תקצירים

Abstracts

כנס החברה הגיאולוגית

ירושלים | 2024

החברה הגיאולוגית הישראלית

מודה לגופים ולמשפחות הבאים על תרומתם לכנס 2024

רציו אנרגיות ש"מ

אורי דור – גיאולוגיה לתכנון והנדסה

המכון הגיאולוגי לישראל

גיאו-פרוספקט בע"מ

ד"ר עמיר אידלמן - גיאולוג

אוניברסיטת חיפה

גיאו-לוג שירותים טכניים בע"מ

ד"רג'ון הול

האוניברסיטה העברית

משפחת גבירצמן

משפחת גרדר

חברי ועד החברה הגיאולוגית הישראלית לשנת 2023-2024

נשיא – אורי שטנר

סגן נשיא – עודד כץ

גזבר – יואב נחמיאס

אחראי כנס – רן נוף

מרכז תכנים – מייקל לזר

אתר האינטרנט ותקשורת – מיכל רוזנטל

מדיה – נורית שטובר-זיסו

מפגשים מקוונים – ליאור קמחג'י

תרומות ויחסי חוץ – עמית רייס

וועדת ביקורת

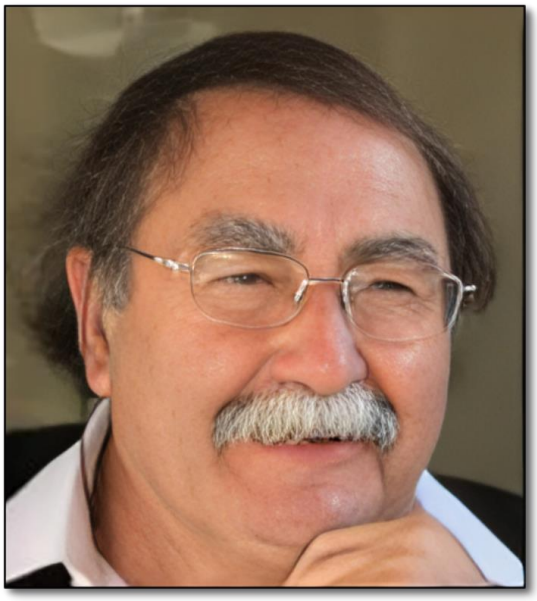
שרית אשכנזי- פוליבודה, אנטון ווקס, יואב בן דור

עריכה ועיצוב

אורי שטנר ומייקל לזר

לזכרם - דברי הספד לחברי החברה שהלכו לעולמם ב- 2023-2024

ד"ר דויד סודרי ז"ל
1942-2024



פטירתו של דויד היא מכה קשה. דויד למד גיאולוגיה באוניברסיטת ננסי בצרפת וסיים את לימודיו ב 1966. דויד עלה לארץ ממרוקו ב 1967 והחל עבודתו במכון הגיאולוגי ב-1968 במחלקת המיפוי ואח"כ במחלקת מחצבים. בשנים 1974-1976 עבד במיפוי שדות הפוספטים בחברת הפוספטים. מאוחר יותר ב 1983 הגיש דוקטורט דאטה באוניברסיטת ננסי בנושא הפוספטים שהיה לתחום התמחותו ובו תרם רבות מבחינה כלכלית ומדעית. ב2004 זכה בפרס היוקרתי על שם רפאל פרוינד של החברה הגיאולוגית על עבודה חדשנית ומקורית בגנזה של הפוספטים. מחקריו הרחיקו לכת ולדוגמה מחקרו המבריק יחד עם טוביה וייסברוד על הסטרומטוליטים בתצורת תמנע. דויד ידע גם להעריך את הפוספט כאחד מאבות המזון החשובים והנכחדים ופרסם על כך מאמרים. הכרתיו יותר מקרוב כשהיינו שכנים בבניין המחצבים קומה שניה במכון בשנלר. איש משכיל, צנוע וליברל עם ידע רב גם ביהדות. אדם חכם שהשיחות אתו על בעיות השעה הציגו חוכמה ומקוריות והבנה עמוקה ביחסי ישראל עם העולם הערבי. דויד אהב והכיר מוסיקה קלסית ובעיקר את מאהלר למיטב זכרוני. דויד היה מסוג האנשים שההכרות אתו העשירה את מכיריו. לצערי לא נפגשנו בתקופה האחרונה אבל הערכתי אותו מאוד הן כמדען והן כאדם ואני משתתף בצערה של משפחתו. תרומתו רבת השנים למכון כחוקר בכיר בעיקר בתחום הפוספטים ראויה להערכה רבה.

יהי זכרו ברוך

כתב: מיכאל בייט

ד"ר דן גיל ז"ל
1938-2023

דן, איש אשכולות, בעל תחומי ידע ועניין רבים ומגוונים, החל את דרכן במכון הגיאולוגי כגיאולוג בתחום מערכות נתונים גדולות. את הדוקטורט עשה באוניברסיטת מישיגן וכשחזר למכון הקים בשנת 1982 את מערכת המחשוב הראשונה ועמד בראשה. דן היה גם יועץ לממשלת תאילנד בנושא מערכות נתונים של מים. ב-1980 דן היה מבין הראשונים שקיבל את פרס החברה הגיאולוגית על שם פרופ' רפאל פרוינד ז"ל.

קורס מורי הדרך שסיים הביא את דן לעיסוק שהיה כל כך אהוב עליו - השילוב בין מדע הארכיאולוגיה, היסטוריה וגיאולוגיה. דן ראה בחשיבות שילוב זה ובתרומת תובנות מתחום מדעי האדמה לפתרון סוגיות ארכיאולוגיות. מבין הנושאים העיקריים בתחום הגיאו-ארכיאולוגיה בהם עסק דן שפורסמו בעיתונות בינלאומית חשובה היו מחקריו בהבנת מערכות המים התת קרקעיות בעיר דוד, המצור הרומאי במצדה ואבני הבניין במבנים קדומים בירושלים.

יהי זכרו ברוך

כתבה: מירה בר מטיוס

ד"ר בנימין (בוכי) בוכבינדר ז"ל
1937-2023

בוכי תמיד התעניין במדעי הטבע. הוא החל את לימודיו במחלקה לגיאולוגיה באוניברסיטה העברית בירושלים בשנת 1959, וכדי לממן את לימודיו עבד כפקיד בנק. כשחסך מספיק נטש את הבנק. הצטיינותו בלימודים העניקה לו משרת עוזר הוראה ולאחר מכן עבודה במכון הגיאולוגי והמכון למחקרי נפט וגאופיזיקה.

בוכי התמחה בסטרטיגרפיה וסדימנטולוגיה ותרם רבות להבנת הגיאולוגיה הסדימנטרית של ישראל. את מחקריו בהתפתחות אגנים סדימנטריים החל כבר בעבודת הגמר על הגיאולוגיה של אזור מעלות-תרשיחא (1964). בשנת 1969 השלים את המיפוי הגיאולוגי המפורט של אזור השפלה שכלל שישה גיליונות בקנ"מ 1:20000. עבודת הדוקטוראט שלו, על הליתוגנזה של גירי שוניות במיוקן בישראל, הוגשה בשנת 1975. במהלך השנים חקר בוכי כיוונים והיבטים רבים. לידיעותיו ומיומנותו בשיטות מחקר סדימנטולוגיות מתקדמות הייתה חשיבות כלכלית רבה בסקרי נפט וגז. היתה לו תפיסה גאולוגית מקיפה אותה שמח לחלוק, ותמיד מוכן היה לדון בנושאים החורגים מתחומי התמחותו. כשביקשתיו להתלוות אלי לסיורים גיאולוגיים, וולקנולוגיים וארכאולוגיים הסכים בשמחה. בתקופה שלפני יציאתו לגמלאות התמקדו מחקריו בתיאור ופיענוח אגנים סדימנטריים בשיטת סטרטיגרפיית הרצפים.

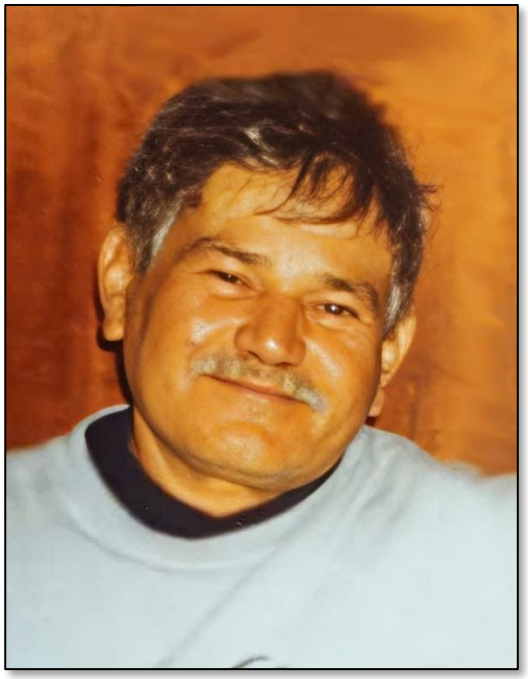
בוכי היה איש נעים הליכות וצנוע ומעולם לא התפאר בידיעותיו והישגיו. תמיד מוכן היה לעזר ולשתף פעולה. בוכי יחסר מאוד לידידיו הרבים ולמשפחתו.

הותיר את אשתו אניטה וילדיו יעל ועודד ונכדיו מאשתו לורי ז"ל.

יהי זכרו ברוך

כתב: דובי לויטה

ד"ר יאיר שילוני ז"ל
1935-2024



יאיר שילוני (סולניק), יליד ירושלים, למד במחלקה לגיאולוגיה באוניברסיטה העברית בירושלים. בעבודת הגמר חקר את שדה הפוספטים במכתש הקטן ועליה זכה בדיפלומה של ה-Imperial College (London). מאז, הווייתו המקצועית נשזרה בגילוי ובפיתוח משאביה הטבעיים של מדינת ישראל. יאיר חקר את תפרושת מרבצי הפוספטים ברחבי הארץ ואפשרויות ניצולם במסגרת המכון הגיאולוגי ובשיתוף פעולה הדוק עם חברת הפוספטים. גולת הכותרת של עבודתו הייתה הייזום והביצוע של הפרויקט הלאומי הגדול - סקר הפוספטים הארצי. בנוסף למחקריו הרבים בהקשרים של מסלע הפוספט עסק יאיר במסירות בנושאים מרכזיים נוספים של תעשיות המחצבים והאנרגיה, כגון פצלי שמן, חומרי גלם לתעשיות הבנייה, אנומליות מתכתיות במכתש רמון, חיפושי אורניום בישראל ובסיני, ועוד. מחקריו הרבים הקיפו תחומים מגוונים, כמו הפליאוגיאוגרפיה של הסנון, ביוסטרטיגרפיה, שיטות אנליטיות, ושפיעת הרדון.

יאיר כיהן כסגן מנהל המכון הגיאולוגי וניהל את האגף למחצבים ומקורות אנרגיה בו. במשך שנים הוא הדריך וליווה גיאולוגים צעירים רבים בתחילת דרכם המקצועית בתחומי הגיאולוגיה הכלכלית. יאיר כיהן בוועדות מקצועיות רבות בנושאים שונים בגיאולוגיה כלכלית, היה חבר פעיל באיגוד הישראלי להנדסה ולמדעי המחצבים, ואף שימש כיו"ר הועדה המארגנת.

יאיר היה מוכר ומוערך בזכות הידע הבלתי נדלה שלו, מומחיותו המקצועית, מסירותו הרבה לעבודה וחדשנותו. לצד זאת היה אדם נעים הליכות, נדיב וחבר נאמן. הסתלקותו מאיתנו היא אבדה גדולה לקהילה הגיאולוגית בישראל.

יהי זכרו ברוך

כתב: צבי מינסטר

ד"ר זאב (זברה) לוי ז"ל
1940-2024

שבעים ואחת שנים הלכנו יחד, מאז ימי בית הספר התיכון ב"תיכון חדש" בתל אביב. את הסיור הגיאולוגי הראשון עשינו לאורך מצוק החוף מתל אביב להרצליה עם מורנו דר' יהויקים פאפוריש שדאג להעביר את אהבתו לגיאולוגיה לתלמידיו.

זברה נולד להורים שעלו מגרמניה אחרי עלית הנאצים לשלטון. אביו רודולף היה נגן בתזמורת הפילהרמונית, ואימו מינה הייתה ציירת. בבית ילדותו נחשף לערכי התרבות האירופית, אשר ליוו אותו לאורך חייו. וגרמו לו לעסוק באומנות ובמדעי הרוח, לצד עיסוקו המדעי בגיאולוגיה.

בגיל צעיר חבר לדר' חנן ביטינסקי-זלץ מראשוני הזואולוגים המודרניים בישראל במכון הזואולוגי באבו כביר, שקדם לאוניברסיטת תל אביב. חנן לקח אותו תחת חסותו, והדריכו בשיטת הסיסטמטיקה של בעלי החיים, ודחפו ללימודי הגיאולוגיה.

בשרותו הצבאי, שרת בממר"ם, יחידת המחשב הראשונה של צה"ל, עוד בתקופה שצה"ל נסמך על שרותי המחשב של מכון ויצמן, משנרכש המחשב הצה"לי הראשון, עסק בהטמעת שימושי המחשב בצבא.

בלימודנו באוניברסיטה עבדנו כזוג במעבדות ובמחנות המיפוי, ואחר כך באותם שטחים באזור אילת, לצורך עבודות המוסמך. אחרי מלחמת ששת הימים עבדנו בסיני, במסגרת מפעל שהוקם על ידי האוניברסיטה העברית ומשרד הביטחון, למיפוי הגיאולוגי של חצי האי.

זברה צד מהר את עיניהם של מורי הפליאונטולוגיה באוניברסיטה העברית, הפרופסורים משה אבנימלך וזאב רייס, ובשלב מוקדם של לימודי המוסמך שלו הציעו לו לשמש כעוזר הוראה במחלקה לגיאולוגיה. שם שימש כמדריך עד ראשית שנות השמונים, עת עבר לעבוד במכון הגיאולוגי.

במכון הגיאולוגי הפך להיות בר סמכא מרכזי בנושאי הפליאונטולוגיה והסטרטיגרפיה, ועזר רבות לעובדי המכון שנזקקו לסיוע, כאשר נתקלו בבעיות במהלך עבודתם. הוא היה קשוב מאד לנושאים שהועלו על ידם, ועם זאת המשיך בעבודות המחקר שלו.

שיתופי הפעולה חשובים שלו היו בנושאי הפוספטים עם דר' דוד סודרי שנפטר לאחרונה, ובנושאי הוראת הגיאולוגיה עם פרופסור עמנואל מזור ממכון ויצמן, כאשר סייע בידו להקים את מרכז המבקרים הראשון במצפה רמון, שנועד להנגיש לקהל הרחב את הגיאולוגיה של מכתש רמון. לצורך זה חיבר גם את המדריך הראשון למאובנים הגדולים של ישראל.

עבודתו של זברה חרגה מתחומי הארץ, אל עבר בעיות כלל עולמיות, ובעיקר נמשך אל נושאים של ראשית החיים, ופרסם מאמרים בעיתונות המדעית על נושאים אלה.

חיבתו לארכיאולוגיה דחפה אותו לעסוק בנושאים ארכיאולוגיים. שם מצא את עצמו קורא תיגר על מוסכמות, אך לא ויתר על דעותיו, ובסופו של דבר זכה להכרה, דבר ששימח אותו מאד בתקופת מחלתו.

תנחומינו לאשתו גלוריה ולילדיו מיכל, דני ויעל.

יהי זכרו ברוך

כתב: יוסי ברטוב

תכנית הכנס

כנס החברה הגיאולוגית, 2 באפריל 2024, ירושלים			
8:00	9:00	התכנסות ורישום בכניסה למכון למדעי כדה"א	
9:00	10:30	מושב הרצאות ראשון	
		אולם מדעי המוח **סייסמולוגיה וגיאופיסיקה** יו"ר: **גוני יגודה-בירן**	אולם 109 **גיאו-ארכאולוגיה, פליאו-אקלים, הידרולוגיה והאזור הקריטי** יו"ר: **יואב בן דור**
9:00	9:15	**סימנים מקדימים למתקפה בשבעה באוקטובר מאנליזה של הרעש הסייסמי** **ענבל, א.**	**אגני יצור מלח כסמן חדש למפלסי הים היחסי במהלך 2000 שנה אחרונות, מקרה מבחן מהחוף הדלמטי, קרואטיה** **בכור ב.**, ברוק א., אבנעים-כתב ס., חרות ב., פורת נ., סיון ד.
9:15	9:30	**הקטנת חוסר-הוודאות של נפילת המאמצים בעת רעידות-אדמה** **קורזון א.**, ליחובסקי ו., שגיא א.	**חידושים אחרונים במחקר מקורות צור באתרים ארכאולוגיים באמצעות מדידות גיאוכימיות של יסודות קורט** **בן דור, י.**, פינקל מ., שרון ג., תירוש א., בר ע., בן-יוסף א.
9:30	9:45	**הקמתו ופעילותו של מערך החירום 7-24 של אגף סיסמולוגיה במכון הגיאולוגי** **נבון ה.**, קורזון א., נוף ר., וצלר נ., אבירב ו., פולוזוב א.	**מידול הידרוגאולוגי של אגן בלתי מנוטר - אקוויפר היורה בחרמון** **בן צור א.,** בארי-שלוין י., גל ג., גבירצמן ח.
9:45	10:00	**מודל סייסמו-טקטוני עדכני למפת סיכונים סייסמיים לישראל** **יגודה - בירן, ג.**, חמיאל, י., שגיא, א., פרובטו, ע., וצלר, נ., אנגלברג, ש., שרון, מ., קורזון, א, דור, א., קלה, א., שפירא, א., קמאי , ר., וסלמון, ע.	**יצירה מתמשכת של קרקעות באזור ההררי של ישראל** **סנדלר, ע.**
10:00	10:15	**הרוחב האפקטיבי הנמדד בגבולות לוחות מסוג סטרייק סליפ** **אנגלברג ש.**, וצלר נ., עגנון א.	**מידול זרימת מי תהום במערכת אקוויפרים דו-קומתית המזינה עשרות מעיינות** **שלום א.,** לב ע., גבריצמן ח.
10:15	10:30	**מה ניתן ללמוד מהשתפלות חריגה של שולי יבשת על אופייה של הליתוספירה בזמן ביקועה? תובנות ממידול אנליטי מוכוון תצפיות** **לנג ג.**, טן ברינק א., מקובסקי י.	**Deccan fingerprints in the late Maastrichtian of Hor Hahar at orbital time scales: X-Ray Fluorescence analysis and calcareous nannofossil evidence** **Marconato S.**, Abramovich S., Thibault N., Adatte T., Rosenberg Y.O., Ashckenazi-Polivoda S.
10:30	11:00	**הפסקת קפה**	

		אולם מדעי המוח **גיאולוגיה א'** יו"ר: **עמית שגב**	אולם 109 **גיאולוגיה ב'** יו"ר: **אדר גלזר**
11:00	11:15	**ההתנגשות של אסטרואיד צ'יקסולוב לפני 66 מיליון שנים: שינוי מוחלט בגיאודינאמיקה של לוחות טקטוניים ופלומים מעטפתיים** **שגב ע.**, וצלר נ. אונייל ק., רוזנבאום ג.	**התפתחות מורפוטקטונית של אזורי ביקוע במשך 130 מיליון שנה: אין נסיגה משמעותית של מצוקים, אין שינוי במיקום פרשות מים ראשיות לאורך זמן. דוגמה מבקע האטלנטי הדרומי בדרום אפריקה** **אבני, י.**
11:15	11:30	**Influence of ocean bottom current on shelf-edge clinoforms buildup, a case study from the Santos Basin, southeastern Brazilian Atlantic margin** **Lintser S.**, Schattner U., de Mahiques M.M.	**מקור החתך הסיליסיקלסטי מגיל אוליגוקן-מיוקן באגן הלבנט: מחקר פרובננס של חול וחרסית מקידוחי הים העמוק** **גלזר א.**, אביגד ד., מורג נ.
11:30	11:45	**מיפוי תת הקרקע במרכז ישראל** **ברטוב י.**, ויגווסקי ס, וולאז' י.	**מבנה הליתוספרה בים האדום מתוך מודל צפיפויות תלת מימדי** **ישששכר ר.** גומז-גרסיה א. מ. אבינגג י.
11:45	12:00	**Quantitative analysis of the Eratosthenes Seamount bathymetry – a tool for understanding subducting plate processes** **Nelaev, A.**, Frieman, S., Lazar, M., Schattner, U.	**האם תעלת הלבנט פעילה? המשמעות לגבי ההיסטוריה הגיאולוגית והסכנה הגיאולוגית** **כץ, ע.**, טורפשטיין, ע., כנרי, מ., חיימס-קפצן, א.
12:00	12:15	**המבנה של הכנרת** **זלצמן, ע.**	**Dead Sea Stromatolite Reefs: A testing ground for automated detection of life forms and their traces in harsh environments** **Gedulter N.**, Thomas C., Ariztegui D., Levin N., Agnon A., Ben Dor Y.
12:15	12:30	**ארכיטקטורה ואבולוציה של הסגמנט הצפוני ביותר של העתק ים המלח בין אגני חולה (ישראל) ואמיק (תורכיה): האם העתק ים המלח נהיה טרנספורם?** **שטנר א.**, שגב ע., וצלר נ.	**שיחזור סביבות ותנאי ההיווצרות של קרבונטים בסלעי הטריאס במכתש רמון בעזרת איזוטופים מצומדים** **קופר-פרומקין ש.**, אברט י., אפק ח., ריב א.
12:30	13:30	**הפסקת צהרים ופוסטרים**	
13:30	15:30	אולם מדעי המוח **אספת מליאה** יו"ר: **אריאל היימן** הענקת פרסים: חברות כבוד, מדלית החברה, פרס עבודה יישומית, פרס ע"ש גבירצמן ז"ל הרצאות פרס גרדר (דר' חני ויגדרוביץ', דר' חגי איל) הרצאת פרס פרוינד (פרופ' זהר גבירצמן) הרצאת נשיא	

