu.ac.il

Wetlands are water-logged ecosystems that play a role in the global carbon cycle due to their ability to accumulate, bury and store organic carbon on the one hand, and generate greenhouse gases on the other. Carbon storage, as well as CO_2 and CH_4 generation, occurs preferably under anoxic conditions, largely dictated by the hydrology of the system. Hence, understanding the role of such reconstructed ecosystems in climate change mitigation is critical.

The goal of the current study was to evaluate the organic matter stability in a newly restored wetland in Agmon Emek Hefer, Israel.

Three representative sediment cores were retrieved from three ponds in the study site. Sub-samples were analyzed using the Rock-Eval 6 to assess fractionation to labile and recalcitrant (i.e., decomposition-resistant) elements. In addition, water samples were analyzed for major ionic composition.

Across the study site, high TOC values were observed, up to 8.3% (wt) on the surface. In the 4-10 cm interval, the TOC gradually decreases to an average of 4.4% (wt), and below the 10-30 cm depth interval, a background value of 1-2% (wt) is observed. In addition to the decreasing organic richness, organic matter diagenesis proxies (hydrogen index (HI), oxygen index (OI) and I and R indices) suggest the occurrence of humification processes. This aligns with processes in which labile organic matter in the soil transforms into a more stable fraction. These results exemplify that young, reflooded ponds can effectively capture carbon. However, not all this carbon remains stable with burial and is remineralized back to the atmosphere.

Small endorheic basins as paleoenvironmental archives

Vainer S. (1), Roskin J. (1), Raish I. (1), Markin M. (1), Taha N. (2), Bookman R. (2)

[1] Department of Geography and Environment, Bar-Ilan University, Ramat-Gan, 52900, Israel

[2] The Dr. Moses Strauss Department of Marine Geosciences, Leon H.Charney School of marine sciences. University of Haifa

shlomy.vainer@mail.huji.ac.il

Israel's varied landscape along climatic gradients suggests varied responses to environmental perturbations of the late Quaternary. These may have been correspondingly distinctive, and not necessarily contemporaneous or unidirectional. Some of these environmental changes resulted from rapid and short-term climatic events, requiring the use of spatially spread and temporally continuous, high-resolution paleoenvironmental archives.

Endorheic (closed/terminal) basins record hydro-climatological conditions and long-distance aeolian fluxes, thereby offering a potential paleoenvironmental record. Sediments in small basins are expected to provide continuous and well-preserved records due to limited source-sediment variability and erosion. We are studying climatic-controlled geomorphic process between small basins along south-north transects from the Negev Desert through the East Mediterranean coast, while also identifying local site-specific events, to construct a regional paleoenvironmental framework for the late Quaternary.

Here we show preliminary results from the sedimentological infill of three endorheic basins across a ~150 km south-north transect (1) Givat Hayil (0.08 km^2, ~80 mm annual rainfall) (2) Agamim (0.87 km^2, ~390 mm annual rainfall) (3) Dora (0.14 km^2, ~450 mm annual rainfall). We performed continuous and high-resolution analyses of grain size distribution, magnetic susceptibility, luminescence, and elemental geochemistry. These proxies will be used to reconstruct depositional environments, track sediment sources, and determine burial ages and sedimentation rates. Results indicate several distinct depositional phases often with cyclic characters, that when dated, are hypothesized to often correspond to established climatic events.

Aolian chronology reveals causal links between tectonics, climate, and erg generation

Vainer S. (1,2,3), Matmon A. (1), Ben Dor Y. (4), Verrecchia E. (2), Eckardt F. (5), ASTER Team (3)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Institute of Earth Surface Dynamics, University of Lausanne, 1015 Lausanne, Switzerland

[3] Aix-Marseille Université, CNRS, Collège de France, IRD, INRA, CEREGE, 13545 Aix-en-Provence, France

[4] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[5] Dept. Environ. & Geog. Sci., University of Cape Town, 7701 Cape Town, South Africa

shlomy.vainer@mail.huji.ac.il

Evaluating the impact and implications of aeolian repositories that mark large-scale climatic transitions requires knowledge about the timing of their emplacement and the mechanisms responsible for their production, which remain highly uncertain. Here we apply numerical modelling of cosmogenic nuclide data measured in aeolian sand using two independent dating methods. Nineteen samples were collected in the largest continuous terrestrial body of sand on Earth, to determine settings under which the sand was generated, by constraining the timing of sand introduction into the interior of southern Africa. Our findings reveal that major events of sand formation and accumulation in the Kalahari Desert occurred between ~2.2 and 1 Myr ago. The establishment of the Kalahari sand field corresponds to regional, continental, and global scale climatic and morphotectonic changes that contributed to the mass production and widespread dispersion of sand. These changes substantially altered existing habitats, thus constituting a crucial milestone for flora, fauna, and hominins in southern Africa during the Pleistocene.

Recent advances in the reconstruction of Neogene and Quaternary humid periods in the Negev Desert

Vaks A. (1), Golan T. (1), Langford B. (1, 2), Gerdes A. (3), Albert R. (3), Haviv I. (4), Avni Y. (1)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[3] Department of Geosciences, Goethe-University Frankfurt, Frankfurt, Germany

[4] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

antonv@gsi.gov.il

The Sinai-Negev land bridge between Africa and Asia was an important migration route for animals and hominids for millions of years. The current climate along this bridge is hot and arid, but it has experienced multiple humid periods in the past. During these periods the navigability of the Sinai-Negev land bridge improved. When humid periods in the northern and southern part of the Saharan-Arabian desert belt occurred simultaneously, the desert belt could become discontinuous, enabling “time windows” for hominid and animal migrations out of Africa.

During the Negev humid periods, water seepage into caves was enhanced and speleothems were deposited in the vadose zone. This study attempts to reconstruct the humid periods in the Negev using speleothem chronology. It includes ages from past studies, as well as new laser ablation U-Pb results. Quaternary deposition of vadose speleothems occurred mostly during the following intervals: 109-142 ka, 185-258 ka, 285-365 ka, 430-500 ka, 555-635 ka, 750-860 ka, 1060-1085 ka, 1258-1282 ka, 1320-1350 ka, 1360-1550 ka and 1755-2250 ka. During periods with no speleothem deposition desert conditions prevailed in the region. Older speleothems grew at 2.95-2.98 Ma, 3.1-5.0 Ma, 5.3-6.2 Ma, 6.4-10.5 Ma and 16.7-18.0 Ma, but this record is still incomplete. An ongoing study strives to improve the accuracy and precision of this chronology and to identify additional humid periods.

Nitrate as a control on methane emissions from Lake Kinneret sediments

Waisman A. (1), Sivan O. (1), Eckert W. (2)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Israel Oceanographic & Limnological Research, the Yigal Allon Kinneret Limnological laboratory, Israel

amitwa@post.bgu.ac.il

Methane (CH_4) production and consumption in lake sediments is controlled by many chemical, geological and biological factors. As an important greenhouse gas, monitoring methane emissions and studying the natural controls on its consumption within lake and marine sediments, is important for better understanding methane cycles. One control on methane release to the atmosphere is the presence of electron acceptors such as sulfate, iron, nitrate etc. These are related to anaerobic microbial oxidation of methane (AOM). This study was conducted to evaluate the potential of nitrate as a sole electron acceptor for AOM in a controlled sediment-water mesocosm.

Over a water mesocosm redox conditions, chemical and biological samples were taken daily to identify possible pathways for AOM and other respiratory processes. Methane and Fe(II) decrease seems to be coupled to nitrate addition, indicating either direct or indirect processes such as nitrate reduction through iron oxidation, nitrate dependent AOM and more. The fact that CH_4 keeps decreasing after depletion of nitrate points towards possibly methane oxidation by Fe(III) reduction which was seen possible in Lake Kinneret sediments in previous studies. Further investigation on nitrate/nitrite and iron coupling is required to get a better understanding of AOM processes and other microbial mechanisms related to the nitrogen and iron cycles in such environments.