15:30	16:00	**הפסקת קפה**	
		אולם מדעי המוח **גיאומורפולוגיה** יו"ר: **נורית שטובר-זיסו**	אולם 109 **גיאולוגיה חינוכית, סביבתית, וגיאוכימיה** **יו"ר: עמית ריס**
16:00	16:15	**עדויות גיאומורפולוגיות חדשות לפעילות טקטונית הולוקנית לאורך העתק אמיצהו** **אסיף א.**, לנגפורד ב., בלמס א., ווקס א., פרומקין ע., מושקין ע.	**שפיעת מי תהום מגבירה את קצב החמצת מי הים באזורים חופיים לאורך צפון החוף הישראל בים התיכון** **סילברמן, י.**, עספור, מ.
16:15	16:30	**הערכת גיל השקעה באמצעות מכשיר לומינסנציה נייד של משקעים איאולים-פלוביאלים בשולי שדה הדיונות של צפון-מערב הנגב** **רובינס, ל.**, גרינבאום, נ., רסקין, י.	**חקר אזורי המילוי החוזר ואופן הזנת המעיינות באקוויפר האאוקני באגני הנחלים השופט וציפורי** **הר, נ.**, הרלב, נ., תמיר, ש., עוז, ס., מדינה, ע., מורן, א.
16:30	16:45	**מורפודינמיקה של קרקעית הים הרדודה במהלך סערה: תצפיות ישירות ברזולוציה גבוהה** **רוזן נ.**, בץ ת., לנסקי נ., כרובי א., בץ ע., מושקין ע., עגנון א.	**טומוגרפיית פוזיטרונים למעבר וכימות תהליכי הסעה בתווך נקבובי - מקרה מבחן ממטריצות צמנטיות באפליקציות טיפול בפסולת רדיואקטיבית** **ריס ע.**, קולנקמפף י., שונגרט י.,בר-נס ג., פישר ק., עמנואל ס.
16:45	17:00	**גיאומורפולוגיה בשירות נקרוגיאוגרפיה: ליתוליגיה ותפוצת הקברים בנקרופוליס של ירושלים בימי בית שני** **שטובר-זיסו נ.**, זיסו ב.	**מודל דו-שלבי לדולומיזציה של הפלטפורמה הקרבונטית הקרטיקונית בהר הכרמל** **לוינסון י.**, איילר ג'., וורגפט א., ניאגו נ., אברט י., ריב א.
17:00	17:15	**ערוצי נחלים במדף היבשת הרדוד של הגליל המערבי, בפליסטוקן העליון ובהולוקן** **צביאלי ד.**, לפיד ר., ויטנברג ל., גלילי א.	**השפעות אנתרופוגניות וסדימנטולוגיות על פרופילים גיאוכימיים מול מפרץ חיפה, ישראל** **וייס-סרוסי ק.**, בוקמן ר., סילברמן י. טויטש נ.
17:15	17:30	**התגובה הגיאומורפולוגית של נחלים אלוביאליים לאירועי שטפונות בדידים במהלך ירידת בסיס סחיפה** **בן משה ל.**, לנסקי נ.	**מהנהר עד לים - היתרונות של סיורים במציאות מדומה** **ישראלי י.**, לוינסון י.
17:30	18:00	**קפה, פיזור, נסיעה טובה**	

רשימת פוסטרים

.1	**אפיון כמותי של אפקט ה"באלאסט" בזמן אירועי הרחפת סדימנט במפרץ עקב** Quantification of the ballasting effect during abrupt sediment resuspension events in the Gulf of Aqaba קלרפילד, ע., טורפשטיין, ע.
.2	**השפעת שינויי האקלים על השכיחות והעוצמה של אירועי גשם קיצוניים באזור המזרח התיכון וצפון אפריקה** Climate change impact on extreme precipitation frequency and intensity in the Middle East and North Africa region גולדשמידט י., מורין א., מרה פ.
.3	**השפעת שינויי האקלים על הנגר העירוני במזרח הים התיכון** Climate Change Impact on Urban Runoff in the Eastern Mediterranean נוסבאום ר., מורין א.
.4	**חקירת דפוסים ביחסי עוצמה-משך-שטח-שכיחות משקעים באמצעות שימוש בנתוני מכ"מ גשם** Exploring patterns in precipitation intensity-duration-area-frequency relationships using weather radar data רוזין ט., מרה פ., מורין א.
.5	**עדויות סייסמיות חדשות במחנה הלגיון הרומי, שולי עמק יזרעאל** Geoarchaeological analysis of suspected seismic event at the Roman Legionary Base in the Jezreel Valley, Israel וילר, נ., טפר י., קסלר, א.ש., תורג'מן יפה, ז., אלימלך, ח., נג'אר, ע., צין, ב.
.6	**מחול לזכוכית-בחינה גיאוכימית של תעשיית הזכוכית הרומית בתל יבנה** Evaluating local sand contribution to Roman glass production-Tel Yavne as a case study וילר נ., בן דור, י., סורקין, ק., גורין רוזן, י., בצר, פ., ורגה, ד., זילברמן, ת., יסעור, ג., אשר, י.
.7	**חמצן 17 בספלאוטמים במערת שורק** ^{17}O excess in Soreq Cave Speleothems עשור א., ברקן י., אפק ח.
.8	**השפעותיהן של תגובות הטרוגניות על האלקליניות הכללית והפחמן האנאורגני המומס במפרץ אילת** Heterogeneous reactions and their effect on dissolved inorganic carbon and total alkalinity אדוורדסון ג., טורפשטיין ע. וונג א., טיטמוס פ.ד., לזר ב., מורקסקי ק., צ'רצ'יל ג'., וורגפט א.
.9	**שונות ביחסי יסודות שונים בין חדרים בשלדים של שני מיני פורמיניפרה פלנקטונית Globigerinoides ruber albus ו- Turborotalita clarkei ממפרץ אילת** Inter-chamber elemental ratio variability in two planktic Foraminifera species from the Gulf of Eilat: Globigerinoides ruber albus and Turborotalita clarkei לוי, נ., טורפשטיין, ע., שיבל, ה., טשרניחובסקי, נ., יובום, ק.פ., וויס, א., שטול, ב., האוג, ג.
.10	**כמות, הרכב ומקור גזים עיקריים במערכות מי תהום בישראל** Quantity, composition and source of major gases in groundwater systems in Israel בן-נון לבנון ה., רוזנברג י., גנאור י., רזניק א.
.11	**שחזור הדיאגנזה בסלעים סדימנטריים מגיל איאוקן בישראל בעזרת תיארוך אורניום-עופרת בשיטת מס-ספקטרומטריה עם דיגום לייזר** Reconstruction of diagenesis in Israeli Eocene sedimentary rocks by Laser-Ablation-Mass-Spectrometric (LA-MS) U-Pb chronology ווקס, א., גולן, צ., לוינסון, י., סריווסטווה, ה., קורנגרין, ד.

12.	**הערכת פוטנציאל הטמנה של CO_2 ברצף הסדימנטרי איאוקן-מיוקן במדף היבשת של ישראל** CO_2 storage potential assessment of Eocene-Miocene sedimentary sequence on the continental shelf of Israel קורנגרין, ד., ווקס, א., סריווסטווה, ה., זילברמן, ת., מורג, נ., בן דור, י.
13.	**שחזור ביוסטרטיגרפי של חתך האיאוקן במדף היבשת של ישראל** Biostratigraphy reconstruction of the Eocene of the Israeli continental shelf סריווסטווה, ה., ווקס, א., קורנגרין, ד.
14.	**שחזור פלאוסביבתי על ידי ננופלנקטון באלביאן-קנומן באזור ירושלים** Palaeoenvironmental reconstruction by calcareous nannofossils of the Albian–Cenomanian succession of the Jerusalem Area אובצ'קין מ., וקס א., אבני י.
15.	**גרדיאנט צפון-דרום בהרכב האיזוטופי והריכוז של ליתיום בקרקעות טרה-רוסה בישראל, בין 1500 ל-300 מ"מ גשם בממוצע לשנה** North-south gradient in Li isotopic compositions and concentrations in Terra-Rosa soils from 1500 mm to 300 mm isohyets in Israel מורג, נ., וקס, א., ווילסון, ד., פוגי פון סטרנדמן, פ.
16.	**התפתחות של מערכות העתקים נורמליים: תיארוך ברקציה סין-טקטונית ושחזור קצב החלקה ארוך טווח על העתק, מתלול צורים, הגליל, ישראל** Exploring the Evolution of Normal Fault Systems: Dating Syn-Tectonic Breccia and Reconstructing Long-Term Fault Slip Rate, Zurim Escarpment, Northern Israel שרייבר ג., מטמון א., סימן-טוב ש., גולן צ.
17.	**אוליגוטרופיקציה ימית כתוצאה מחסימה אנתרופוגנית של סדימנטים דקים ונוטריינטים במעלה נהרות: מקרה סיכור הנילוס** Marine oligotrophication caused by anthropogenic fine sediment and nutrient retention in large rivers: the Nile damming case חרות ב., גיא-חיים ת., אלמוגי-לבין א., פישר ה., רנסבי ד., סנדלר ע., בץ ת., אבנעים-כתב ס.
18.	**עקבות ביקוע של Po210 בזכוכית כשיטה להגדרת חשיפה רטרוספקטיבית ארוכת טווח לראדון: ניסויים ראשונים בישראל** Glass implanted 210Po as a method of defining long-term retrospective exposure to radon: First experiments in Israel שירב שורץ מ., חאקין ג.
19.	**עדויות על עלייה בערכי התולכה באקוויפר החוף על פי מבחני שאיבה** Evidence of Costal Aquifer transmissivity increase using pumping tests בלייר א., עמיעז י., גוטמן י.
20.	**שימוש במורפולוגיית בולענים להערכת יחסי חלוקים-חרסיות בתת הקרקע באמצעות שיטות למידת מכונה** Using Sinkhole's Morphology for Evaluating Subsurface Gravel to Clay Ratio with Machine Learning Approaches גוטמן נ., נוף ה., גורן ל.
21.	**חקר פלסטיות של טמפרטורות נמוכות באוליבין: תובנות מניסויי ננואינדנטציה** Exploring Low-Temperature Plasticity in Olivine: Insights from Nanoindentation Experiments אשכנזי ע., בונה י.
22.	**פאליאו-קונטורים מנתונים סייסמיים תלת-מימדיים בקצה מדף היבשת: סמני חוף מעידני קרח?** Quaternary paleo-Shorelines from 3D seismic data, indicators for glacial low stands? צרפתי ג., מדבדב ב., עגנון א.

.23	**מיפוי Vs30: שילוב פרמטרים גיאולוגיים וטופוגרפיים** Mapping Vs30: Integrating Geology and Terrain Parameters for Enhanced Correlation פרוכט ע., קמאי ה., יגודה-בירן ג.
.24	**העיבוד החדש בסייסקומפ – יתרונות, בעיות, אתגרים** Advancements in Seismic Data Analysis at the Geological Survey of Israel (GSI) גורשטיין מ., איזנשטט א., גילר ד., נבון ה.
.25	**בקרת איכות סיסמית של תחנות "תרועה"** Seismic quality control stations of earthquake early warning system (EEWS) for Israel קלמנוביץ מ., נבון ה., וצלר נ., גילר ו., בר-נתן א., שוורצבורג א., פולוזוב א., שרדון ל., פורטנוב פ., קורזון א.
.26	**גילויים מרשת סיסמית מקומית על שבר יריחו** Revelations from a local seismic network on the Jericho Fault קלינגר א., קורזון א., שגיא, א.
.27	**אוטופיקרים חדשים בסייסקומפ ברשת הסיסמית הישראלית - תכנון, יישום וביצועים** New automatic local earthquake detectors for the ISN using SeisComP: Planning, implementation and performances שרדון, ל., נבון, ה., גורשטיין, מ., גילר, ד., אייזנשטט-סופר, א., פולוזוב, א. נוף, ה.נ., וצלה, נ., קורזון, א.
.28	**Size and morphological changes in Coccolithus pelagicus across the Danian and their link to environmental recovery from the K/Pg mass extinction** Marconato S., Abramovich S., Thibault N., Rosenberg Y.O., Ashckenazi-Polivoda S.
.29	**התפתחות המגמטיזם של קשתות האיים הניאופרוטרוזואיות בצפון המסיב הערבו-נובי על פי איזוטופים של U-Pb-Hf-O בזירקון דטריטי מצפחות אילת** Neoproterozoic island arc evolution and reworking in the northern Arabian-Nubian Shield: U-Pb-Hf-O isotopes in detrital zircons from Eilat schist ורדי ח., אביגד ד., גלזר א., גרדס א., לי ש., אלברט, ה.
.30	**The paleomagnetic record from Lake Fagnano (southernmost Argentina): insights into Earth's magnetic behavior from the End of the World** Anieti M., Waldmann N., Nilsson A.
.31	**קידוחים יבשים בתווך קרסטי ככלי לניהול נגר עירוני והעשרת אקוויפרים: תוצאות שדה ממבחני החדרה ומאיסוף נגר טבעי** Karstic Drywells as a tool for Urban Stormwater Management and Aquifer Recharge: Field Results from Injection Tests and Runoff Collection ולדמן א., גנות י., פרבר א., אמיר נ., עמיעז י., קמאי ת.

רשימת תקצירים

The paleomagnetic record from Lake Fagnano (southernmost Argentina): insights into Earth's magnetic behavior from the End of the World

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Acquisition and modeling of paleomagnetic data stand out as a robust method for reconstructing past millennial-to-centennial variabilities in the Earth's magnetic field. However, due to the uneven distribution of paleomagnetic records across the globe, especially pronounced in the southern hemisphere, determining global variability remains challenging. This discrepancy primarily stems from a scarcity of suitable and accessible sediment records in the southern hemisphere. In this research, we utilize a 7-meter sediment core extracted from Lake Fagnano in Tierra del Fuego to reconstruct paleomagnetic data that goes back to the early Holocene. Employing a diverse array of geoscientific proxies—including mineralogical, petrophysical, and magnetic analyses—we aim to assess stable characteristic components (ChRM) while delineating possible remanent magnetization errors. Our objective is to conduct a high-resolution rock-magnetic study of lacustrine sediments, aiming to retrieve a continuous full-vector paleomagnetic record. This record, combined with existing regional paleosecular variation (PSV) data, will facilitate the construction of a master geomagnetic reference curve for Tierra del Fuego spanning over the past ~15-20 ka. We intend to leverage the extracted PSV in conjunction with established models to aid global geomagnetic field modeling and correlation efforts. Simultaneously, this PSV will suffice for building a refined age-depth model for the lake sediments. Being of glacio-tectonic origin, lake Fagnano sediments boast an ideal sedimentation rate and robust magnetic components, hence making them suitable for producing results that will carry a comprehensive decadal to millennial geomagnetic signature. This signature is pivotal for detailed characterization and comprehension of the global field variations particularly in periods between geomagnetic excursions and reversals, especially for a region situated within the weak magnetosphere of the South Atlantic Anomaly (SAA), where very little record is available.

Exploring Low-Temperature Plasticity in Olivine: Insights from Nanoindentation Experiments

חקר פלסטיות של טמפרטורות נמוכות באוליבין: תובנות מניסויי ננואינדנטציה

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One of the most important deformation mechanisms to govern the lithosphere strength and dynamics is low-temperature plasticity. Low-T plasticity is a deformation mechanism in which dislocation glide is activated under conditions of low temperature and high stresses. Although likely to occur in the lithosphere, deformation experiments inducing low-T plasticity presents challenges due to the need for extremely high confining pressures and applied stresses (> 3 GPa) that will suppress fracturing and induce plastic deformation at these low temperatures. Indentation tests using a nano-scale tip, frequently used in material science but relatively new to the field of geology, offer solutions to address this challenge. The nano-scale tip penetrates the sample inducing locally high stresses and confining pressures that inhibits fracture initiation. Here we present a first set of nanoindentation tests on the mineral olivine to investigate its mechanical properties such as Young's modulus, hardness, and viscosity coefficient. Olivine is among the most common minerals in the lithosphere. Previous research indicates that olivine strength varies depending on factors such as crystal orientation and the presence of dislocations within the mineral structure. Here, we use unique samples that underwent deformation followed by annealing (growing of grains by strain energy-driven recrystallization) to investigate using the nanoindentation technique how deformation and annealing processes influences the mechanical behaviour of olivine. We have conducted a series of indentations on an olivine xenolith from Wyoming, which comprises both deformed and dislocation-rich grains and dislocation-free annealed grains. The primary findings suggest that variances in deformation levels may not mainly control the mechanical properties of olivine crystals. Crystal orientation and size effect (as influenced by the applied force on the sample) also play significant roles, overriding the impact of deformation density. The next phase involves neutralizing the size effect and orientation to address our question effectively.

New geomorphic indications for Holocene tectonic activity along the Amazyahu Fault

עדויות גיאומורפולוגיות חדשות לפעילות טקטונית הולוקנית לאורך העתק אמיצהו

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The Amazyahu Fault is a tectonic lineament that extends over a distance of 16 km and cuts through the Lisan and Samra sediments at the southern border of the Dead Sea basin. The fault's sub-vertical scarp varies in elevation from tens to several meters, and has been interpreted as a listric-normal fault. While recent (Holocene) tectonic activity is commonly associated with the Amazyahu Fault, quantitative field-based evidence for such geologic offsets have not been yet systematically described. To address this knowledge gap, we conducted a field-based survey along the 11 km segment of the fault as it strikes WNW on the Israeli side of the border with Jordan. We identified abandoned alluvial terraces within streams that cross the fault as they drain northeastwards to the Sedom playa, which serves as the local base level. These abandoned terraces, which are uniquely rich in organic matter, are located at varying elevations above the current active stream bed (1-10 meters). We assume that recent fault activity is generating basin subsidence and changes in the stream gradient. In response to those changes a rapid channels incision took place, leaving these terraces high and dry. During most of the Holocene, the Dead Sea level was low and distant from the fault scarp, leaving the Sedom playa as the local base level. Therefore, fault activity is associated with the formation of those abandoned terraces. Initial 14C dating yielded terrace deposition ages of 3692-3849 and 523-646yr calBP. Based on the dating of the terraces, which corresponds to the time of abandonment and channel incision, we conclude that the Amazyahu Fault was tectonically active during the Holocene. This tectonic activity plays a key role in the landscape evolution of the region, including stream incision and piping erosion.

^{17}O excess in Soreq Cave Speleothems

חמצן 17 בספלאוטמים במערת שורק

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Speleothems δ18O is a common tool that provides information about regional paleoclimate. However, δ18O depends on both the temperature and the water isotopic composition, making it difficult to partition these parameters. Furthermore, the composition of cave water reflects a complex combination of several processes. The new proxy 17O excess can provide additional paleo hydrological information. 17O excess is defined as the deviation of δ17O from the generally accepted 17O-18O mass-dependent reference line. In carbonates, it records mostly the 17O excess of the parent water. In the case of rainfall, 17Oexcess allows to reconstruct the normalized relative humidity in the region of moisture formation, with lower relative humidity corresponding to higher 17O excess in the rainfall. As such, 17O excess is analogous to rainfall d-excess. Here, we measure 17O excess in ancient speleothems from Soreq cave (Israel). The Soreq Cave speleothem record provides continuous information about the climate in the last 250 ky, through the measurements of δ18O and Δ47 that together reconstruct temperature and rainfall δ18O. 17O excess values of paleo rainwater were reconstructed from 17O excess in Soreq Cave speleothems, at an age range of 0-160 ka, using samples that were mostly previously measured for clumped isotopes and fluid inclusions d-excess. Using the expected 17O excess values for a range of the modern trajectories of Mediterranean cyclones, we estimate possible storm trajectories and relative humidity in the past. Most samples fall within the range of the modern trajectories, with a tendency to a more Westerly track. In several cases, a more Southern route with higher normalized relative humidity is likely. A comparison with d-excess records from Soreq, Peqi'in, and Jeita caves suggests that in most cases these two proxies agree with each other and express the dominant influence of the Mediterranean Sea on these areas.