Reconstructing the Early Pleistocene environmental conditions of the Levantine Corridor: insights from a multi-proxy study of a core from Lake Ubeidiya

Waldmann N. (1), Dean S. (1,2), Yadav A. (1,3), Greenlee J. (1,4), Barzilai O. (5), Belmaker M. (6)

[1] The Dr. Moses Strauss Department of Marine Geosciences, Leon H.Charney School of marine sciences. University of Haifa

[2] Department of Environmental Sciences, Ca' Foscari University of Venice, Italy

[3] Department Physical Geography, Georg-August University of Gottingen, Germany

[4] Department of Earth and Environmental Sciences, Syracuse University, USA

[5] Israel Antiquities Authority, Israel

[6] College of Arts & Sciences, University of Tulsa, USA

nwaldmann@univ.haifa.ac.il

The Ubeidiya site and the lacustrine Ubeidiya Fm. (UBD) in which it is embedded, is highlighted as a key site in the route of faunal (and early hominin) migrations out of Africa 1.6-1.2 million years ago. Although previous studies provided a plethora of information on the faunal assemblages in the Levantine Corridor, much is unknown about the lake conditions. Here we present a new study carried out on a 17 m long core retrieved in the site that appears to recover older units of the nearby exposed formation. The current study uses techniques such as continuous XRF and granulometry (end-member analysis) to reconstruct the hydrological conditions that prevailed in the region and may have facilitated early hominin migration through the region. The core revealed a well-layered lacustrine sequence of mainly alternating clays and silts. The pristine mm-thick laminated packages point to anoxic to sub-oxic conditions (and perhaps a deep lake environment). Moreover, the presence of a carbonate layer suggests that a fresh-water oxygenated water body facilitated enhancement in biological activity. Here we present new geochemical and sedimentological data from the core to reproduce the environmental conditions of both the surrounding terrestrial and limnic settings. The initial interpretation of the datasets points to an apparent cyclicity in the depositional environments, varying from high lake levels (dominated by pristine laminated alternations of clays) to shallow lake levels (dominated by coarse sediment fraction). Overall, the data suggest a contemporaneous shift in the hydrological regime, which in turn can point to an optimal window of opportunity for the migration of fauna and early hominins outside of Africa.

The role of submarine groundwater discharge in the ocean carbon and alkalinity budgets

Weber N. (1), Kiro Y. (1)

[1] Department of Earth and Planetary Sciences, Weizmann Institute of Science, Rehovot, Israel Submarine, Israel

nurit.weber@mail.huji.ac.il

Ocean chemistry is dictated by weathering and transporting elements from the land to the ocean and their removal through precipitation and adsorption. Submarine Groundwater Discharge (SGD) may release large amounts of trace metals, nutrients, carbon, and other dissolved species into the coastal ocean. The element fluxes may be comparable to surface water flow due to groundwater interaction with the aquifer. The DIC and alkalinity fluxes are influenced by the mechanisms driving groundwater flow in the subsurface, affecting the flow paths, residence times, and redox states. Our study shows a significant contribution of alkalinity by fresh groundwater discharge and also during long-term seawater circulation. Even on a relatively small spatial scale as the Israeli Mediterranean coastline (~150 km), we observed differences in alkalinity and DIC derived from the shift in the aquifer's rocks as carbonate amounts drop and sand levels increase from north to south. To comprehensively and globally understand alkalinity fluxes through SGD, we compilated an extensive dataset of coastal aquifers worldwide. This data is used to characterize the interactions between groundwater and country rocks depending on the type of rock and how they may impact groundwater alkalinity and DIC. Most of the groundwater samples lie below the 1:1 Alkalinity-DIC ratio line, which may suggest that the major processes affecting the carbonate system contribute more DIC than Alkalinity (e.g., respiration). Sandy and carbonate aquifers demonstrate the greatest enrichment in DIC compared with alkalinity, which indicates a significant amount of CO_2 and low pH levels. In contrast, alluvial aquifers have a minor DIC enrichment compared to Alkalinity, and basaltic aquifers usually have DICs equal to alkalinities (the most common species is bicarbonate). This study improves our understanding of the carbonate system in coastal aquifers and is a crucial step in resolving some major uncertainties in the ocean carbon budget.