Morphotectonic evolution of rifted zones over 130 Ma: No significant cliff retreat, no change in major water divides over time. An example from the South Atlantic rift in South Africa

התפתחות מורפוטקטונית של אזורי ביקוע במשך 130 מיליון שנה: אין נסיגה משמעותית של מצוקים, אין שינוי במיקום פרשות מים ראשיות לאורך זמן. דוגמה מבקע האטלנטי הדרומי בדרום אפריקה

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The Suez Rift and the South Atlantic Rift in South Africa were analyzed, aiming to evaluate the impact of their time differences - over 100 Ma - on their morphotectonic evolution. The main conclusions are 1. Despite their differential evolutionary time, many similarities were found in both regions, including their morphotectonic structure and topographic heights related to the rifting process. 2. In both regions, the main escarpments bordering the rifts were created at the meeting point between the pre-rift truncation surface and highly resistant stratigraphical units included in the geological succession. 3. Since their initial establishment, major cliffs in both regions are in their near-original position with only minor retreat, regardless of their time differences (130 Ma along the eastern side of the South Atlantic and over 20 Ma in the Suez). However, some minor and local modification along the escarpments were observed, caused mainly by local slope retreat processes. 4. A major lithological control on differential weathering rates was found along the Great Escarpment in South Africa resulting from humid periods evolved during the Cretaceous. Quartzites are most resistant to weathering, while granites were subjected to deep weathering, lowering their original heights by 450-600 m over 130 Ma. 5. There is no change in the location of the main water divides during the last 20 to 130 Ma in both regions. However, local changes can develop due to tectonic deformation, mainly tilting, of some local segments of the Great Escarpments toward the rift. These conclusions strongly suggested that some of the computerized modeling applied to geomorphological process, such as those presented by Willett et al., 2014 and Whipple et al., 2017, claiming on significant migration of water divides and cliff retreat, fail to describe the geomorphological dynamics over large time scales, as described here for rifted structures.

Mapping of the deep subsurface of the central Israel

מיפוי תת הקרקע במרכז ישראל

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The Israel's onshore oil exploration suffered some bad timing while major drilling efforts, along the years, missed important technology and research developments. Recently, major efforts have been conducted to improve the deep subsurface imaging to obtain a more accurate regional picture of the deeper geological horizons. New processing technologies were developed and applied to most of the existing seismic data and reassembled into a unified subsurface geological model of time and depth migrated data. This huge database has been the pivot of a new approach to observe some of the exploration concepts that were used in the past. The study provides a new view of different structures of central Israel with eight significant structural maps from the top Permian to the late Miocene.

Ancient saltpans as a new proxy for the last 2ka relative sea levels, a test case from the Dalmatian coast, Croatia

אגני יצור מלח כסמן חדש למפלסי הים היחסי במהלך 2000 שנה אחרונות, מקרה מבחן מהחוף הדלמטי, קרואטיה

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Paleo sea-level reconstructions are based on multi-proxy records, including archaeological constructions, that were originally above sea level or in contact with the sea surface and today lie below mean sea level. Intertidal salt production facilities have existed continuously around the Mediterranean since classical antiquity but have never been studied as sea-level indicators. This study aims to develop a harmonized method of using the ancient intertidal saltpans as relative sea-level indicators. The Dalmatian coast, located in the central part of the east Adriatic, contains many ancient salt production remains, currently submerged by the rising sea, well-preserved and well-dated by historical archives, creating great potential for their development as a relative sea level (RSL) proxy. The study uses a holistic approach, combining photogrammetric mapping of the saltpan sites with geochemical, sedimentological, and molecular to macrofossil analyses of the sediments cored into the saltwork area. This study reveals the depth of the saltpan's indicative structures, indicating the sea level at the time of construction and operation. In addition, the research identified the salt production units in the basins of the saltpans and dated their boundaries by optically stimulated luminescence (OSL). The current study concludes that the relative sea level on the Dalmatian coast during the late Roman time, 5th to 6th century CE, was -79 ± 16 cm, rising to -50 ± 12 cm in the 9th century CE. During the medieval period, RSL descended to -95 ± 9 cm in the 12th to 13th century CE. Medieval low sea levels were also observed in the northern and southern parts of the eastern Adriatic coast, as well as in the Israeli coast and the Aegean Sea. Climate-related events assumedly drove medieval low sea levels, generating centennial scale fluctuation in past sea levels that sea-level models cannot predict.

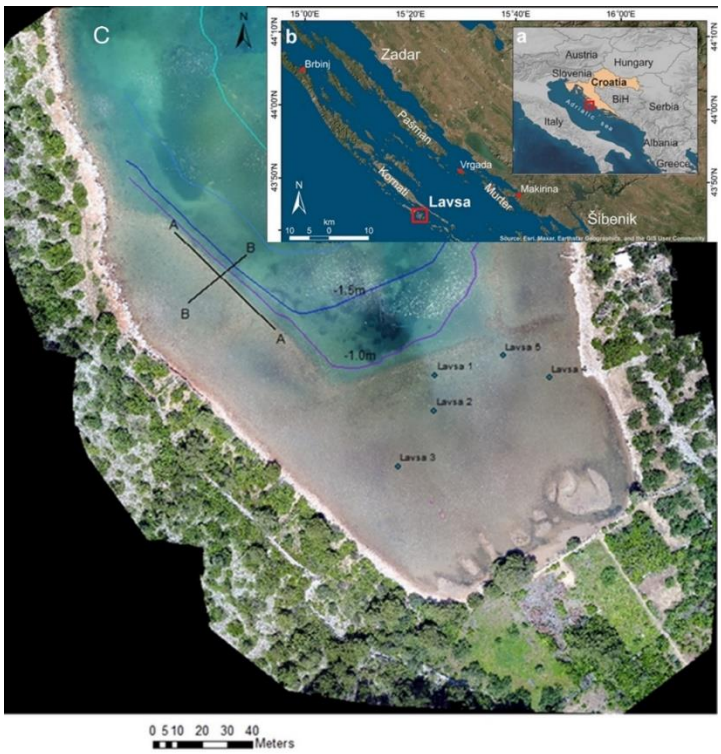

Figure 1. Saltpans in the Dalmatian Coast: a) Croatia and the Adriatic Sea, b) The study area, c) Lavsa saltpans

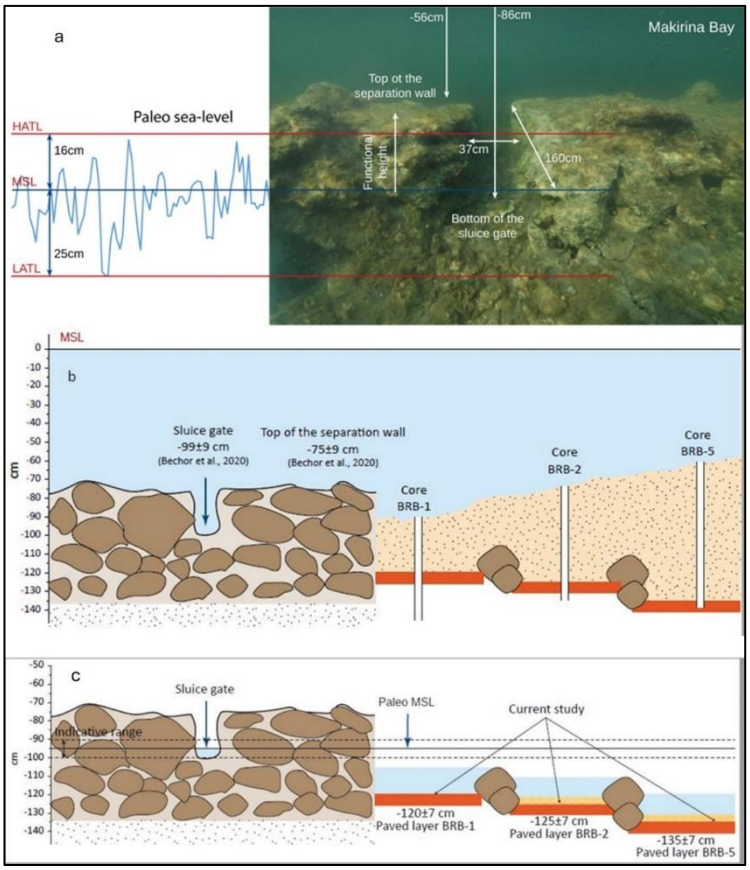

Figure 2. a) Sluice gate in Makirina Bay, b) Coring in Brbinj saltpans, c) Brbinj at the time of operation

Recent advances in the provenance study of chert using detailed geochemical analyses of trace elements

חידושים אחרונים במחקר מקורות צור באתרים ארכאולוגיים באמצעות מדידות גיאוכימיות של יסודות קורט

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Due to its widespread appearance in prehistoric sites, determining the provenance of flint artefacts is crucial for interpreting procurement strategies of prehistoric people, which testify to their level of expertise and knowledge of their environment. Over the years, various approaches and methods have been used for such studies, which often makes it difficult to compare between them. Over the last years, we have been exploring the potential of bulk rock composition of flint, determined using inductively coupled mass-spectrometry (ICP-MS) for investigating its provenance. Through systematic sampling of flint from all across Israel and the establishment of the flint collection, and the investigation of a large suite of trace elements, we are developing a robust approach for determining the provenance of flint in Israel and its environs. By measuring a large set of elements in several specimens from each site, we investigate the variability of compositional data in natural rock sources, and develop a framework for evaluating the uncertainty of flint provenance. First case studies in key archaeological sites in Israel shed new light on flint provenance in the region’s prehistory.

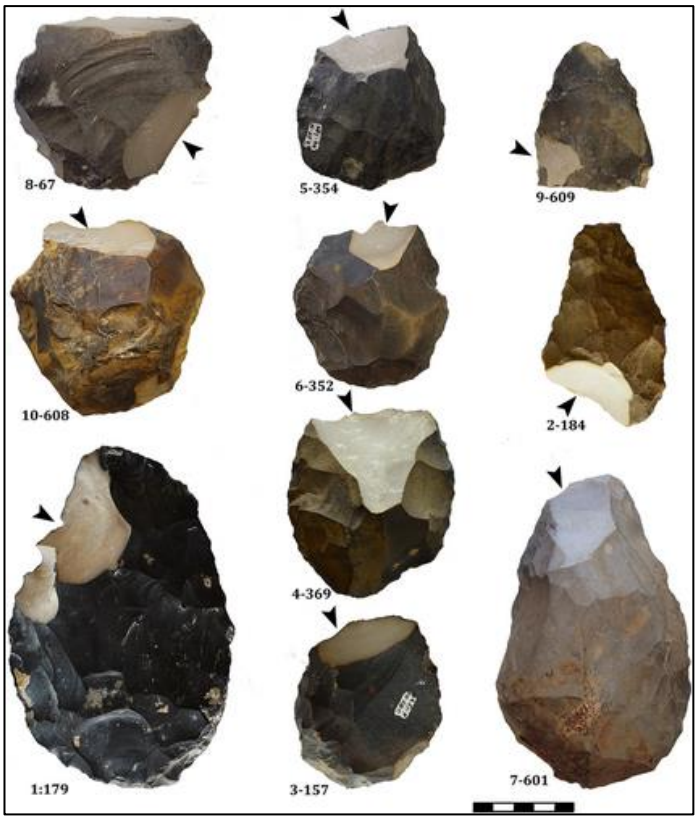

Figure 1. Handaxes from Gesher Benot Ya'aqov tested geochemically. Arrows indicate the striking of flakes sampled (Finkel et al., geoarchaeology, 2023).

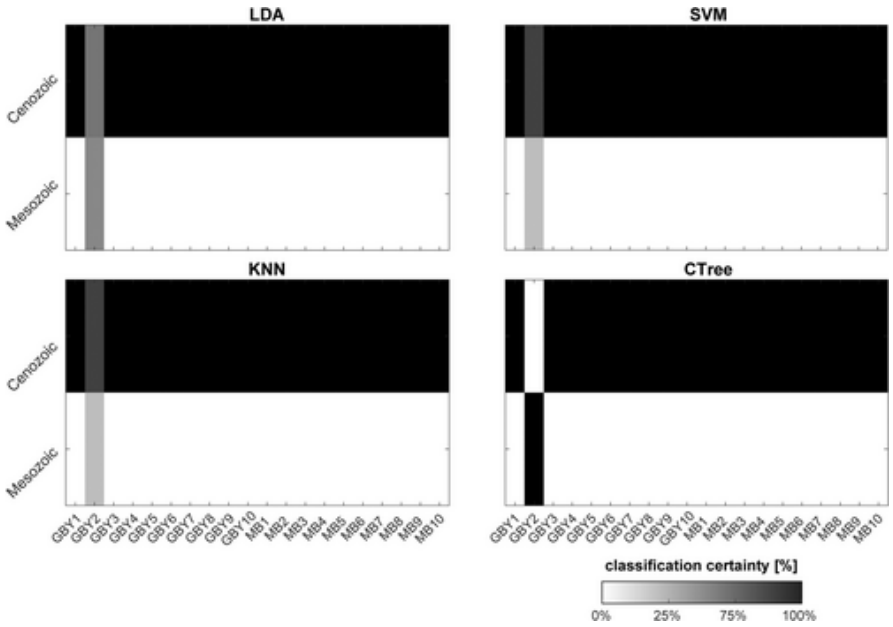

Figure 2. Summary of classification results carried out using four different algorithms using 4–10 elements. All items (except for GBY2) were consistently attributed to Cenozoic sources, whereas item GBY2 was assigned to a Mesozoic source at a different level of confidence by the different algorithms. CTree, classification tree; LDA, linear discriminant; KNN, k-nearest neighbors; SVM, support vector machine (Finkel et al., 2023).

Geomorphic response of alluvial streams to flood events during base level lowering

התגובה הגיאומורפולוגית של נחלים אלוביאליים לאירועי שטפונות בדידים במהלך ירידת בסיס סחיפה

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The geomorphological impact of base level lowering on ephemeral alluvial streams has been extensively investigated through fieldwork, experimentation, and modelling. Yet, the understanding of hydrological parameters governing the dynamics of the stream's geometry during discrete flood events is lacking due to limited direct measurements of flood-scale erosion/deposition. The emergence of novel remote sensing methods allows quantifying morphological modifications caused by floods in alluvial streams. This study utilizes drone surveys and hydrological data to quantitatively investigate the relation between channel evolution in alluvial tributaries draining to the receding Dead Sea and the hydrological characteristics of flash-floods. Drone-based photogrammetric surveys were conducted during four years, before and after 25 floods in Darga and Arugot streams, to generate centimeter-scale Digital Elevation Models (DEM) and orthophoto maps of two major streams. The outcomes of these DEMs are: Maps of ground elevation changes (erosion/deposition), thalweg longitudinal profiles, and channel cross sections, revealing the incision/aggradation along and across the streams. Statistical comparison of results with flow hydrographs identified potential relations linking the hydrological characteristics of each flood and the corresponding geomorphological modifications. Peak discharge emerged as the primary factor influencing sediment removal, leading to more efficient sediment evacuation and a negative sediment budget with increased discharge. Water volumes of floods also exhibited a secondary effect on the sediment budget. The chronological order of floods, whether first or later in the season, was identified as the primary factor determining incision magnitude. Knickpoints formed at the streams' outlets during the dry period, when lake-level drops, amplifying the impact of the first flood. These findings have potential implications for infrastructure planning and environmental management in the context of climate change and altered water runoff.

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

כמות, הרכב ומקור גזים עיקריים במערכות מי תהום בישראל

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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 by various sources and/or processes: phase changes depending on the prevailing pressure (P) and temperature (T) conditions, biogeochemical reactions, adsorption/desorption of gases to solid surfaces, dissolution/precipitation reactions, leakages from oil and gas reservoirs, deep crustal or mantle sources and thermochemical reactions. Though significant geological, hydrological, and environmental implications, such as greenhouse gas emissions to the atmosphere during water production and CO2 sequestration projects relate on our understanding, little is known regarding the amount, composition and state of matter of subsurface gases (dissolved/free/supercritical). Gases were separated during the production of groundwater from water wells using a gas-permeable membrane. From each well, independently collected samples were analyzed for molar fractions of N2, O2, CO2, CH4 and heavier hydrocarbon gases, H2, H2S, He, Ne, Ar, Kr and Xe. Preliminary results of four hydrogeological systems show that gas compositions are primarily controlled by (a) the hydrogeological system and (b) the geographical location of the well they were extracted from. Fresh groundwater from the karstic Yarkon-Taninim aquifer contained a mixture of N2, O2, and CO2 and showed a decrease in O2 and an increase in CO2 molar fractions down the flow path. In contrast, gas extracted from fossil groundwater of the Kurnub aquifer in the Arava region had significantly higher molar fractions of N2 and CO2, and almost no O2. Additionally, all gas samples contained He concentrations that were orders of magnitude higher than the atmospheric abundance. Meanwhile, gases extracted from the same geological unit in the northern Negev contained hydrocarbon gases, as well as extremely high molar fractions of H2S (up to 1,600 ppm).

Hydrogeological modeling of a poorly gauged basin – the Hermon Jurassic aquifer, the Levant

מידול הידרוגאולוגי של אגן בלתי מנוטר - אקוויפר היורה בחרמון

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The Hermon Jurassic carbonate aquifer is the largest water resource in northern Israel, supplying annually about 700 MCM to the Jordan River tributaries, the Damascus basin, and to minor springs in Lebanon. The absence of rain gauges and monitoring wells, and the low-resolution data from Lebanon and Syria, makes the evaluation of the aquifer's water balance and fluxes a significant challenge. Here we present a unique approach to address this challenge using aquifer geology and springs data to determine its boundaries and water levels. Analysis of geological characteristics shows that the aquifer is bounded at its base by the top Triassic anhydritic aquiclude and surrounded at its sides by the marly Kidod formation and Lower Cretaceous units aquicludes. Based on elevations of the main springs, the water table is estimated to be a high (ca. 1100 m asl) flat extended area at the aquifer's north-eastern part, while a water gradient towards the Hula Valley (200 m asl) characterizes its southwestern edge. These insights serve as boundary and initial conditions for a numerical steady-state model, using MODFLOW code. Following few assumptions about the aquifer's recharge and characteristics, the model shows a good observed-simulated match of the main spring's averaged discharge (<5% difference). The results reveal different flow paths and storage sizes for each of the major springs, which is reflected by their discharge volumes, hydrograph fluctuations, and chemical compositions. The model also ran in a transient mode, where the recharge time series was based on rain station data from northern Israel. The observed-simulated hydrographs of the main spring's averaged discharge have a satisfactory match as well, especially for the Dan (NSE=0.542) and Banias (NSE=0.646). This study sheds light on the significant Hermon Jurassic aquifer characteristics, and reveals a novel approach to investigate poorly gauged aquifers.

Evidence of Costal Aquifer transmissivity increase using pumping tests

עדויות על עלייה בערכי התולכה באקוויפר החוף על פי מבחני שאיבה

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The Dan Region Wastewater Reclamation Plant, commonly known as “The Shafdan” plant, plays an integral role in Israel's water supply system by treating wastewater and injecting a significant volume of the treated wastewater, into the coastal aquifer through infiltration ponds (Soil Aquifer Treatment - SAT)(Negev I et al, 2020). The filtration of treated wastewater occurs naturally as it passes through layers of sand, where it is filtered before being stored in the aquifer. Recent years have seen a growing need for additional/substitute boreholes (on existing boreholes yards), to increase production capacity from the Shafdan. To enhance water production from boreholes, significant modifications and improvements have been made to the technical configuration of substituted boreholes compared to older ones (Guttman J. and Zigmund B., 2023). Mekorot - Israel national water company Ltd, issued a tender for planning substituted boreholes, including engineering support and hydrogeological upgrades under a Design-Build (DB) contract. S. Gilboa Engineers Ltd is responsible for two substitute boreholes located in the Soreq Basin of the Shafdan: “Dan Water 21B” and “Dan Water 7A”. Pumping tests were conducted at both boreholes, in order to monitor the aquifer's response to pumping and measuring dynamic levels under increasing pumping rates. Drawdown measurements were taken during the initial pumping phase and the recovery phase, where Darcy's law is applicable. The Cooper and Jacob (1946) method was used to determine aquifer transmissivity and storativity. The results of these tests show an improvement in aquifer transmissivity, relative to old boreholes properties. Additionally, our findings indicated high borehole efficiencies, with aquifer losses (B) exceeding well losses (C). This suggests a long-term migration of fine particles to the old boreholes, due to prolonged pumping. Potentially leading to an increase in aquifer permeability over time. This insight into the behaviour of the aquifer and substitute boreholes is crucial for optimizing water production and its management as part of the Israeli water supply system.

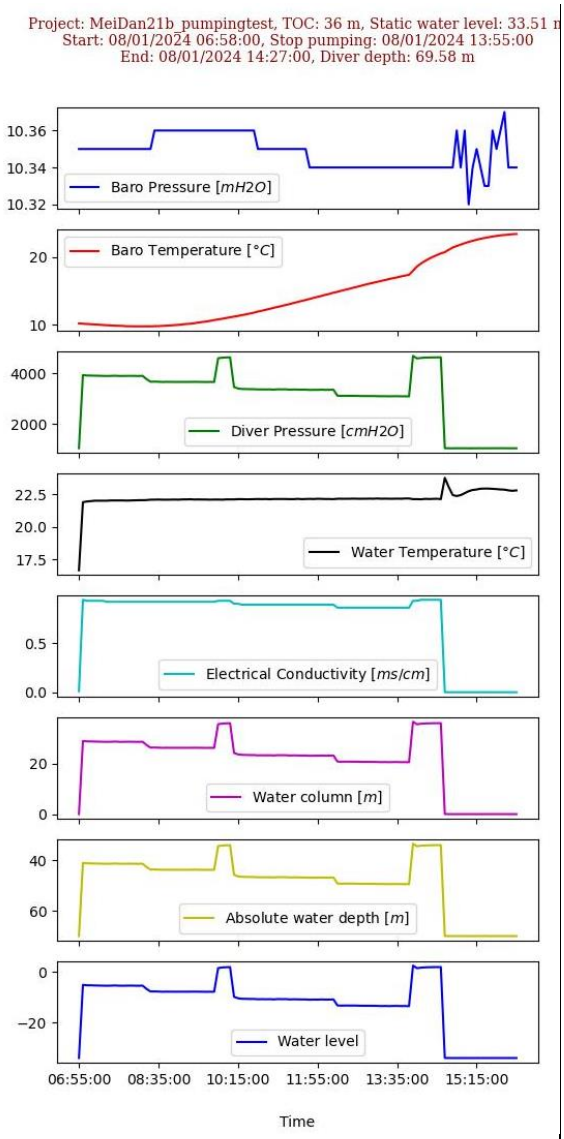

Figure 1. Transmissivity and storativity regression for Mei-Dan 21B borehole pumping test, using Cooper and Jacob method (1946)

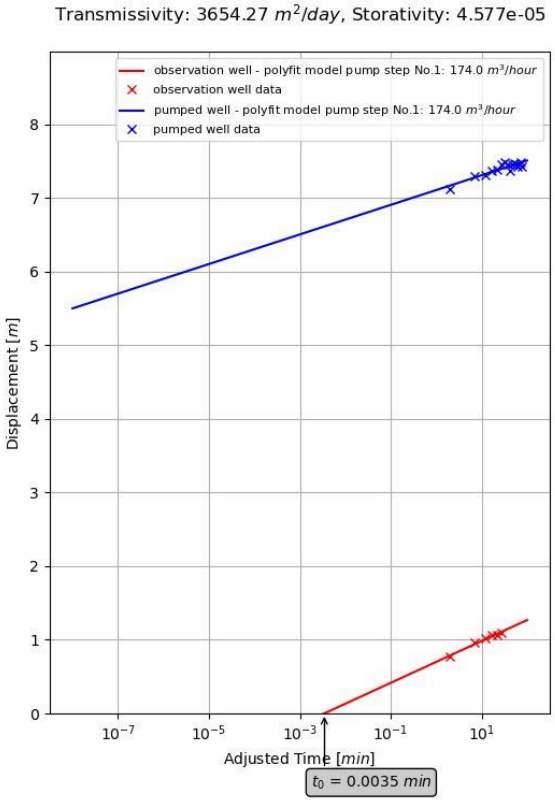

Figure 2. Monitoring Mei-Dan 21B in pumping test, finding water column and electrical conductivity of the water.

Quantification of the ballasting effect during abrupt sediment resuspension events in the Gulf of Aqaba

אפיון כמותי של אפקט ה"באלאסט" בזמן אירועי הרחפת סדימנט במפרץ עקבה

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The biological carbon pump is the process by which Particulate Organic Carbon (POC) produced in the euphotic zone sinks to the deep ocean and is removed from the atmosphere for timescales of millennia or more. Lithogenic and biogenic minerals aggregate with POC throughout the water column, packaging “marine snow” particles with relatively high density. Consequently, the POC is encapsulated and protected from degradation while sinking through the water column at relatively high velocities, resulting in limited POC microbial degradation and overall higher export production fluxes. This process, termed the “ballasting effect”, is potentially an important, yet poorly quantified component of the global carbon cycle. The objective of this study is to quantify the ballasting effect through the study of the interplay between lithogenic and POC fluxes, by comparing between Trace Element (TE) and POC concentrations, with focus on daily timescale bottom sediment resuspension events in the Gulf of Aqaba, an open ocean proxy site in the northern Red Sea. To date, eleven cruises were performed during Dec. 2022 - Feb. 2023, from which vertical suspended particulate matter profiles were sampled, alongside coeval sediment trap samples and dissolved macronutrient profiles. Preliminary results display an overall positive correlation between dissolved silica and bulk sediment fluxes in the bottom waters together with an enrichment of particulate micro-nutrients, such as Cd, in the upper water column. These will be compared to POC patterns and evaluated in the context of previously published compositions of dissolved trace elements in the Gulf of Aqaba. The results of this study are expected to shed light on the link between lithogenic fluxes and excess POC sequestration in the oceans through the ballasting effect, with implications to a better understanding the global carbon cycle and impacts on global climate change.

Clumped isotope constraints on formation environment of Triassic carbonates in Makhtesh Ramon

שיחזור סביבות ותנאי ההיווצרות של קרבונטים בסלעי הטריאס במכתש רמון בעזרת איזוטופים מצומדים

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Despite prolonged research, the formation environments of dolomite remain debated. Previous studies have associated the apparent decrease in dolomite abundance during the Cenozoic with a major transition in marine depositional environments. Conditions changed from warm, saline, shallow platforms in which dolomite formation was possibly mediated by microbial activity, to deeper and cooler environments in which dolomite formation was largely inhibited. Others suggested that large volumes of pre-Cenozoic dolomites reflect dolomitization at elevated burial temperatures of these rocks, whereas most Cenozoic carbonate platforms mostly did not reach sufficient thermal maturity. A third, hybrid model suggests that Mg-rich dolomite precursor minerals precipitated in shallow environments and later underwent deep diagenesis to a more ordered and stoichiometric dolomite. The combination of carbonate oxygen ($\delta^{18}O$), carbon ($\delta^{13}C$) and clumped ($T\Delta_{47}$) isotope analysis can be used to constrain and distinguish among these formation environments.

Here, we combine $\delta^{18}O$, $\delta^{13}C$ and $T\Delta_{47}$ measurements in marine carbonate rocks from the Triassic Ramon Gr. in Makhtesh Ramon, southern Israel, to constrain their formation environments. The studied section records a transition from a carbonate platform, dominated by fossil-rich limestone (Saharonim Fm.), to a shallow evaporitic lagoon (Mohila Fm.) dominated by laminar dolomite and gypsum. Calcite samples in the Saharonim Fm. recorded $\delta^{18}O$ and $T\Delta_{47}$ values from -8.7 to -2.7 ‰ VPDB, and from 30 to 96 °C, respectively. Two calcite samples recorded $T\Delta_{47}$ values of 150-227 °C, associated with isotopic solid-state reordering in response to local heating near igneous intrusions. Dolomite samples at the top Saharonim and base Mohila Fms. recorded $\delta^{18}O$ and $T\Delta_{47}$ values from -5.2 to -2.1 ‰ VPDB and from 41 to 73 °C, respectively. These results indicate that carbonate minerals recrystallized in burial-diagenetic environments in an open system with respect to $\delta^{18}O$. The observation that dolomite, associated by stratigraphic contex and texture with deposition at (or near) the surface, has been recrystallized at depth, supports a multi-stage dolomite formation process, in which carbonates were first enriched in Mg^{2+} in the lagoon and later recrystallized in high-temperature, deep-diagenetic environment.

Heterogeneous reactions and their effect on dissolved inorganic carbon and total alkalinity

השפעותיהן של תגובות הטרוגניות על האלקליניות הכללית והפחמן האנאורגני המומס במפרץ אילת

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The dissolved inorganic carbon (DIC) and total alkalinity (TA) in the ocean constitute main parameters in the carbonate system, and determine seawater's tendency to absorb or release CO2 from the atmosphere. Consequently, the processes which govern these parameters, and the carbonate system in general, have been thoroughly studied during the last few decades. Heterogeneous reactions between dissolved ions and solid particles can substantially affect the TA and DIC in some regions of the ocean. Nevertheless, few systematic studies on the nature of these processes have been conducted. This study aims to determine whether heterogeneous reactions constitute a significant sink for DIC and TA in the ocean, by combining laboratory experiments and in-situ measurements in the Gulf of Aqaba (GOA), northern Red Sea. In our experiments, we observed a decrease in both TA and DIC with time upon the introduction of various local sediments into GOA seawater. The ratio of the TA decrease to the DIC decrease is ~ 2:1, suggesting that heterogeneous CaCO3 precipitation is the primary mechanism responsible for the observed change. To follow the CaCO3 precipitation rate, we developed a method involving the measurements of the δ13C changes of particles, which have been introduced to 13C-enriched seawater. These experiments revealed that particles with a higher percentage of CaCO3 exhibited a greater precipitation rate. The in-situ measurements, included generating seasonal DIC and TA profiles from the GOA, as well as a focused campaign, demonstrating the effect of resuspension events on the water column's chemistry, indicate a link between particle flux and TA decrease. The experiment's results, combined with the in-situ observations, provide evidence supporting our hypothesis, that heterogeneous interactions constitute a pathway in the TA and DIC budgets, and promote further research on the significance of heterogeneous reactions in ocean waters.

Systematics of the effective width of strike-slip plate boundaries

הרוחב האפקטיבי הנמדד בגבולות לוחות מסוג סטרייק סליפ

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The extent of delocalization of seismicity across plate boundaries varies according to the maximal depth of hypocenters. This property of individual segments of major faults can be used to better understand fault dynamics and might have implications for hazard assessment. Seismicity tapers away from the area of high strain concentration, which can be recognized as mainshocks or plate boundaries. However, the extent and gradient pattern of this decrease varies for different faults and depends on different factors. Here we systematically quantify the seismicity gradient patterns by a large-scale comparative study focusing on strike-slip fault segments. We define a characteristic effective seismogenic width (defined on the horizontal dimension) of fifteen segments along four major strike-slip plate boundaries: the San Andreas, the Dead Sea, the North Anatolian, and the East Anatolian Faults. To study the effect of the aftershocks on the seismogenic width we declustered the catalog allowing us to compare the background and the aftershock populations. The average effective width for the declustered population is ~7 kilometers, and for most of the segments increases by 1-4 km for the aftershock population. The seismogenic width is tested for two depth intervals associated with the median of the seismogenic depths, indicating the localization of seismicity with depth. Within the deep interval, three plate boundaries consistently exhibit an effective width ranging from 3-5 km, indicating that these fault segments are characterized by localized faults at depth. This observation reveals that age and motion rate have negligible influence on the effective width. In the shallow interval of most of these segments, the width ranges between 1 – 9. The seismogenic width is found sensitive to the geometrical structure of the fault, highlighting the geometry of pull-apart basins along the Dead Sea fault and fault segmentation along the East Anatolian fault.

Mapping Vs30: Integrating Geology and Terrain Parameters for Enhanced Correlation

מיפוי Vs30: שילוב פרמטרים גיאולוגיים וטופוגרפיים

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When considering the contributors to ground motions at a specific site, site response is recognized to be a dominant factor. Therefore, any hazard analysis or ground motion estimation would have to consider the geological and mechanical conditions at a site. The most basic and essential property of the site, for the purpose of site effect characterization, is the shear wave velocity profile with depth, and its derivative, the time averaged shear wave velocity of the upper 30 meters, VS30, which has been the single most successful proxy for site-effect predictions since the early 1990's, and is used in the Israeli building standard as well. We present here a VS30 site database, for engineering applications. Our database includes locations measured commercially by colleagues in the working industry, locations measured for research by colleagues in the Academia, locations from the seismic station database and locations measured specifically for this database by our team. The database includes more than 500 measured VS30 values and additional parameters such as surface geology (lithology and age), soil type and terrain based parameters. This database is used to generate local correlations between VS30 and additional parameters, by implementing machine learning (ML) models. Such correlations, in turn, can be used in an interpolation to generate a state-wide VS30 map, useful for national hazard estimations, and other applications.

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

שוניות סטרומטוליטים בים המלח: אתר מבחן לזיהוי אוטומטי של צורות חיים ועקבותיהן בסביבות חיים קשות

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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 the ability to thrive in extreme environments that they reflect, stromatolites are thoroughly investigated to understand the initial appearance of life on Earth and potentially on Mars and other planets. One of the main points 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 aragonitic stromatolites in terms of biological and sedimentological processes, reflecting primitive life and their corresponding environmental record. This study integrates in-situ and hyperspectral remote sensing methods with mineralogical and 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 artificial intelligence 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 (and bi-carbonate) 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. We examine the mineral composition and geometry of fossil stromatolites as well as microbial mats, while focusing on Aragonite structures and strontium concentrations as a diagnostic tool.

From circum-Red Sea Rift sources to the Levant Basin sink: Coupled sand and clay provenance of Oligocene-Miocene sediments from deep-sea boreholes

מקור החתך הסיליסיקלסטי מגיל אוליגוקן-מיוקן באגן הלבנט: מחקר פרובננס של חול וחרסית מקידוחי הים העמוק

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The Levant Basin of the Eastern Mediterranean contains a 3 km-thick siliciclastic section of Oligocene-Miocene age that evolved with the uplift of the bordering continental areas. To shed light on the origin of the siliciclastics, we applied various provenance techniques, including detrital zircon U-Pb-Hf and Sr-Nd isotopes, to Oligocene-Miocene sandstones and clay fractions retrieved from Myra, Dolphin, Leviathan, and Karish North boreholes. This allowed us to constrain at high temporal and spatial resolution the provenance of the entire siliciclastic section and to reconstruct for the first time the related source-to-sink system. Our investigations reveal that siliciclastics were conveyed into the Levant Basin by the Nile in NE Africa and by a coeval drainage system in Arabia, both initiated by the rising Afro-Arabian (Afar) dome. Sand fractions exhibit temporally varying provenance: Early Oligocene (~31 Ma) and early Miocene (23-16 Ma) sand intervals, including the hydrocarbon-bearing “Tamar Sands”, sourced primarily from Arabia via the Levant continental margin, whereas late Oligocene (27-23 Ma), lowest early Miocene (~23 Ma), and middle-late Miocene (16-7 Ma) intervals from NE Africa. The quartz-rich sand was mainly recycled from Paleozoic-Mesozoic sandstones of Afro-Arabia. However, the fine, clay-size sediments, which volumetrically make up most of the siliciclastic section, primarily sourced from NE Africa via the Nile Delta with minor contributions from Arabia. They were mainly derived from erosion of Neoproterozoic basement rocks of the Arabian-Nubian Shield. Finally, we show that (1) Initial uplift of the Afro-Arabian (Afar) dome correlates with the onset of siliciclastic sedimentation in the Levant Basin, (2) Subsequent uplift of Red Sea Rift flanks correlates with the highest sedimentation rates recorded in the basin and with the deposition of the “Tamar Sands”, and (3) The erosional base level that formed along the Dead Sea Transform in the middle Miocene captured the Arabian sediment transport system.

Climate change impact on extreme precipitation frequency and intensity in the Middle East and North Africa region

השפעת שינויי האקלים על השכיחות והעוצמה של אירועי גשם קיצוניים באזור המזרח התיכון וצפון אפריקה

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Extreme precipitation events are climatic hazard phenomena that can result in floods, flash floods, and landslides, posing significant threats for potential damage to society and the environment. In this study, we examine the effect of climate change on the frequency and intensity of extreme precipitation events in the Middle East and North Africa (MENA) region. Our analysis focuses on daily precipitation simulations in spatial resolution of about 50 km, provided by regional and global climate models. We compare the relative change in extreme precipitation return levels between historical simulations and the "business as usual" greenhouse gas emissions scenarios - RCP8.5 and SSP5-8.5 simulations, for the mid-21st century. The trend detection of extreme precipitation events is challenging due to their high variability in time and space. Therefore, in this study, we apply an advanced extreme precipitation frequency analysis method, the Simplified Meta-statistical Extreme Value (SMEV) methodology. Recent studies have shown that the SMEV can reduce stochastic uncertainty compared to traditional extreme precipitation frequency analysis methods. We first present a comparison between the performance of the innovative SMEV method and the performance of the traditional method. Then, we present the expected change trends in the extreme precipitation events over the MENA region.

Advancements in Seismic Data Analysis at the Geological Survey of Israel (GSI)

העיבוד החדש בסייסקומפ – יתרונות, בעיות, אתגרים

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The Seismology Division at the Geological Survey of Israel (GSI) monitors seismic activity in the vicinity of Israel as part of the national earthquake preparedness plan. This task is facilitated by the upgraded Israel Seismic Network (ISN), which includes the early warning system TRUAA and Cooperating National Facilities (CNF) stations. Until 2023, processing an analysis of seismic data was done the Java tool for Seismic Traces Analyses and Research (JSTAR) software package. Since April 2023, we have transitioned to the SeisComp3 software package, a comprehensive seismological software developed by GEMPA, for data acquisition, processing, distribution, and interactive analysis. The SeisComp3 module SCOLV serves as the primary interactive tool for reviewing and revising earthquake parameters, providing detailed information about the hypocenter, time, and station distribution. Arrival residual plots against distance and azimuth help to identify outliers. Similarly, each magnitude and its residual are displayed graphically and in a separate table. The manual picker is designed for reviewing automatic picks and for manual picking. Zooming, sorting, aligning, and filtering options create a user-friendly work environment. Another benefit of the software is the ability to integrate in-house applications, for example, the Focal Plane solution – HASH, for determining specific faulting geometries. Despite the numerous benefits and expanded capabilities of SeisComp3, adaptation to local conditions remain an ongoing process. This adaptation involves ensuring the reliability of the automatic earthquake detector (Autolocator) and refining velocity models to achieve satisfactory location accuracy for seismic events. One of the main challenges for analysts is the problem of discriminating between man-made explosions and small-magnitude earthquakes. In JSTAR software, it was possible to apply comparative analysis using the corner frequency of displacement spectra for P and S-waves. So far, SeisComp3 has not provided a tool to help solve this problem. Efforts to overcome this challenge are ongoing.

Using Sinkhole's Morphology for Evaluating Subsurface Gravel to Clay Ratio with Machine Learning Approaches

שימוש במורפולוגיית בולענים להערכת יחסי חלוקים-חרסיות בתת הקרקע באמצעות שיטות למידת מכונה

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The formation of sinkholes in the Dead Sea area poses a significant hazard to both civilians and regional infrastructure. In response, the Geological Survey of Israel has initiated comprehensive national efforts to mitigate this danger, employing diverse methods to predict and map these sinkholes. A previous study (Baer et al., 2018), utilizing InSAR measurements found that the gravel-to-clay ratio of the host sediments plays a crucial role in determining the duration and magnitude of precursory subsidence, preceding sinkhole collapse. The study revealed that higher gravel fractions corresponded to longer precursory times, demonstrating the importance of the lithologic variations to sinkhole hazards. However, information about the subsurface lithology in the sinkhole-prone area is exceptionally scarce and relies on several tens of boreholes limited to a small region. Development of an automated Lithology classification model for this sinkhole-prone area is, therefore, a desirable goal. Such a model is expected to predict the distribution of the subsurface lithology, thereby assisting in assessing the precursory time for future sinkhole collapse following the identification of an initial subsidence. In this research, we explore sinkhole morphology as a proxy for predicting the subsurface gravel to clay ratio. This goal will be achieved through the implementation of two consecutive machine learning models. The first model is a Logistic Regression sinkhole mapping model, that uses a LiDAR-based digital surface model and ten morphological indices (Figure 1) extracted from it as the model features. Additionally, it utilizes a manually mapped sinkhole map as ground truth label data. The second model will use the sinkhole pixels identified by the first model and its morphological indices as features, with Dead Sea shores boreholes data as ground truth, to predict the gravel-to-clay ratio in the surrounding areas of each sinkhole field.

Baer, G., Y. Magen, R. N. Nof, E. Raz, V. Lyakhovsky, and E. Shalev (2018). InSAR Measurements and Viscoelastic Modeling of Sinkhole Precursory Subsidence: Implications for Sinkhole Formation, Early Warning, and Sediment Properties, J. Geophys. Res. Earth Surf. 123, no. 4, 678–693, doi: 10.1002/2017JF004594.

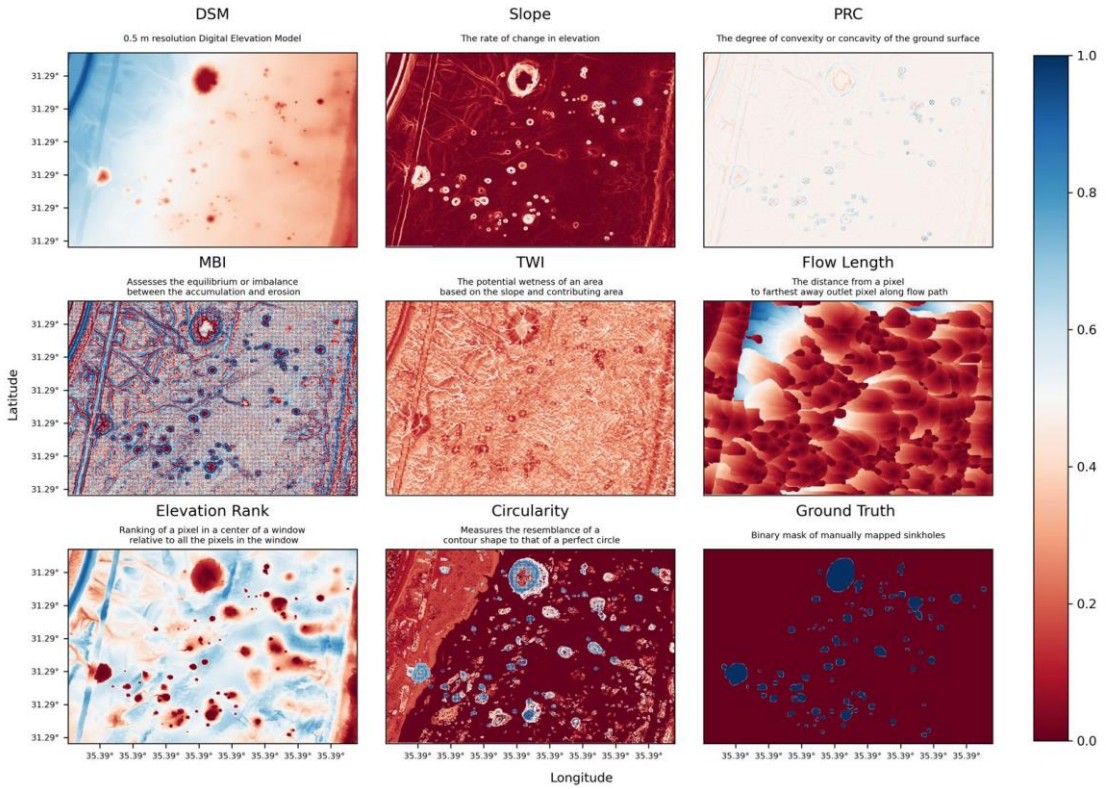

Figure 1. Morphometric Features used as input for the model. On the bottom right - the ground truth data that was used as labels for the model.