Characterization of soil organic carbon stability using Rock-Eval measurements and CO_2/O_2 fluxes ratio

Weiner T. (1), Tolkin A. (2), Rosenberg Y. (3), Angert A. (1)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[3] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

talweiner@gmail.com

Soil is the largest terrestrial carbon sink and contains twice of the carbon in the atmosphere and 3-times more carbon than vegetation. Therefore, any small change in soil carbon sequestration is meaningful to global carbon cycle and climate change. In this study we examine soil samples from Mount Baron, taken under various conditions such as beneath tree vs. grassland, south/north slope, in several heights, for the different fractions of soil organic carbon. We study the stability and degree of decomposition rate using Rock-Eval pyrolysis and compare it to CO_2/O_2 fluxes ratio (apparent respiration quotient -ARQ) from soil incubations that are conducted in different temperatures. In the Rock-Eval analysis, a pyrolysis stage is followed by a complete oxidation of the residual material. A FID detector measures hydrocarbons released during pyrolysis, while CO_2 and CO are detected by infrared absorbance during both steps. The temperature is rising gradually and the amounts of the main emission products are measured for each temperature range. These measurements are used for calculating several basic parameters such as total organic carbon contents, thermal maturity, Hydrogen Index and Oxygen Index. In addition, the data are used for calculating parameters as I _index which is related to immature OM and R_index which represents the mature OM. The ARQ is measured with a Hampadah system consisted on an infra-red gas analyzer (IRGA) for CO_2 measurement and a fuel-cell based analyzer for measuring O_2. These combined measurements allows to learn more on OM mineralization than the standard CO_2 efflux measurements, especially on processes like partial oxidation. Here we will present first results from this project and will discuss the implications.

Radium isotope study of hydrothermal groundwater discharge into the meromictic Lake Kivu

Weinstein Y. (1), Alkalay R. (1)

[1] Department of Geography and Environment, Bar-Ilan University, Ramat-Gan, 52900, Israel

weinsty@biu.ac.il

The research of 'killer lakes', which are meromictic lake that accumulate large inventories of harmful gases in their deep water, is of very high importance due to their possible severe impact on human life and well-being. This was unfortunately demonstrated in the eruptions of Lake Monum and Lake Nyos in 1984 and 1986, respectively. Lake Kivu is a deep (485m) meromictic lake, located along the western branch of the East African Rift, at the foot of the highly active Nyiragongo volcano. It has a shallow mixolimnion (~65 m) and a deeper monimolimnion, which is subdivided into separate water layers by several picnoclines, with the most prominent at 260m. The deep lake holds very large volumes of both CO_2 and CH_4 (300,000 and 60,000 km^3, respectively). Importantly, lake stratification is maintained via discharge of hot springs at depth and cold springs (and surface flow) at shallow layers, enhanced by recent warming of surface water. In a field campaign during Sept. 2022, we sampled a water column profile, as well as onshore fresh and hydrothermal springs for Ra isotopes. Deep water (400 m) shows relatively low ^{226}Ra activities, while relatively high ^{228}Ra activities (2000 and 100dpm m^{-3}, respectively). Considering the much shorter half-life of ^{228}Ra (5.75 yr, compared with 1600 yr of 226Ra), isotope budgets suggest a quite low $^{226}Ra/^{228}Ra$ ratio in discharging groundwater (0.42, compared with ~20 in onshore hydrothermal springs). This implies that the travel times of the discharging hydrothermal groundwater are no more than a few years (velocities of kms/yr). Surface water (mixolimnion) also has relatively high ^{228}Ra (77dpm m^{-3}), which is not justified by water budgets (influx by rivers and deep-water convection; outflux by the Rusizi River and decay). This could be the result of lake water recirculation in the sediments, which should be further studied.

The spatial distribution pattern of sediment deposition in Haifa Bay during wintertime determined from sediment traps

Weiss-Sarusi K. (1,2), Teutsch N. (1), Bookman R. (2), Silverman J. (3)

[1] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[2] The Dr. Moses Strauss Department of Marine Geosciences, Leon H.Charney School of marine sciences. University of Haifa