Investigation of springs in the Eocene aquifer recharge area; HaShofet and Zippori streams basins

חקר אזורי המילוי החוזר ואופן הזנת המעיינות באקוויפר האאוקני באגני הנחלים השופט וציפורי

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Due Alonim-Menashe syncline is constructed out of carbonate (mainly chalk) rock of the Avdat group (Eocene), super-imposed on top of Mt. Scopus group (Taqiye fm., Paleocene), outcrops of which can be seen in several locations. Structural deformations and transitions in rock facies have a spatial effect on the infiltration regime. These phenomena manifest in small springs, perched atop the marly Taqiye aquitard, which sustain aquatic habitats and wetlands. The work focused on the Zippori stream basin, Gvaot Alonim and its surroundings, and HaShofet stream basin in Ramat Menashe.

Considering the poor hydraulic characteristics of the chalk, several other pathways were examined as additional potential water sources for the springs. A several-year-long study was conducted which included infiltration rates measurement of the soil-rock system, seasonal alterations in water content along the depth column and relative to spatial location. The results of these measurements were compiled considering soil-rock characteristics, seasonal rain depth and measured plant water intake rates. Moisture measurements were conducted along a series of 8-meters boreholes using a neutron probe for frequent moisture measurements. Moreover, a long-term continuous measurements conducted using gypsum blocks. When combined with data from literature, the study helps to conduct a model for a deeper understanding of the water regime of the local rock-soil-plant system. Underground flow directions were estimated according to structural data atop Mt. Scopus group and relative to surface topography and faults. A series of shallow boreholes shed light on local stratigraphy and groundwater levels. The main water contributor was found to be the limestone facies of Timrat fm., which acts as a local aquifer. While having lower infiltration rates, the chalk and marly-chalk rock units presented lower but significant water conductivity, as small springs were found to be charged from them. This study provides significant knowledge that assists protecting springs and natural habitats.

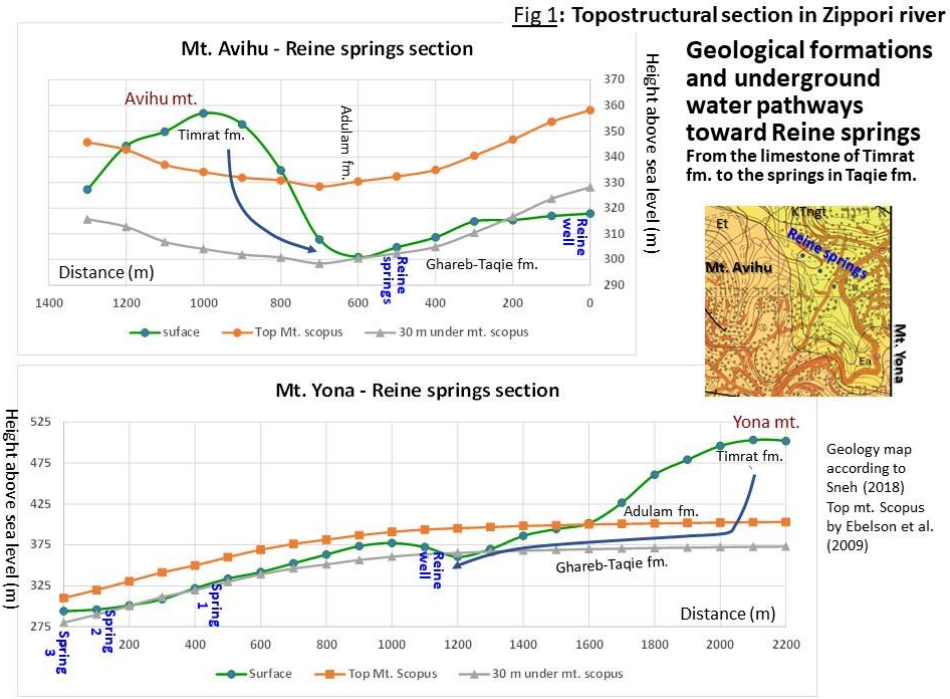

Figure 1. Geological formations and underground water pathways toward Reine springs

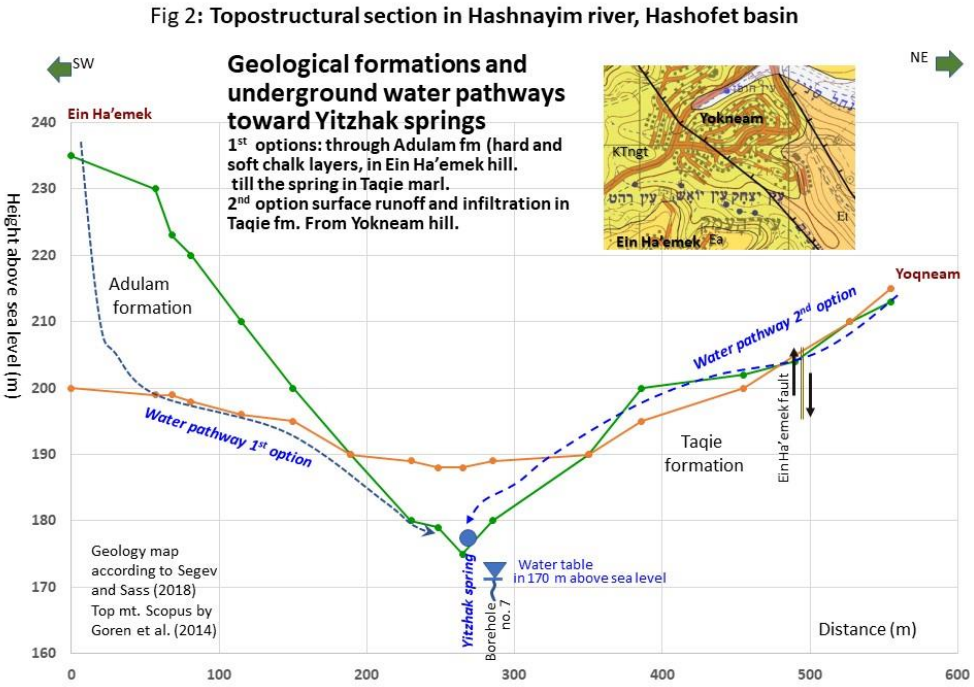

Figure 2. Geological formations and underground water pathways toward Yitzhak springs

Marine oligotrophication caused by anthropogenic fine sediment and nutrient retention in large rivers: the Nile damming case

אוליגוטרופיקציה ימית כתוצאה מחסימה אנטרופוגנית של סדימנטים דקים ונוטריינטים במעלה נהרות: מקרה סיכור הנילוס

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In the last two centuries, human activities have radically reduced the transport of suspended sediment and water to marine systems, mainly in the northern hemisphere, while complete sediment retention has been reported for the Nile River after the construction of the Aswan High Dam (AHD). Here, we present changes in the Israeli Mediterranean inner-shelf sediments most exposed to the pre-AHD flood plume in the distal part of its littoral cell as a predictor of the ecological response to large river fragmentation. Substantial reductions in fine (15-40%) and increases in coarse (~8 fold) sediment accumulation rates, increases in CaCO3 (~50%), decreases in autochthonous and total organic carbon (OC), and changes in the benthic foraminiferal assemblage toward more OC-sensitive species suggest an enhanced oligotrophication trend. Reduced nutrient fluxes, OC accumulation, and the coarsening of the shelf sediments inhibit the retention of “blue” carbon. Combined with fast climate warming and salinization, river fragmentation may have essential implications for the Eastern Mediterranean ecosystem via benthic oligotrophication processes.

Precursors for the October 7 attack from seismic noise analysis

סימנים מקדימים למתקפה בשבעה באוקטובר מאנליזה של הרעש הסייסמי

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Seismic noise-field analysis is a powerful tool for characterizing anthropogenic activities. This methodology is used here to examine seismic signals associated with precursory activity leading to the October 7 attack. The activity in Gaza included massive mobilization, which took place in the hours leading to the attack and was widely documented in the media. Favorable conditions, which arose due to a temporary lack of anthropogenic activity in Israel, allow remote Israeli Seismic Network stations to record signals due to Gaza vehicle traffic. These seismograms were used to identify anomalous ground motions, associate them with pre-attack mobilization signals, and precisely determine their location. Most of the activity was found to be located near the Khan Younis and Rafah areas. In the 30 minutes preceding the attack, this activity generated loud noise that significantly exceeded the background amplitudes. The locations obtained from short-term noise bursts reveal that in the last 20 minutes before the attack, Hamas terrorists left the Khan Younis area and advanced towards the Gaza fence. Their motion can be tracked along the Salah al-Din road and out to the southern- and northernmost fence breach points. First signals from locations north of Khan Younis were detected at about 06:25 local time, just minutes before the fence in those areas was breached. These findings suggest that embedding seismic noise-field analysis into decision-making protocols could enhance preparedness, thus providing an opportunity to blunt terrorist attacks and reduce the number of casualties.

From the river to the sea - the advantages of Virtual Reality field trips

מהנהר עד לים - היתרונות של סיורים במציאות מדומה

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In response to the limitations posed by the ongoing war, we had to find an innovative solution to maintain the quality of our geology courses, in which field trips are a major component. Leveraging our expertise in virtual reality (VR), we developed a set of solutions including both synchronous and asynchronous virtual field trips. Our most exciting virtual trip was to the Ardon stream in Makhtesh Ramon. The tour included photogrammetric 3D models generated from drone imagery and ground footage that were uploaded to the Spatial platform. Each student received a VR headset and a virtual avatar that represented him or her in the virtual space. In addition to realistically walking in the field, hearing the live guidance, and asking questions interactively, VR tours also provide opportunities that are not possible in regular field trips. These include reaching inaccessible places, such as jumping on vertical cliffs and displaying 3D objects and presentations on top of the natural landscape. However, this synchronous field trip did not solve the problem for those who could not attend. Moreover, the time that one can spend with the VR headset and stay focused, is limited. Thus, we also suggested an a-synchronic map-based field trip of the entire Makhtesh Ramon including 360-degree images and photogrammetric 3D models together with recorded audio guidance using the Padlet platform. Lastly, we used this technology for a field trip that did occur during the semester, using available 360 photos from Google Maps, together with 2D images and sound recordings of the field trip on the Mediterranean shore. Despite the semester's constraints and the complicated situation, the VR tour not only bridged the gap but also deepened students' understanding of geological processes. Feedback from participants was overwhelmingly positive, highlighting the potential of VR in geoscience education.

Figure 1. A snapshot, taken from one of the students' VR headsets during the virtual reality field trip to the Ardon stream in Makhtesh Ramon.

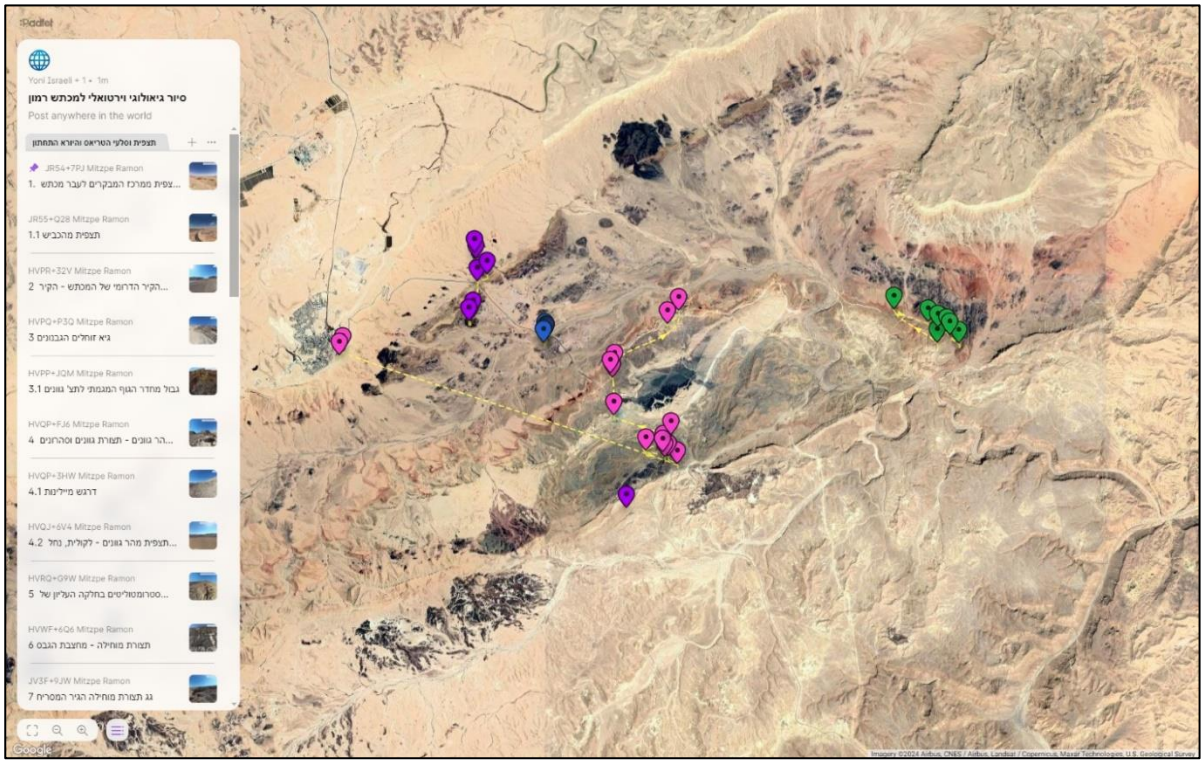

Figure 2. A screenshot of the map-based virtual field trip to Makhtesh Ramon from the Padlet platform.

Lithospheric Structure of the Red Sea Based on 3D Density Modeling: A Contrasting Rift Architecture

מבנה הליתוספרה בים האדום מתוך מודל צפיפויות 3D

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The Red Sea is a young example of continental break-up, a process in which a continent disintegrates into smaller pieces and an ocean is formed between them. We explore the sub-surface structure of the Red Sea, down to 140 km, aiming to better understand the mechanisms that allowed the Arabian plate to separate from Africa ~23 million years ago. We examine the gravity response of four end-member models of rift structures and compare them to the gravity signal measured in this region. We find that the sub-surface structure in the central-southern region is different than in the northern regions. Toward the south, the crust is thin and stretched, the lithospheric mantle is absent, and the asthenosphere is rising in a wide region. In the north, the lithospheric mantle is exhumed and the asthenosphere is rising in narrow regions below the center of the basin. We discuss the reasons for these differences and support the possibility that the Afar Plume, currently located to the south of the Red Sea, had a thermal weakening effect on the central-southern regions of the Red Sea, which allowed the lithosphere to deform more easily, having direct implications in the present-day architecture of the Red Sea.

Seismic Quality Control Stations of Earthquake Early Warning System (EEWS) for Israel

בקרת איכות סיסמית של תחנות "תרועה"

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During 2017-2022, the Geological Institute of Israel (GSI) has deployed 119 new stations to allow an efficient Earthquake Early Warning System (EEWS) for the state of Israel. In order to provide high-quality real-time seismic data, the seismological division in the GSI has been continuously monitoring the EEWS stations. This process includes a detailed integral analysis of the background seismic noise at each station. Specifically, detailed spectral and statistical characteristics of seismic noise levels were obtained, combined with the geological characteristics of each site. As part of the seismic quality check, seismic responses to individual dominant earthquakes for each channel were examined and quantified. Based on a detailed analysis of all stations, we classify the stations into four types according to the quality of the recorded signal: “Reference”, “Normal”, “Below normal” and “Not working”. The monitoring process improve the quality of operation of stations in the overall network and the performances of EEWS. The identification of stations with relatively low background levels assists the automatic and manual processing of seismic data, providing more reliable and accurate phase picking.

Is the Levant Channel active? Implications for geological history and geo-hazard

האם תעלת הלבנט פעילה? המשמעות לגבי ההיסטוריה הגיאולוגית והסכנה הגיאולוגית

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Submarine channels represent key features of sea-floor landscapes, sculpted by sediment-laden turbidity currents and gravity flows. They serve as vital conduits for sediment to deep-water environments. A network of meandering submarine channels, spanning hundreds of meters in width and up to 50 meters in depth, has been mapped across the northern Sinai continental margin. The easternmost Levant Channel extends across 270 km between the southeastern Levantine basin and the Eratosthenes seamount. This work aims to study the nature and temporal patterns of turbiditic activity within the Levant Channel, with a specific focus on its current activity status and the provenance of sediment deposition in its thalweg. The findings hold significant implications for understanding the recent geological evolution of the Levant Basin and assessing potential geo-hazards. Two ~30 cm long sediment cores were sampled at 1,400 m water depth at, and off, the channel thalweg (cores LECH1400 and TA1400, respectively), offshore central Israel. Radiocarbon-based sedimentation rate in core LECH1400 is ~6 cm/ka, with a basal age ca. 4,000 years cal BP. The core exhibits two distinct stratigraphic units differentiated by sediment-color and major element content. The entire core length hosts the Holocene-age planktic foraminifera Globigerinoides ruber pink and autochthonous benthic foraminifera, suggesting local sediment origin. The presence of the glacial foraminifera Globorotalia scitula together with allochthonous (shallow-origin) benthic foraminifera and coarser grain-size at a depth of 16-17 cm, equivalent to an age ca. 1,500 years cal BP, suggests the occurrence of a minor mass transport event. Core TA1400 displays homogeneity throughout its stratigraphy, with similar foraminiferal assemblages as LECH1400 and evidence of minor mass transport events. The preliminary results indicate that no major mass transport events occurred at the study site within the Levant Channel thalweg over the last 4,000 years, with a minor exception ca. 1,500 years BP.

Revelations from a local seismic network on the Jericho Fault

גילויים מרשת סיסמית מקומית על שבר יריחו

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Locked faults are seismically active faults, which release a relatively small amount of seismic moment compared to the on-going loading stress. However, how much of this locking is complete? Here, the microseismicity and damage-zone characteristics of a locked fault are investigated in a major strike slip fault segment north of the Dead Sea Lake. The Jericho Fault (JF) is seismically silent for Mw>2 earthquakes during recent decades although it generated significant earthquakes in the past. We extend seismological observations towards the microseismic range by deploying nine microseismic seismometers and strong motion accelerometers directly on the inferred surface trace. From one year of continuous recording data (06/22 – 06/23) we find 61 seismic events in the range of 0.9 < Mw < 2.4, that are below the detection threshold of the permanent regional network. Most of these events are located west of the fault zone and represent activity on other smaller faults, with only three events located along the Jericho Fault zone itself. We also find that the JF releases significantly less seismic moment compared to a seismically quiescent segment of the San Jacinto Fault - the Anza gap, indicating that the JF is a particularly quiet fault segment even in the microseismic domain and may be accumulating elastic strain energy along the locked-creeping boundary. Analysis of trapped waves allow us to physically characterize the fault damage zone at seismogenic depths. We report the first observations from earthquakes of damaged rock coherently trending northwards from the Dead Sea Lake. We invert data from the trapped waves and obtain a fault zone velocity of 0.95 -1.15 kms^-1 with ~50% reduction from the host rock to the damaged rock. The length of coherently damaged rock trending northwards from the Dead Sea Lake is ~13 km, ending up near original field observations by Begin, 1974.

CO2 storage potential assessment of Eocene-Miocene sedimentary sequence on the continental shelf of Israel

הערכת פוטנציאל הטמנה של CO2 ברצף הסדימנטרי איאוקן-מיוקן במדף היבשת של ישראל

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The subsurface Eocene sedimentary sequence of the Israeli continental shelf south of the "Palmahim disturbance" (Ashdod), is suggested to be a site for CO2 sequestration. The work purpose was to examine a number of critical geological parameters for initial feasibility assessment, from three shoreline-seaward boreholes (Ashqelon 1, Yam 2 and Yam-West 1), and relevant inland outcrops for comparison. The sequestration target is the Early to Middle Eocene marl-chalk sequence that yielded high carbonate content, ca. 60% - 80% wt. The chalky terrestrial outcrops exhibit porosity ranges of 20 – 43%, due to various diagenetic processes. As stable isotope analysis ($\delta^{18}O$ – $\delta^{13}C$) shows, the latter processes did not affect the porosity of the submarine sequence. The original permeability was found to be near zero, but other hydraulic conductors that increase the penetrability were detected (sliding planes, fractures). The Late Eocene - Oligocene sequence display upward gradual reduction in carbonate content (<30%), and increase in the siliciclastic content dominant by phyllosilicates. This heterogenic chalk-marl sequence is covered by mainly siliciclastic sequence of the Miocene Saqiye Group, ca. 1900 m thick, with further upward reduction of carbonate content (<20%), bisected by the salty Mavqiim Formation. All of the above suggests that it constitutes a capable caprock along with the sea-water above. The Eocene target sequence is the extensive and the shallowest carbonate interval, with high porosity, which may even expand over time because of acidic reactions. It is 40 to 80 m thick, extending over 50 km westward, and much more northward, hence, static method using volumetric approach can estimate the site's CO2 storage capacity. The phyllosilicates (smectite, illite and kaolinite) are considered to have high CO2 sorption capacity. It is worth paying attention to the upward change in the clay content from dominant illite/smectite in the Eocene sequence, to kaolinite dominant in the Miocene one.