[3] Israel Oceanographic & Limnological Research Ltd., Tel-Shikmona, P.O.Box 8030, Haifa 31080, Israel

kerenw@gsi.gov.il

Haifa Bay (HB), an industrialized zone that has undergone significant changes over the last 100-years due to port development, urbanization, river watershed adjustments, and increased pollution inputs. These have and continue to influence transport of sediments and their quality, particularly in terms of Heavy Metal (HM) concentrations, within and out of HB. The Carmel coast shallow shelf is a major source of relatively uncontaminated coarse sediments that are transported into HB with the northerly long-shore current aided by the seasonally varying wave action. During wintertime, flooding events in the Na'aman and Qishon streams discharge large volumes of contaminated fine sediments and organic matter directly into HB. To examine the effects of these processes on transport and accumulation of sediments, eight sediment traps were deployed (19.10.20) within HB at depths of 15 m and 30 m and collected ca. quarterly to represent the seasonally varying spatial distribution of suspended sediments. First sediment trap samples were collected during late February and early March 2021. Sediment flux ranged between 0.5-0.9 g/day for all stations except one trap (out of two) in Carmel Head (3.5 g/day), suggesting HM dilution as high values are present in adjacent trap. Major and trace elements were measured for sediment trap samples in four fractions: total dissolution (T; strong acids) and labile fraction (L; dilute acid) in both bulk sediment (T_{Bulk}) and the <250 μm sediment fraction (T250). Although HM adsorb more to fine sediments, concentrations showed T250≅T_{Bulk}. As expected, HM concentrations showed L250>L_{Bulk}. In stations closer to Na'aman outlet, Acre and Carmel Head, HM concentrations are higher than other HB stations possibly due to the increased contaminated sediment accumulation. Low L/T ratios of Pb in both fractions indicate non-anthropogenic sources while Zn and Cd ratios are higher (1-30% and 20-50%, respectively), suggesting anthropogenic input.

Fresh-saline water interface dynamics due to saline groundwater pumping in a confined coastal sub-aquifer

Wolansky Y. (1,2), Reznik I.J. (2), Levy E. (3), Shalev E. (2), Yechieli Y (2), Sivan O. (1)

[1] Department of Earth and Environmental Sciences, Ben Gurion University of the Negev, Beer Sheva 84105

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

[3] Geophysical Institute of Israel, P.O.Box 182, Lod 71100, Israel

yairwo@post.bgu.ac.il

The research aims to investigate the potential for desalination using beach wells in coastal aquifers, which extend beneath the freshwater-saltwater interface (FSI). The water produced from these wells typically has lower salinity and lower organic matter concentration compared to seawater and is thus considered more suitable for desalination using reverse osmosis (RO). However, the effect of pumping water from below the FSI on the overall coastal aquifer is not well understood, particularly in confined sub-aquifers. The study focuses on two observation wells drilled into the FSI of confined sub-aquifers of the coastal aquifer of the Mediterranean. These wells are affected by two nearby pumping wells of saline groundwater. The goal is to quantify and model changes in water level, salinity, chemical composition, and FSI position as a result of the nearby pumping. a comprehensive array of sensors has been installed both within the well and outside the casing of the observation wells. The sensors within the well continuously monitor temperature, electrical conductivity (EC), and pressure. The well water is sampled seasonally to increase our geochemical understanding of the system and calibration of the sensors. Electrical resistivity is measured outside the well using an array of electrodes, by the Electrical Resistivity Tomography (ERT) method. The first results from 2 years of monitoring show a 5-10% decrease in water salinity. The decrease is not linear and there appears to be more than one parameter controlling the FSI dynamic. However, the effect of the pumping seems to control the short-wave cycles (several hours oscillations) as well as the large trend. A FEFLOW numerical model supports these results and suggests that the freshening will continue until the FSI reaches the pumping wells. Further calibration of the model will be performed with the ongoing collection of field data prior to the determination of quantitative conclusions.

Detection of near-surface anomalies using Backscattering analysis of surface waves

Yurman A. (1,2)

[1] The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, Israel

[2] Geophysical Institute of Israel, P.O.Box 182, Lod 71100, Israel

adiyur@gmail.com

Surface waves incident upon near-surface anomalies result in backscattered waves. Particularly, discontinuities characterized by sharp lateral boundaries, generate high amplitude surface waves of distinct moveout. A novel method called Backscatter Analysis of Rayleigh Surface Waves (BASW) takes use of these backscattered wave fronts to delineate near-surface anomalies. The data processing stages include dynamic linear moveout corrections of surface wave fronts followed by common receiver stacking. This type of processing places the origin of backscattering events at time zero. Consequent F-K filtering enhances the backscattered energy, producing an image indicating the location of the discontinuity.