Reducing the Uncertainty of Stress-Drops

הקטנת חוסר-הוודאות של נפילת המאמצים בעת רעידות-אדמה

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Stress-drop defines the overall reduction of average stress due to the release of stresses due to an earthquake, and should reflect geometrical, rheological and dynamic properties of the seismic source. Its variability up to four-orders made it an enigmatic parameter, and a reason for extensive research. There have been many efforts to reduce the stress-drop uncertainty, and to perceive better understanding of the factors controlling its variability. These efforts focused mainly on observational aspects, in which source properties such as, corner-frequency and seismic moment, were measured, considering site, path and additional source properties. Another aspect, that has hardly been pursued, is to challenge the formulation applied for stress-drop calculation. One of the basic assumptions is a constant K coefficient, relating corner-frequency with geometrical dimensions of the source. We suggest an alternative formulation, based on the results of dynamic modeling, in which the K coefficient is not constant and increases with strain-drop (ratio between slip and source length), resulting in a new equation relating stress-drop with seismic moment and corner-frequency. While for a constant K coefficient, stress-drop is proportional to a cubed corner-frequency, for the strain-drop dependent K, stress-drop is proportional to the corner-frequency in a power of 4/3, reducing the impact of corner-frequency uncertainty on the stress-drop. Therefore, our stress-drop formulation, significantly lowers the stress-drop uncertainty, and shows better fit to field observations. Using the new formulation, we show that the stress-drop values range between 5-25 MPa, for dynamic rupture events with a wide range of seismic moments, and corner-frequencies.

What can an anomalous post-rift subsidence tell us about the syn-rift state of the lithosphere? Insights from data-constrained analytical modeling

מה ניתן ללמוד מהשתפלות חריגה של שולי יבשת על אופייה של הליתוספירה בזמן ביקועה? תובנות ממידול אנליטי מוכוון תצפיות

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Thermal subsidence is a key driver of the massive sediment accumulation at passive continental margins. Several models (e.g., McKenzie, 1978) have been proven useful in predicting thermal subsidence at numerous sedimentary basins. However, a growing number of observations, especially from volcanic margins, deviate from the predictions of these models. Magmatic additions, elevated mantle temperatures and convection at volcanic margins do not conform to prevailing models' assumptions, such as volume preservation and cooling by conduction. We present a physics-constrained empiric model that predicts the accommodation space during the early post-rift period as a function of crustal thickness by considering the effects of magmatism, non-uniform stretching, variable thermal diffusivity and elevated mantle temperatures. To constrain these effects, we utilize a dataset that includes crustal and early post-rift sedimentary thicknesses offshore the mid-Atlantic section of the U.S. Margin. Early post-rift subsidence at this volcanic margin was up to 3 times faster than the predictions of the classical models. We explore the parameter space of seven parameters that determine the amount of magmatic addition, the thermal diffusivity of the lithosphere, the degree of non-uniform stretching, the initial crustal thickness and mantle temperature within a range of acceptable values. The best fit to the observations is obtained when magmatic addition to the crust is proportional to crustal thinning by a ratio of 0.8 km of added magma per km of thinning. Moreover, thermal diffusivity increases linearly up to 1.9x10-6 [m2s-1] as a function of crustal thinning, the mantle lithosphere is stretched 1.8 times more than the crust and the mantle temperature is 1400°C. The model's fit with these parameters, reveals the complexity of thermomechanical processes and the possible fluid flow contribution during the breakup of continents, shedding light on the lithospheric conditions that lead to the anomalous subsidence.

Two-step dolomitization of Cretaceous carbonate platform at Mt. Carmel

מודל דו-שלבי לדולומיזציה של הפלטפורמה הקרבונטית הקרטיקונית בהר הכרמל

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The 'dolomite problem' refers to the paucity of dolomite in Cenozoic rocks and in modern marine depositional environments compared to its high abundance in pre-Cenozoic rock records. Considering that dolomite formation is kinetically inhibited at Earth surface temperatures, previous studies have associated the dolomite problem with either: 1) Missing catalyzing factors for dolomitization (e.g., microbial mediation) in Cenozoic marine environments; or 2) low thermal maturity of Cenozoic platforms, insufficient for dolomitization during burial diagenesis. The combination of carbonate oxygen ($\delta^{18}O$) and clumped isotopes ($T\Delta_{47}$) analyses can distinguish between surface and burial environments of carbonate mineral crystallization or re-equilibration, and so sheds light on this question. We measured $\delta^{18}O$ and $T\Delta_{47}$ of dolomite samples from the Albian Reef complex at Nahal Me'arot (Mt. Carmel, north Israel). Massive replacive dolomites in the complex are restricted to the back-reef lagoon facies and associated with reflux-brine dolomitization at the shallow subsurface of the lagoon. These samples recorded high $T\Delta_{47}$ values (29-54°C) negatively correlated with $\delta^{18}O_{dolomite}$ (-3.25 to -1.35 ‰VPDB). This trend is explained by dolomite recrystallization in shallow to deep (1-2 km) burial environments buffered by seawater-derived pore waters ($\delta^{18}O_{water}$ = -1‰VSMOW). Considered together, our observations suggest a two-step dolomite formation process: 1. Mg^{2+} uptake by carbonate sediments forming proto-dolomite, associated with brine reflux at the shallow subsurface; and 2. Dolomite recrystallization from proto-dolomites at elevated burial temperatures. Large volumes of dolomite in the Phanerozoic sedimentary rock record have been associated with the brine-reflux mechanism; and show similar isotope values and trends. In this context, the proposed two step dolomitization process may reflect a global phenomenon, and the dolomite problem could be driven by kinetic inhibition on either 'shallow' or 'deep' steps of dolomite formation. Comparing compiled records of dolomite abundance with Mg/Ca ratio in Phanerozoic marine carbonate rocks could test which of the steps has acted as a limiting factor for dolomite occurrence in Cenozoic sediment.

Inter-chamber elemental ratio variability in two planktic Foraminifera species from the Gulf of Eilat: Globigerinoides ruber albus and Turborotalita clarkei

שונות ביחסי יסודות שונים בין חדרים בשלדים של שני מיני פורמיניפרה פלנקטונית Globigerinoides ruber albus ו- Turborotalita clarkei ממפרץ אילת

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The elemental compositions of planktic foraminifera shells are influenced by both environmental and biological factors, and can be utilized as paleoceanographic proxies. Thus, understanding the drivers of elemental variability within the chambers of individual shells and in response to environmental fluctuations is crucial. Here, we investigate single chamber element to calcium ratios of the planktic species Globigerinoides ruber albus and two phenotypes of Turborotalita clarkei ('big' and 'encrusted') retrieved from sediment traps deployed in the Gulf of Aqaba, northern Red Sea, during 2014–2015. Samples were collected from five water depth horizons (120 m, 220 m, 340 m, 450 m, 570 m) as well as seafloor sediment core tops. Element to calcium ratios were analyzed alongside in situ measurements of water column chemistry and hydrography. Average element to calcium ratios (Mg/Ca, Sr/Ca, B/Ca, Na/Ca, Ba/Ca, Mn/Ca, Ti/Ca, Al/Ca, Th/Ca, Co/Ca, Fe/Ca, Pb/Ca, Nd/Ca, U/Ca) exhibit both element-specific and species-specific trends, with distinct differences observed between sediment trap and core top measurements. Generally, G. ruber albus displays less inter-chamber variability compared to T. clarkei, which may reflect, in some ratios, differences in the dwelling depth range. Some elements (e.g., Mg/Ca, Na/Ca, Al/Ca) tend to be higher in T. clarkei during water column mixing months than during stratification, suggesting their potential as a tracers of past water column stability. In all morphotypes, the final chamber (F-0; i.e., the last chamber grown) typically shows lower or similar values compared to preceding chambers (e.g., F-1, F-2). Calibration of Mg/Ca-Temperature using individual chamber Mg/Ca from G. ruber albus agrees with average in-situ surface mixed layer temperature. Seasonal trends in the single-chamber B/Ca in G. ruber albus and T. clarkei show poor agreement with pH. Additionally, Al/Ca, Ti/Ca, Th/Ca, Mn/Ca, and Fe/Ca co-vary, likely influenced by terrigenous sources.

Influence of ocean bottom current on shelf-edge clinoforms buildup, a case study from the Santos Basin, southeastern Brazilian Atlantic margin

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Shelf edge clinoforms typically form by combining sediment influx from the shore and currents. However, in southeastern Brazil, the 1500 km long Serra do Mar mountain range limits direct terrestrial sediment supply to the adjacent Santos Basin in the Atlantic Ocean. Consequently, clinoforms there are primarily fed by shore-parallel ocean currents: the Brazil Current carrying sediment SW between 0-500 m depths and the Intermediate Water Brazil Current that flows NE at depths greater than 500 m. Previous studies linked these vigorous currents to a sharp lateral shift in the modern seafloor morphology along the São Sebastião sediment Divider line (SSD), defined based on surface sediment samples. To further understand the initiation of this shift, we analyzed 90 industrial 2D seismic reflection data across a 300 by 150 km area encompassing the morphological shift. Our findings reveal that the Santos shelf and slope are divided into two distinct 150 km by 150 km domains exhibiting unique sedimentological characteristics, accumulation patterns, and progradation styles. The boundary between these domains coincides with the surface SSD, suggesting that the coastal range, regime of oceanic currents (and hence geostrophic conditions), and depositional pattern have been established since at least the mid-Miocene. We propose that these domains represent the leading edge of much larger margin depositional cells: the 300 km long Campos cell to the northeast and the ~1500 km long Pelotas cell to the southwest. As currents approach the study area, i.e., the edge of the depositional cell, net sediment accumulation gradually tapers off towards the SSD. Over time, since the mid-Miocene, this along-margin accumulation gradient forms an *angular progradation pattern* defined here for the first time. Similar angular progradation patterns likely exist in other environments worldwide dominated by margin-parallel currents, but additional sediment sources might obscure their identification.

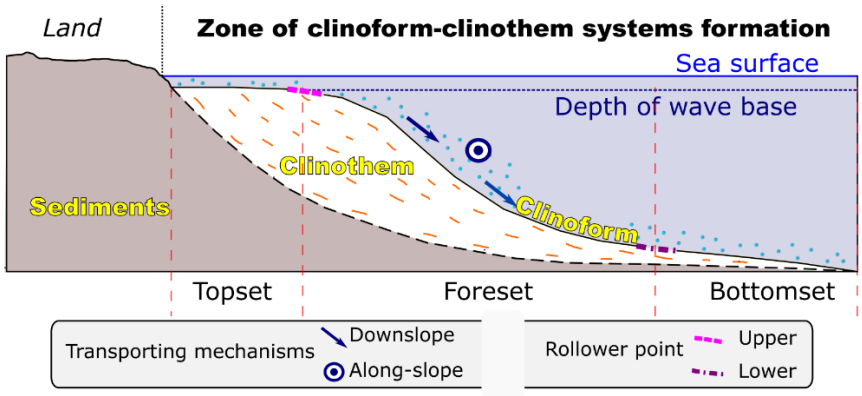
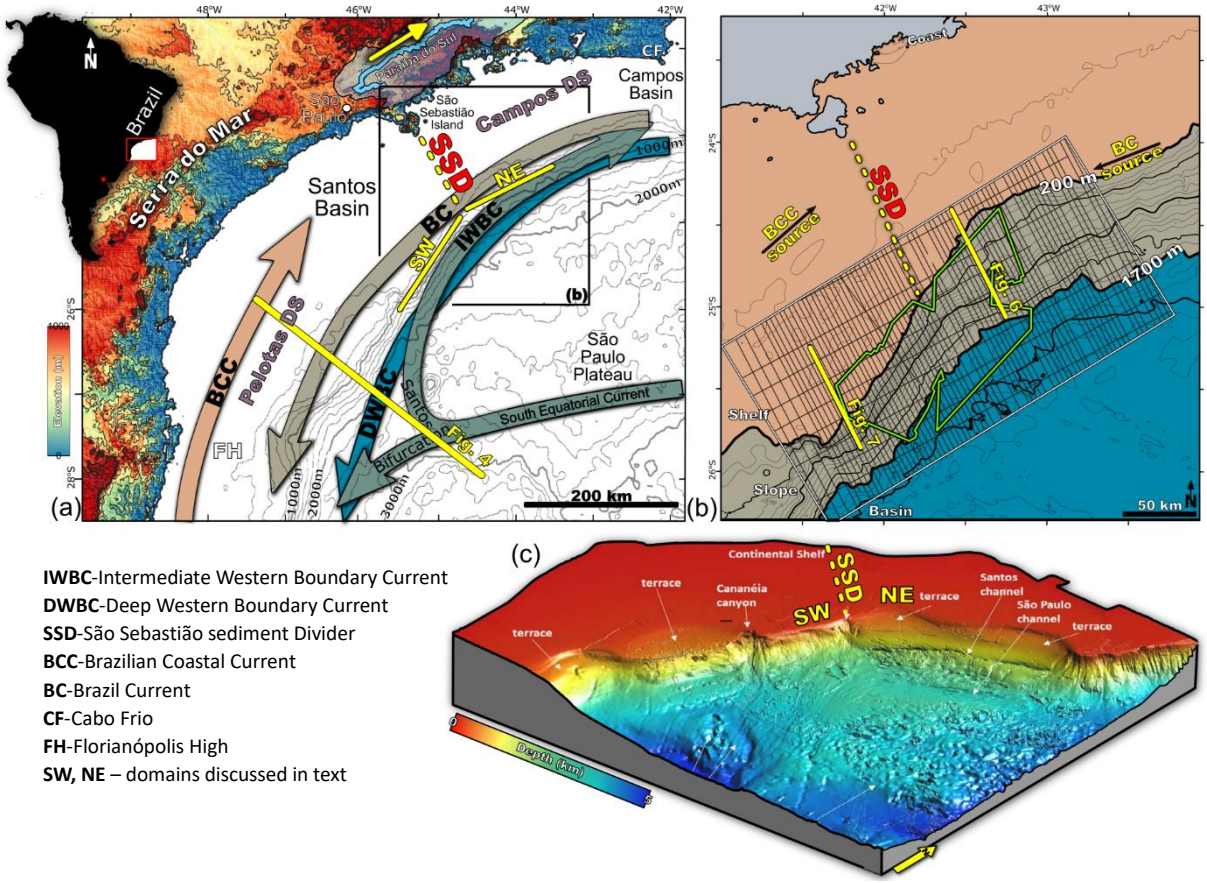


Figure 1. CCS elements (after Patruno, 2018; Pellegrini et al., 2020). Vertical and horizontal scales are exaggerated.



IWBC-Intermediate Western Boundary Current
DWBC-Deep Western Boundary Current
SSD-São Sebastião sediment Divider
BCC-Brazilian Coastal Current
BC-Brazil Current
CF-Cabo Frio
FH-Florianópolis High
SW, NE – domains discussed in text

Figure 2. Regional geologic context of the SE Brazil continental margin and adjacent Atlantic Ocean (after Schattner et al., 2024). (a) Isobath contours from ETOPO-1 (500 m interval; Amante & Eakins, 2009). N and S marked the location of the domains discussed in this study. SSD - São Sebastião sediment Divider line. (b) A zoom into the Santos shelf, slope, and basin (100 m contour interval). Green polygon - extent of the PSDM 3D seismic reflection data. White polygon and black lines - 2D seismic profiles interpreted in this study. Yellow lines mark the location of seismic reflection profiles presented in the lecture. (c) Regional bathymetry with vertical exaggeration based on extensive seismic interpretation (after Hercos et al., 2023). Note the difference between the downslope-dominated SW domain and the along-slope-dominated NE domain morphology, divided by the SSD.

Deccan fingerprints in the late Maastrichtian of Hor Hahar at orbital time scales: X-Ray Fluorescence analysis and calcareous nannofossil evidence

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The end of Maastrichtian is characterized by a pronounced abrupt global warming of 3 – 4°C related to Deccan volcanism. The Hor Hahar section in the Zin basin represents an excellent outcropping condition for the last Maastrichtian up to the KPg Boundary (KPgB), showing prominent cyclicities of clayey marly, chalk, and indurated marly chalk, which are likely related to Milankovitch orbital cycles. X–Ray Fluorescence analysis was performed on 233 samples to test this hypothesis. A spectral analysis of the data was performed using the ACycle software. Additionally, the calcareous nannofossil assemblages of 93 samples from the late Maastrichtian were characterized to assess their potential response to climate changes and volcanic pulses. XRF analyses of Ca and Si content percentages reveal well-pronounced precession, obliquity, and short eccentricity cycles. They indicate that the section covers the last 440 kyr before the KPgB. The most abundant taxon observed in Hor Hahar is Micula ssp., which, in some cases, constitutes up to 80% of the assemblage. Diagenesis has a significant impact, particularly dissolution, on the nannofossil assemblage. A correlation of the maxima in the abundance of heavily recrystallized Micula to the lows in the Si precession filter output suggests an insolation control on the sediment's dissolution and recrystallization of the nannofossil assemblage. These results thus point to potential acidification in bottom waters during insolation maxima that triggered an enhanced early diagenetic overprint in the carbonate deposits beneath the sediment-water interface. The timing of the first occurrence of these recrystallized Micula and the associated drop in Biscutum constans (280 kyr before the KPgB) coincides with the onset of the Deccan greenhouse warming, according to correlation to the Elles section, Tunisia. Therefore, our results suggest a significant lowering of ocean alkalinity in the Zin syncline oceanic basin as a consequence of the Deccan warming and/or associated paleoenvironmental perturbations.

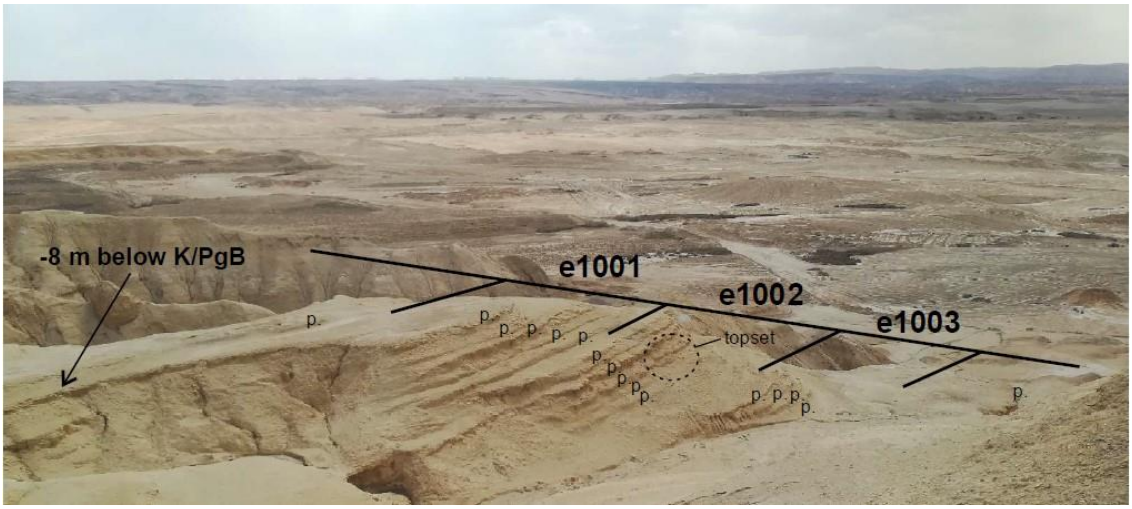

Figure 1. Chalk-marl alternations interpreted as precession cycles and bundling into short-eccentricity cycles in the Chalk Member of the Ghareb Formation, Hor Hahar, Arava region (30° 49' 46.96" N, 35° 3' 22.40" E). View from the Base Paleocene plateau from the North facing southwest.

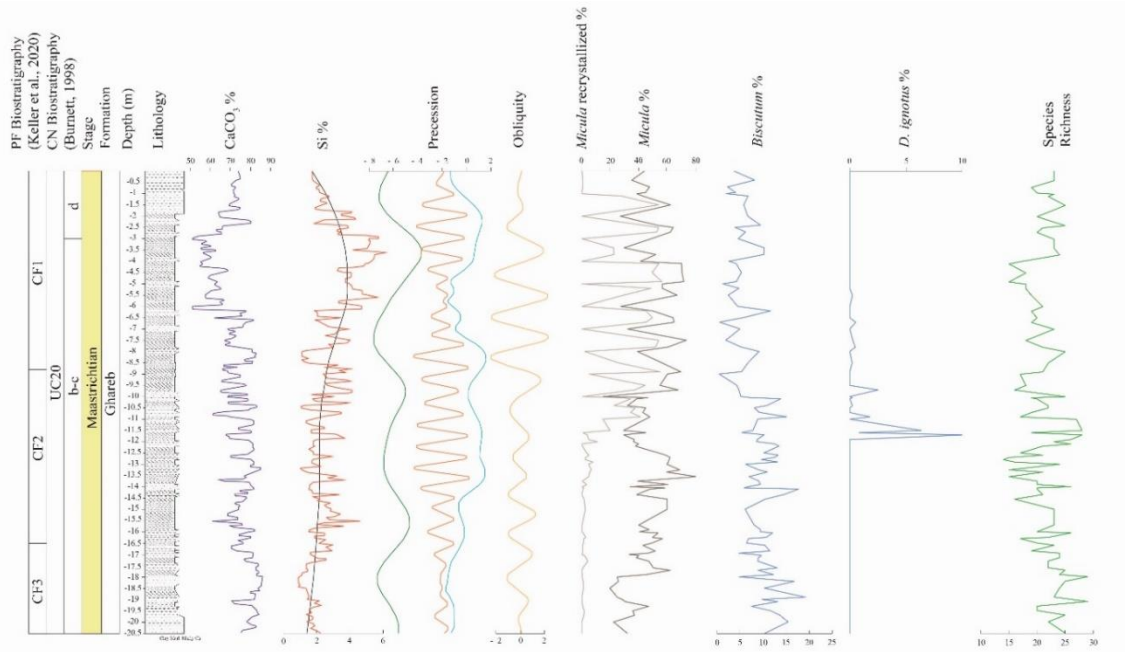

Figure 2. Stratigraphy, CN biozones, and lithology of Hor Hahar with %Si and % CaCO3, Precession and Obliquity cycles, relative abundances (%) of total Micula species, Micula recrystallized, Biscutum constans, Discorhabdus ignotus and the Species Richness.

Size and morphological changes in Coccolithus pelagicus across the Danian and their link to environmental recovery from the K/Pg mass extinction

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Biometry and morphology studies on coccoliths are well-known tools to extend our knowledge of several calcareous nannoplankton species' taxonomy, biostratigraphy, and palaeoecology. In addition, it is well known that the size of the coccoliths may also change due to climatic variations. The present research aims to investigate morphological changes in the Coccolithus pelagicus lineage, an emergent species that shows significant variations in size in its early evolutionary history through the Danian. So far, despite numerous studies pointing to a significant increase in size of emergent Danian lineages, there has not been any study focusing on the morphometry variability of C. pelagicus during its early evolutionary history. Indeed, the study of morphological changes in C. pelagicus and its palaeoecological significance through the Cenozoic is currently very scarce and mostly limited to current or recent time intervals. This study has the unique potential to bring new information on the evolution and climatic adaptation of Coccolithus pelagicus, one of the most ancient, abundant and cosmopolitan extant coccolithophores through the first million years of its evolutionary history. To perform this study, 50 specimens of C. pelagicus per sample across the first 26 m of Paleogene in the Danian part of the Hor Hahar section, Zin basin, were counted and measured with the image software ImageJ. For the first time, circular and Broadly Elliptical morphotypes are reported here. Our preliminary results show that not less than six morphotypes co-exist in the Danian of Hor Hahar with a dominant Elliptical morphotype between 5 and 10 µm. Regarding the average and median biometric parameters, there is a constant increase in the length and width of the whole lineage through the Danian. This increase is likely suggestive of more stable paleoenvironmental conditions.

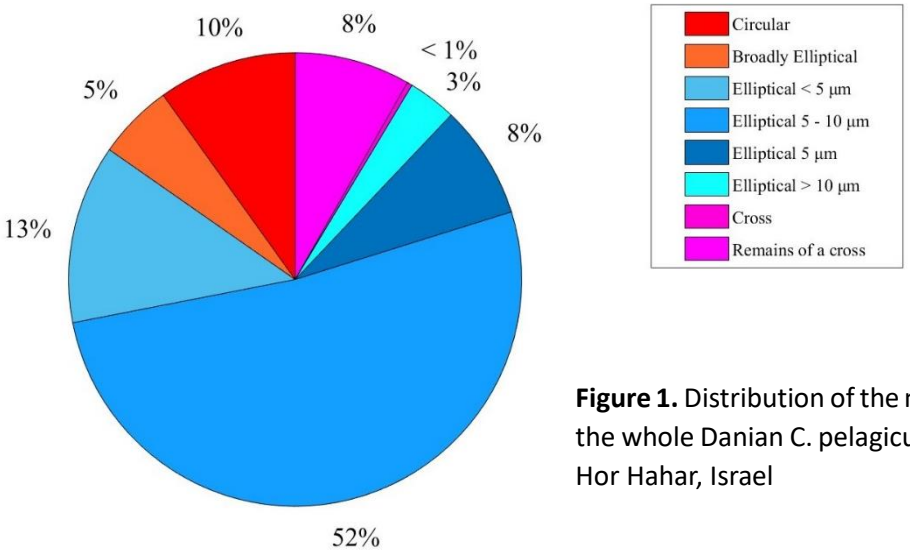

Figure 1. Distribution of the morphotypes in the whole Danian C. pelagicus population in Hor Hahar, Israel

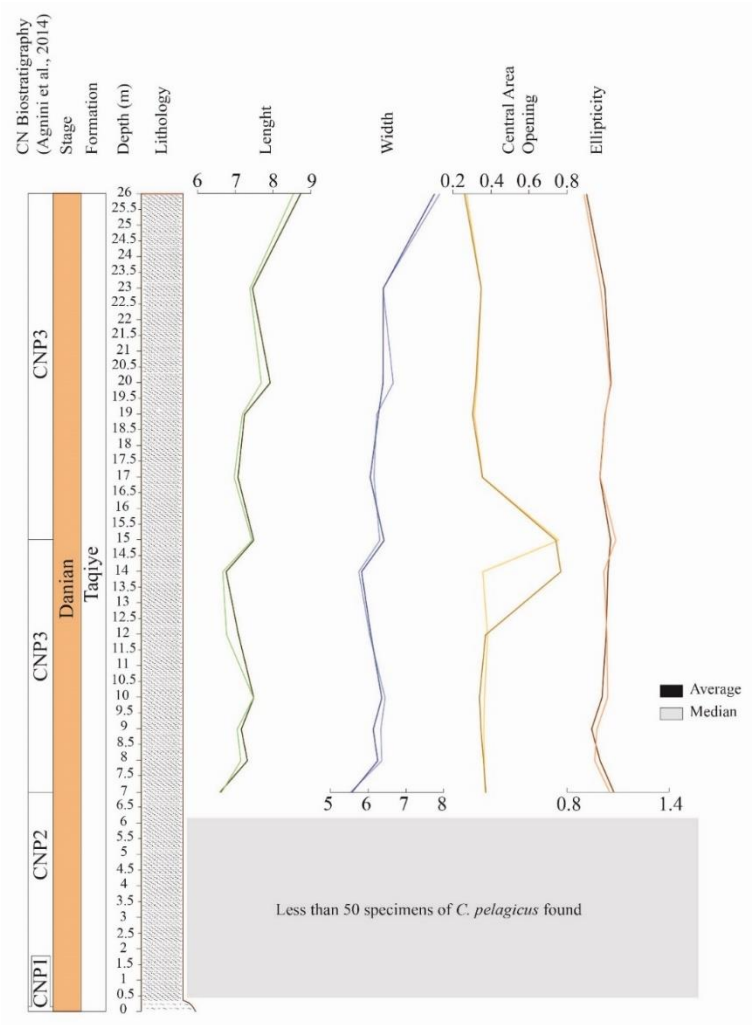

Figure 2. C. pelagicus biometric parameters through Hor Hahar Danian section.

North-south gradient in Li isotopic compositions and concentrations in Terra-Rosa soils from 1500 mm to 300 mm isohyets in Israel

גרדיאנט צפון-דרום בהרכב האיזוטופי והריכוז של ליתיום בקרקעות טרה-רוסה בישראל, בין 1500 ל- 300 מ"מ גשם בממוצע לשנה

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Lithium (Li) isotopes have the potential to be effective tracers of weathering processes due to their large relative mass difference and therefore fractionation. However, the behavior of Li during surficial weathering and precipitation of secondary minerals is not well understood. In this study, an attempt is made to gain better understanding of Li isotope fractionation during silicate weathering in soils, and how it may be affected by climatic conditions. To this end, we directly measured the concentration and isotopic composition of Li in a series of young Terra Rosa soils, developed over similar carbonate bedrocks along a N – S transect of Israel, under a precipitation gradient of 300-1500 mm/yr. We also measured the bulk chemical composition and clay fraction mineralogy of the studied soils to evaluate their degree of weathering and pedogenic evolution. Our results show a correlated increase in both Li concentrations (18 to 55 ppm) and δ7Li values (1 to 4‰) from south to north, with increasing annual precipitation. This trend is correlated with higher Al2O3 concentrations and higher amounts of Kaolinite and Illite in the clay fraction of the soils, indicative of increased pedogenic evolution. The fact that δ7Li values increase together with Li concentrations indicates that the increase in Li concentrations is not merely the result of dissolution and removal of Li-poor minerals (mainly carbonates). The increase in δ7Li values with pedogenic evolution seems to suggest preferential uptake of the heavier 7Li isotope by new, secondary minerals forming in the soil. However, previous studies have shown that such secondary minerals do not fractionate Li, or fractionate in favor of the lighter 6Li isotope. Instead, the higher δ7Li values in the northern samples may reflect a different source of the soil parent material – dust – in this part of the country.

The operational 24-7 setup of the Seismological Division at the Geological Survey of Israel - establishment and activity

הקמתו ופעילותו של מערך החירום 24-7 של אגף סיסמולוגיה במכון הגיאולוגי

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At the end of January 2022 the national Earthquake Early Warning System (EEWS) of Israel, Truaa, has become operational. Truaa is based on the U.S west coast Shake Alert's EPIC algorithm, operating automatically to issue public alerts through the IDF's Home Front Command without any human intervention. However, to verify or refute these automatic alerts, the Geological Survey of Israel (GSI) must offer round-the-clock human oversight to monitor and examine the seismic data, forward the information to the operational teams and provide professional feedback to the media and to the public. To fulfill this requirement, the Seismological Division of the GSI established a new 24-hour unit, responsible for the immediate human response in cases of either seismic events or significant system failures. The emergency setup consists of Network Operation Center (NOC) operators backed up by on-call professional senior staff, ensuring a continuous, effective and high quality day-and-night response. In order to make the 24-7 unit efficient, additional adjustments were made within the supporting software, assisting the 24-7 personnel in obtaining the most comprehensive system status, and in decision making for the various scenarios. These adjustments feature the introduction of a web-based application (GAPS) that offers fast remote access to essential data in a user-friendly format for NOC operators and senior staff. Furthermore, these updates necessitated the development of structured protocols and regular professional training for all teams every three months, ensuring preparedness and efficiency.

Figure 1. NOC- The Network Operation Center of the Seismological Division at the Geological Survey of Israel

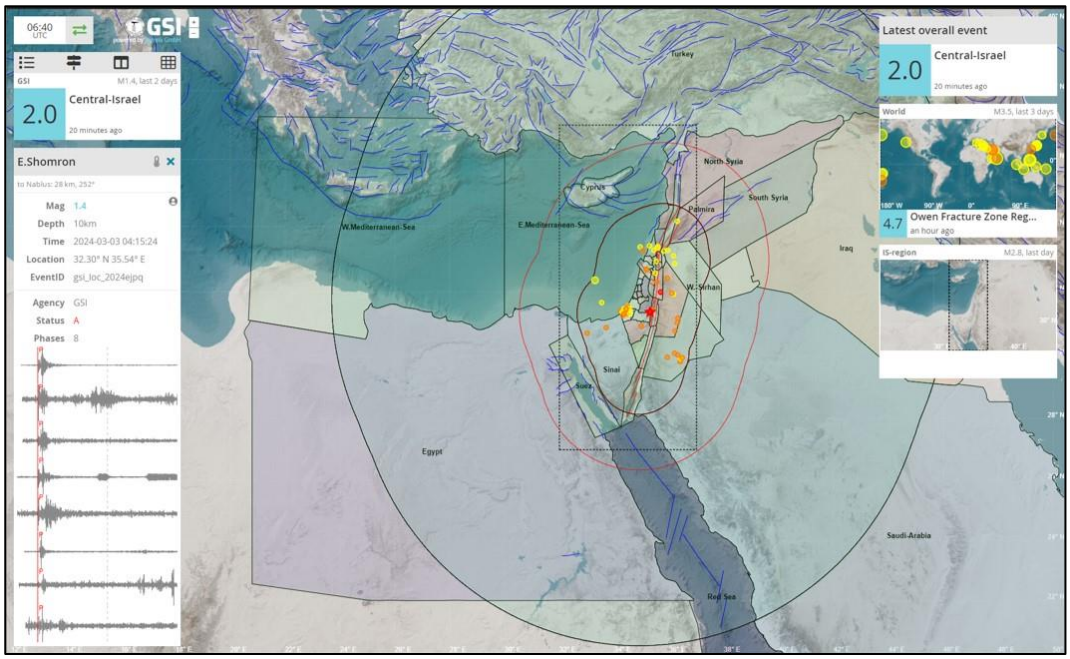

Figure 2. GAPS - a web-based application, which offers fast, remote access to essential data in a user-friendly format.

Quantitative analysis of the Eratosthenes Seamount bathymetry – a tool for understanding subducting plate processes

ניתוח כמותי של מורפולוגיית הר ארטוסטנס התת ימי ככלי להבנת תהליכי הפחתה

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The bending of a subducting plate extends the upper crust through faulting and forms a forearc bulge (Fig. 1a). However, the resulting extensional faults are commonly obscured by sedimentary coverage over the consumed basin. A window into the faulting pattern can be provided in sediment-starved basins and on top of seamounts approaching the subduction trench. The eastern Mediterranean provides these two conditions and serves as a natural laboratory for unravelling the tension of the upper crust of a subducting plate (Fig. 1b). The Eratosthenes Seamount (ESM) is approaching the Cyprus subduction Arc in the central-northern part of this region. Its top and flanks are depleted of soft sediments due to the lack of immediate sources. Previous studies of the seamount provided excellent sedimentologic, structural, and tectonic constraints for its development and incipient collision with the Cyprus arc. However, lack of high-resolution bathymetric data prevented a quantitative geomorphological analysis of its seafloor. The present study analyzes the bathymetry of the ESM and its surroundings through geomorphological and statistical methods. Preliminary results include mapping of 217 faults, 39 channels and 13 submarine landslides across the study area, as well as concise analyses of their physical parameters and relative location. Fault orientation and their extensional nature confirm previous indications of tension across the forearc bulge. The pattern and distribution of slope channels and slides attest to ongoing directional instability despite the lack of an immediate sediment source.

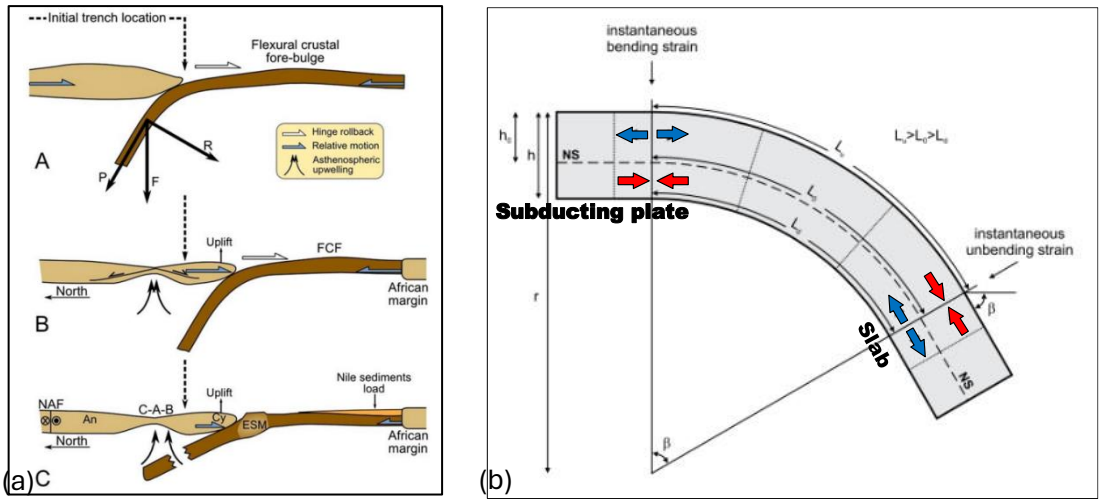
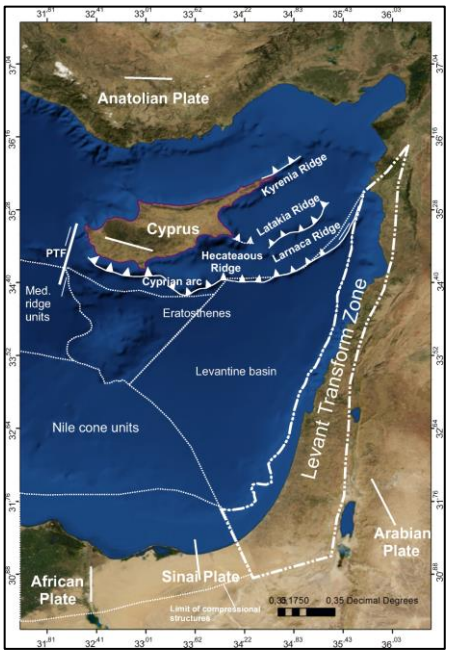
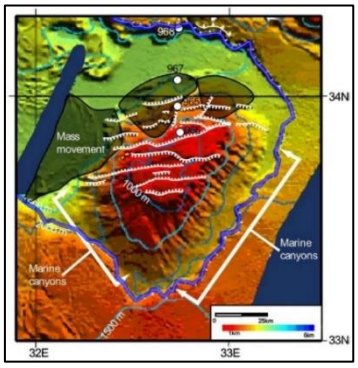


Figure 1. (a) Schematic cross-sections of seamount-induced subduction scenarios (Schattner, 2010). The initial stage includes flexural crustal fore-bulge (FCF), hinge rollback, slab-pull (P), vertical negative buoyancy (F), and slab retreat. B—Typical plate convergence scenario with hinge, FCF rollback, and back-arc stretching of the overriding plate. Without interference, rollback continues. When ESM approaches the Cyprus Arc trench, the down-going plate gets stuck and chokes the subduction zone. (b) End-member orthogonal flexural model geometry for constant curvature radius r, lithospheric thickness h, and dip angle β from Romeo and Álvarez-Gómez (2018). Dotted lines indicate verticality. L_0: longitude along NS, which remains constant, L_u: longitude along the top of the slab, which elongates, L_d: longitude along the bottom of the slab, which shortens, and h_0: depth of NS generates fold geometry.



(a)



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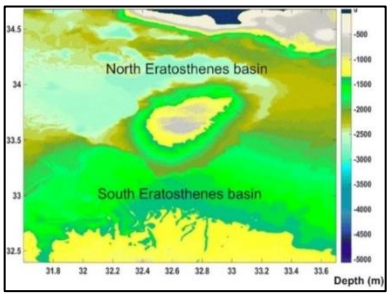

(c)

Figure 2. (a) Location map showing the extent of the Levant Basin, Eastern Mediterranean (USGS, 2010; McClusky et al., 2020; Papazachos and Papaioannou, 1999); (b) morphologic interpretation of the seamount based on bathymetric data available in 2005 (Schattner, 2010). Blue perimeter marks the limit of the present study; (c) medium-resolution (0.25 arc minutes) bathymetric data of ESM from EMODNet (Berthou et al., 2008).

Climate Change Impact on Urban Runoff in the Eastern Mediterranean

השפעת שינויי האקלים על הנגר העירוני במזרח הים התיכון

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In urban environments, excess runoff can cause urban flooding—an impactful disaster that could result in severe outcomes, including loss of life and extensive damage to property and infrastructure. Climate change and urbanization are the main factors contributing to increasing the frequency and intensity of flooding in urban areas. Yet, effectively modeling the intricate and heterogeneous nature of an urban area and understanding the rainstorm and surface properties that impact runoff formation is still a challenge. In addition, there is a lack of research on the interaction between climate change and urban runoff in the Eastern Mediterranean region particularly. We employed high spatiotemporal rainstorm and surface data of the Nahal Ra'anana basin (13 km2) located on Israel's coastline to develop a comprehensive and sufficiently accurate urban rainfall-runoff model. This model, based on the hydraulic-hydrological SWMM model, was refined using data collected from 26 distinct storms, capturing a diverse range of precipitation patterns and intensities. The developed SWMM-based model effectively represents Nahal Ra'anana basin's hydrological response, with KGE values of 0.66 for peak flow and 0.88 for total volume, indicating satisfactory performance. By employing this model, we are currently investigating various factors influencing urban runoff characteristics, including rainstorm properties associated with climate change and land use changes resulting from urbanization. The findings derived from this research will contribute significantly to the enhancement of flood risk management strategies in future urban environments.