The study area at the coastal sand dune south of Caesarea includes partially exposed archeological remains. Relying on the excavator's account and on evidence found at the site it is assumed that the base of an ancient sand-stone wall is buried no deeper than ~0.5m below the surface.

Acquisition of two high precision 2D seismic lines took place adjacent to the remains. The obtained results demonstrate the efficiency of the method in delineating the lateral extent of the sand-stone wall.

Estimating the contribution and sources of dust to the volcanic soils of the Golan Heights, and their effect on soil composition

Zaarur S. (1), Crouvi O. (2)

[1] Department of Soil and Water Sciences, The Robert H Smith Faculty of Agriculture, The Hebrew University of Jerusalem

[2] Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel

shikma.zaarur@mail.huji.ac.il

Aeolian sediments are considered a major material source for upland soils in the Eastern Mediterranean. The volcanic fields of the Golan Heights, northern Israel, located at the western edge of the Harrat Ash-Shaam volcanic field, are a lithological anomaly in this otherwise general carbonate mountains terrain, and a unique opportunity to study the significance of aeolian contribution to the soil, as the allochthonous dust input is mostly felsic whereas the autochthonous input from basalt weathering is mafic in composition. While topographic position and field evidence indicate that nearly all soils formed in situ from bedrock weathering, the contribution of allochthonous aeolian sediments to the soils have long been recognized, mainly through the presence of quartz grains, typical to the regional dust. However, there is still need for a comprehensive understanding of the contribution of aeolian sediments and their sources to these soils. In this study, we address these knowledge gaps.

Soil samples were collected, along a south-north transect following the precipitation gradient (450-900 mm/yr), for grain size distribution, mineralogical, chemical and Sr isotope analysis. Together these provided a comprehensive estimation of dust contribution to the soils. The dominance of dust in the soils is strongly indicated by the grain size fraction distribution modes at the silt fraction (~10 μ and ~100 μ), typical of the regional dust. Comparisons between the chemical composition of the soils, underlying bedrock, and dust, exhibit a more complex picture; different elements or elemental ratios exhibit stronger/weaker autochthonous basaltic or allochthonous felsic signatures in the soils. For example, despite the significant presence of quartz, that indicates dust input, some samples exhibit little to no dust signal in their REEs patterns or insoluble elements concentrations, thus suggesting variations in residence times for different dust components in the soils.

Combining the results from all these different analyses exhibits the complexity in measuring, describing and quantifying the contribution of dust to the soil, and the importance of a multi parameter approach when addressing these types of questions.

Competitive CH_4 bubble growth in aquatic muds

Zhou X. (1), Katsman R. (1)

[1] The Dr. Moses Strauss Department of Marine Geosciences, Leon H. Charney School of marine sciences. University of Haifa

rkatsman@univ.haifa.ac.il

Methane (CH_4) bubbles residing in shallow aquatic muds pose a significant threat to the environment. Impeded by the muddy sediment opacity and insufficient resolution for their characterization, past studies overlooked bubble interactions during their growth. The competitive growth of CH_4 bubble pairs with different initial sizes is simulated, using a mechanical/reaction-transport numerical model. Mechanical and solute transport interactions were found to dominate at the different stages of the bubble growth, both retarding the smaller competitive bubble growth. Stress from the large competitive bubble affects the inner pressure and diffusive flux to the smaller bubble, producing its slower initial growth. The large competitive bubble diverts CH_4 from the smaller one at the later stages, thus inhibiting its growth even more. Bubble stress interactions may produce more laterally oriented smaller bubbles and significant deformations of the larger ones. Competitive bubble growth may shape a bubble size distribution pattern, promote muddy sediment CH_4 gas retention, and produce gas domes. The latter acts as pockmark precursors whose formation induces a violent gas release to the water column and potentially to the atmosphere. Our study presents a basis for proper upscaling to various effective gassy muddy sediment characteristics and gas retention models. It contributes to the evaluation and even reduction of a long-persisting uncertainty related to the CH_4 fluxes from the shallow aquatic sediments.