Palaeoenvironmental reconstruction by calcareous nannofossils of the Albian–Cenomanian succession of the Jerusalem Area

שחזור פלאוסביבתי על ידי ננופלנקטון באלביאן-קנומן באזור ירושלים

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In During the Cenomanian, one of the largest transgressions took place in the southern Tethys, where huge sequences of calcareous sediments were deposited on a wide platform. The Judea Group is the most lithologically diverse in the Jerusalem Area and the least studied in terms of the calcareous nannofossils. Notwithstanding prolific literature and geological mapping of Israel, the palaeoecology of the region is still poorly investigated, especially by nannofossils. Four sections of the Moza and Kefar Shaul Fms. were chosen for examination of calcareous nannofossils in the Cretaceous formations in the Jerusalem area. The section of the Moza Fm. (coords. 31°47'05"N, 35°06'53"E) is represented by beige clayey marls and yellowish calcareous clays (15.5 m). Kefar Shaul sections (31°44'42"N, 35°08'13"E; 31°45'12"N, 35°07'16"E; 31°35'23"N, 35°23'56"E) are represented by soft light yellowish very clayey marls and argillaceous limestones (~30 m). The total of 51 samples for biostratigraphical and palaeoecological analysis were taken at 0.3–1 m intervals. A rich nannofossil assemblages in the Moza Fm. is interpreted as the Lower – lower Middle Cenomanian (UC2a), and possibly the Lower Cenomanian (UC1) for the lowest sample. A very representative and rich nannofossil assemblage of the Kefar Shaul Fm. date this formation as the lower Middle–Late Cenomanian (UC3–UC4b). The quantitative nannofossil analysis suggests that the general dominance of Watznaueria spp. throughout the whole succession of the sections points to quite warm, open marine or coastal, generally oligotrophic conditions. Due to poor nutrient supply, the productivity of the nannofossils was quite low except for three phases of higher fertility within the upper part of Subzone UC3d and in the lower and upper parts of the interval of Subzones UC3e–UC4a. Low values of the Shannon index, Evenness and Species Richness can be interpreted as reflecting unstable environment. The Moza Fm. corresponds to the lower part of the Arqan Fm. (Lower Cenomanian) of the Carmel Area, and was accumulated in oligotrophic waters and relatively warm climate, similar to the lower part of the Arqan Formation. The Kefar Shaul Fm. corresponds to the upper part of the Arqan Fm. (Middle–Late Cenomanian) of the Carmel Area, and was deposited during a progressively cooling period, although characterized by alternating warming and cooling phases and mesotrophic conditions with oligotrophic phases. The Kefar Shaul Fm. probably represents the deepest open marine facies of the Judea Group.

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

Positron emission tomography for visualizing and quantifying transport processes in porous media - A case study from cementitious matrices used for radioactive waste conditioning

טומוגרפיית פוזיטרונים למעבב ובימות תהליכי הסעה בתווך נקבובי - מקרה מבחן ממטריצות צמנטיות באפליקציות טיפול בפסולת רדיואקטיבית

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Fluid dynamics and solute transport rates through porous media play a pivotal role in chemical reactions and contaminant migration in soils, sediments, and rocks, and are key for many geological processes and environmental applications. However, it is challenging to directly observe flow patterns and quantify flow processes through the opaque medium. Consequently, these are often deduced from indirect techniques that effectively treat the solid phase as a 'black box'. Positron emission tomography (PET) is a non-destructive clinical method for measuring the 3D temporal distribution of positron-emitting radionuclides in an opaque, porous medium. The method was developed for use in preclinical studies and clinical applications. Recently, the technique has been extended for use in (geo)materials science. By selecting adequate tracers, PET is applied as a tool for in-situ observation of flow patterns and quantification of fluid transport rates through core-sized samples of geological and engineered materials. Recently, we have explored the potential of PET for obtaining quantitative data on short-term (imbibition) and long-term (diffusion) transport processes through cementitious materials used for solidifying and immobilizing radioactive waste. Here, we will present our data and discuss the physical principles of PET measurements, their capabilities and limitations, and the criteria for selecting radiotracers for Earth and Environmental science applications. Furthermore, we will show that 124I and 22Na are suitable tracers for observing flow fields and quantifying fast and slow transport processes through cementitious matrices. Finally, we will show, based on in-situ measurements, the diffusion patterns in common cementitious matrices and that the rate of imbibition in these materials is linear with time to the power of 0.25, indicating anomalous transport.

Regional Depositional Age Assessment using Portable-OSL of Hand-Augered Aeolian-Fluvial Deposits along a Sequence of Small Dune-Dammed Basins in the Northwestern Negev Dunefield Margins, Israel

הערכת גיל השקעה באמצעות מכשיר לומינסנציה נייד של משקעים איאולים-פלוביאלים בשולי שדה הדיונות של צפון-מערב הנגב

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Aeolian-Fluvial (A-F) interactions range from aeolian- to fluvial-dominated processes. These transitions are common at dunefield margins, where encroaching dunes may block high energy fluvial systems. In arid environments the size of the basin emerges as a critical factor influencing the transition from aeolian to fluvial dominance. In medium-sized (40-200 km2) and large (>200 km2) basins floods often breach the dune-dam while small basins may remain dune-dammed for long periods, adopting a playa morphology. Small dune-dammed basins require sampling techniques such as drilling. Our study highlights the potential of Portable Optically Stimulated Luminescence (port-OSL) for interpreting paleorecords in small dune-dammed basins. In the Shivta-East basin (3.3 km2), at the northwestern Negev dunefield margins, we hand-augered, along the propagation path of an ephemeral stream into the dunefield, three disconnected playa-like sediments of dune-dammed water bodies. Ages were estimated based on a regional linear regression derived from the northwestern Negev dunefield luminescence age database. Testing the model against samples with age assessments according to chrono-stratigraphic analysis demonstrates its ability to discriminate between samples from the Last Glacial Maximum, Heinrich-1, and Younger-Dryas sand incursions. Our findings reveal that along the dune-dammed stream, aeolian sand and fine-grained fluvial sediments were deposited during different periods. The first drill documented punctuated aeolian sand deposition estimated between 16.3-12.1 ka, followed by fine-grained fluvial deposits. Downstream, the port-OSL profile of the second and third drills suggests fluvial reworking of dunefield sand after ~10 ka, indicating the onset of dune-damming at that playa. Interpolating sandy samples along the Shivta East channel demonstrates that during Heinrich-1 and Younger-Dryas events, an aeolian-dominated environment dune-dammed the fluvial system. In the Early Holocene, as the fluvial system propagated into the second dune-dammed waterbody, fluvial energy became sufficient to rework dunefield sand. The cost-efficient of depositional ages emphasizes the port-OSL reader's possibilities for further exploration.

Exploring patterns in precipitation intensity-duration-area-frequency relationships using weather radar data

חקירת דפוסים ביחסי עוצמה-משך-שטח-שכיחות משקעים באמצעות שימוש בנתוני מכ"מ גשם

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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. Extreme precipitation is highly variable in both space and time, thus understanding and managing the related risks necessitates improved knowledge of their probability at different spatial-temporal scales. We employ the simplified metastatistical extreme value (SMEV) framework, a novel non-asymptotic framework, to estimate extreme return levels (up to 100 years) at multiple temporal (10 min–24 h) and, for the first time, spatial (0.25 km2–500 km2) scales using weather radar precipitation estimates. The SMEV framework reduces uncertainties and enables the use of relatively short archives typical of weather radar data (12 years in this case). Focusing on the eastern Mediterranean - a region characterised by sharp climatic gradients and susceptibility to flash floods - we derive at-site intensity-duration-area-frequency relations at various scales. Comparison with extreme return levels derived from daily rain gauge data over areas with dense gauge networks yields comparable results, demonstrating that radar precipitation data can provide important information for the understanding of extreme precipitation climatology. We then examine the climatological differences in extreme precipitation emerging from coastal, mountainous, and desert regions at different spatial and temporal scales. Three key findings emerge:

(i) At the pixel scale, precipitation and duration exhibit simple scaling, but this relationship breaks down with increasing area– this has significance for temporal downscaling.

(ii) Precipitation intensity is dissimilar for different area sizes at short durations but becomes increasingly similar at long durations - thus areal reduction factors may be unnecessary when computing precipitation for long durations.

(iii) The reverse orographic effect causes increased precipitation for multi-hour events and decreased precipitation for hourly and sub-hourly durations; however, this phenomenon decreases over larger areas.

Morphodynamics of the shallow seafloor during the course of a storm: high-resolution direct observations

מורפודינמיקה של קרקעית הים הרדודה במהלך סערה: תצפיות ישירות ברזולוציה גבוהה

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Studying seabeds during storms is crucial for coastal management, yet intra-storm morphodynamics and sediment transport remain understudied due to challenges in obtaining data amid harsh storms. Here we present direct observations of sediment dynamics and seafloor morphology during a high-wave winter event off the central Israeli shore. We analyzed data from two observation stations deployed at ~6.5 m water depth, about 500 m offshore the Ne'urim beach-stretch (north of Netanya), focusing on a storm that occurred on 3-5 March 2023. One station was equipped with current and wave meters, and the second with an underwater camera capturing 30-second videos of the seafloor at 20-minute intervals. Video observations yield distinct behaviors on two scales: on grain movement scale we distinguish stagnation, creep, saltation, suspension (mutually non-exclusive); on seafloor morphology level we distinguish five categories from calm to most intense motion of water and sediment. Observations revealed gradual seafloor changes, from biological control through different types of ripples correlated with the rise in significant wave height, leading to smoothing at the storm's peak. Sediment grain dynamics evolved from stagnation to a combination of creep, saltation, and suspension at peak conditions. Post-storm, seafloor morphology alternated between different ripple types, with no return to pre-storm state even after declining to the initial significant wave height. Sediment dynamics remained stable as the storm declined, combining creep, saltation, and suspension until substantial wave height reduction, then gradually reached stagnation at storm end. Turbidity increased rapidly, peaking with maximal wave height, and gradually declined (with fluctuations) to pre-storm levels. Our analysis highlights a link between seafloor morphodynamics and storm progression, indicating that changes during storm rise occur faster than the return to the original state, and suggesting a hysteretic behavior.

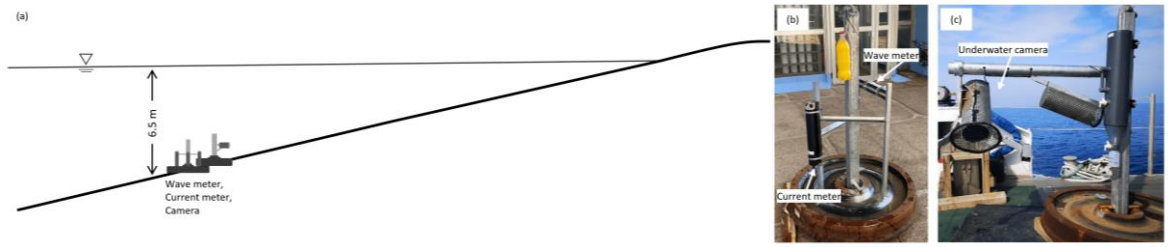

Figure 1. Methods. (a) Observation stations setup, (b) underwater array equipped with current and wave meters, (c) underwater video camera.

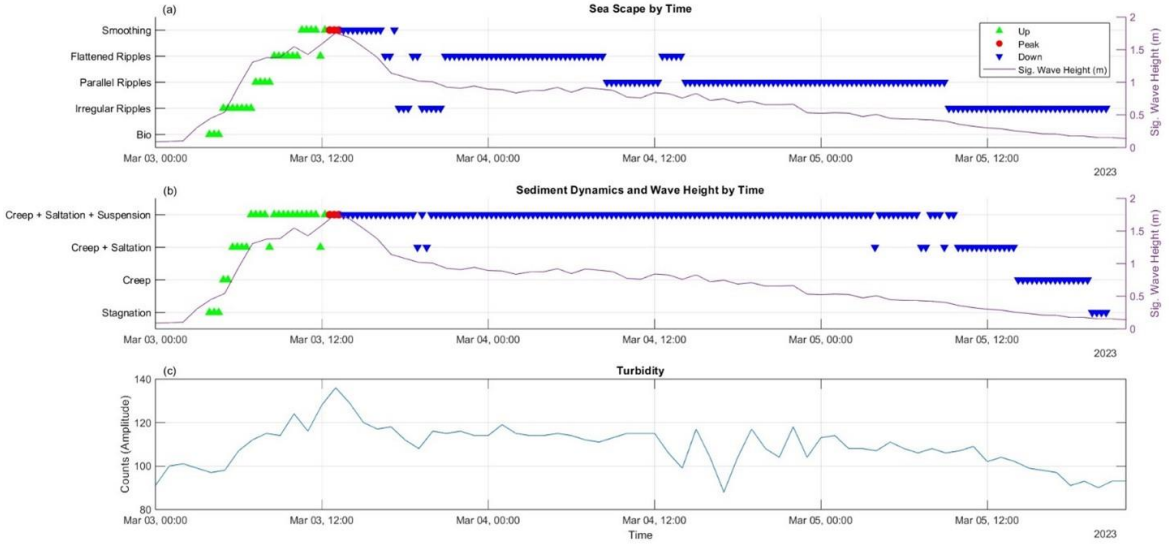

Figure 2. Seafloor morphology and significant wave height during the storm, (b) sediment dynamics and significant wave height during the storm, (c) turbidity values during the storm.

The Structure behind Lake Kinneret

המבנה של הכנרת

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This presentation is long overdue. My M.Sc. Thesis “The Geology of the Tabigha - Huqoq – Migdal Region” was published by TaHal (1964) as P.N. 374. To my regret – I have never tried summarizing it into a published Article. I feel – 60 years later – this could be the right time to present some of its essential highlights. The Research has been ordered by the “Kinneret Team” of the – now extinct Tahal. Tahal’s M.H.D project allowed the extension of both structures to the Hula Valley. The following structures have been defined:

A. A Cenomanian - Turonian Anticline/Ridge along the Northwestern Rim of the Kinneret. A parallel syncline is located westward.

B. Westward of the Anticline/Ridge – an a-symmetric Syncline could be located.

C. All blocks providing the eruption of Salty-Hot Springs form ejected relicts of the ridge. The ridge forms a buried conduit connecting the Blocks.

D. The site of the Barbutim submerged Springs is also located on the Ridge.

E. No N-S Fault dissect the located Anticline/Ridge.

Ongoing soil formation in the mountainous areas of Israel

יצירה מתמשכת של קרקעות באזור ההררי של ישראל

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Chemical and clay fraction mineralogical compositions of red-brown Mediterranean soils along transect from Judea Mts. to the Galilee showed that the current active soils are continuously transforming dust parent material by leaching. Leaching is dependent on both the amount of rain and bedrock/soil permeability. Soil clay assemblages lay between two endmembers: a. dominance of smectites and low amounts of kaolinite and illitization parameters (B`ina Lst.), and b. low smectites and high kaolinite amounts and illitization parameters (Bar Kokhba Lst.). A follow-up study quantified the role of dust in soil along two east-west transects across the Judea and Samaria Mts. and the transition to the semiarid climate, by bulk mineralogical and chemical compositions of major and trace elements (including REE) of various soils and dust. Local (Jerusalem) dust is distinguished from desert dust by a lower quartz content and lower concentrations of SiO2, TiO2, Th, and Zr, suggesting that it is a mixture of remote desert dust and local sources. The eastern side of the Judean Mts. soils, under a semiarid climate, are dominated by a coarse silt mode, like dust, and their compositions reflect a higher contribution of desert dust and weaker pedogenic processes. The clay fraction is the main grain size mode in the leached soils of the western side, under higher precipitation and denser vegetation due to the pedogenic formation of phyllosilicates (smectites). The identical compositions found for two adjacent soils on limestone and on chert demonstrate that dust is almost the exclusive parent material for soils presently forming on hard sedimentary rocks. Both studies suggest an apparent dynamic equilibrium between dust accretion, erosion, climatic conditions, and landscape. Accordingly, the formation of current active soils is a result of ongoing dust accumulation and transformation since the last major erosion event in the early Holocene.

New automatic local earthquake detectors for the ISN using SeisComP: Planning, implementation and performances

אוטופיקרים חדשים בסייסקומפ ברשת הסיסמית הישראלית - תכנון, יישום וביצועים

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At the end of 2022, the GSI's Seismological Division upgraded all of its seismic data processing systems to gempa's SeisComP software package. Here we present the designing and implementing of an automatic earthquake detector, based on the SeisComP autopicker module. The goal of such a detector is to provide reliable automatic preliminary seismic event detections. So far, this task was performed by our in-house software JSTAR (Polozov and Hofstetter, 2013), which was no longer adapted to the upgraded Israeli Seismic Network (ISN), now including 100+ stations (Kurzon et al., 2020). Therefore, we tested different detection parameters in order to maximise local earthquake detections, reach the lowest possible magnitude of completeness (M<2) and minimise false detections. Seismic stations were selected based on their noise levels to further optimise the detection procedure. After real-time testing our final configuration, the new procedure was implemented on January 30th, 2024. We present here the adopted configuration and performances from a month-long testing period in December 2023. We found that, compared to the previous detector, the daily rate of false alerts has dropped by 69%, the minimum detected and confirmed magnitude was M1.0 and the expected magnitude of completeness is M2.2. The average number of detected events for that same period is 17 events/day, of which a daily average of ~8% are natural local earthquakes. Our team of analysts uses the automatic detections as the starting point of manual analysis to provide detailed seismic events information to stakeholders, researchers and the public. The data is publicly available at https://eq.gsi.gov.il.

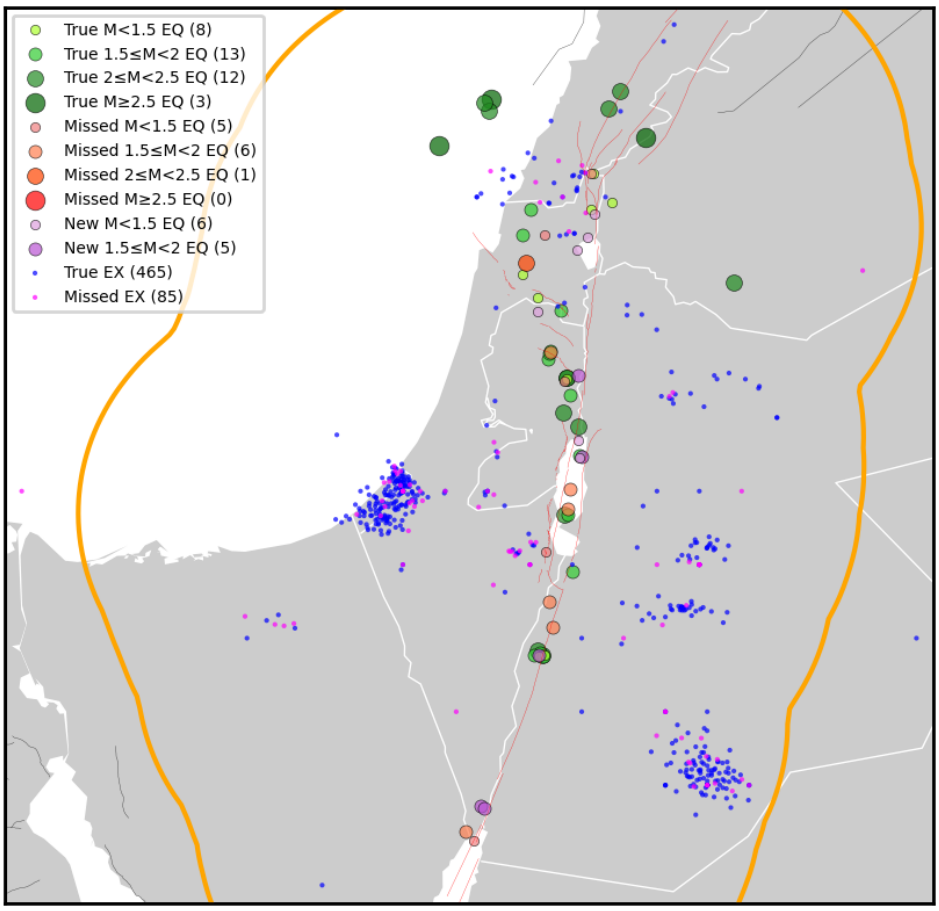

Figure 1. Map showing True (green circles), Missed (red circles) and New (purple circles) detections of local earthquakes (EQ), for several magnitude ranges (see legend), for the month of December 2023. True (blue dots) and Missed (magenta dots) detections of explosions (EX) are also shown. The locations of True and Missed detections are from the GSI catalogue, whereas the locations of New events are from the automatic detector. Local (red lines; Sharon et al., 2020) and regional (grey lines; Global Earthquake Model, www.globalquakemodel.org/) faults and the boundary of the "local" area of interest (orange line) are also displayed.

Architecture and evolution of the northernmost Dead Sea Fault Zone between Hula (Israel) and Amik (Turkey) basins: Has it become a transform?

ארכיטקטורה ואבולוציה של הסגמנט הצפוני ביותר של העתק ים המלח בין אגני חולה (ישראל) ואמיק (תורכיה): האם העתק ים המלח נהיה טרנספורם?

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This study re-evaluates the ca. 20 Myr tectonic development of the Dead Sea Fault System (DSFS) and its definition as a transform plate boundary. The DSFS course and the sinistral displacement of the Arabian-Sinai plate between the Gulf of Eilat and the Hula basin are widely documented and accepted. However, its continuation northwards between the Hula and Amik Basins (HAB) is unresolved. Geologic, geophysical, and tectonic studies reviewed here show that during the Miocene, DSFS faulting splayed from the Hula basin towards NE (e.g., the Miocene Serghaya; Fig. 1a). These displacements reactivated the Late Cretaceous Palmyra folds and faults belt while uplifting the Hermon and the Anti-Lebanon mountain ranges. During that time, DSFS had still not displaced NW Lebanon and Syria. A major regional shift in tectonic stresses occurred in the Early Pliocene (ca. 5 Ma), and deformations continued along the Palmyra area. Nonetheless, the main DSFS shifted to the Yammouneh fault and propagated further north to rupture through the Missyaf-Al Ghab branch (Fig. 1b). At the same time, the Anatolian plate moved westward along the forming Eastern and Northern Anatolian Fault Zones (EAFZ and NAFZ, respectively). Our study attempts to explain the ~90% deficit in DSFS displacement across the HAB, and resolve the structural relations between the DSFS and EAFZ in the larger tectonic context. We suggest that the rigid crust of the subducted and collided Bitlis suture (running parallel to the EAFZ) halts the DSFS northward propagation and its connection with the EAFZ.

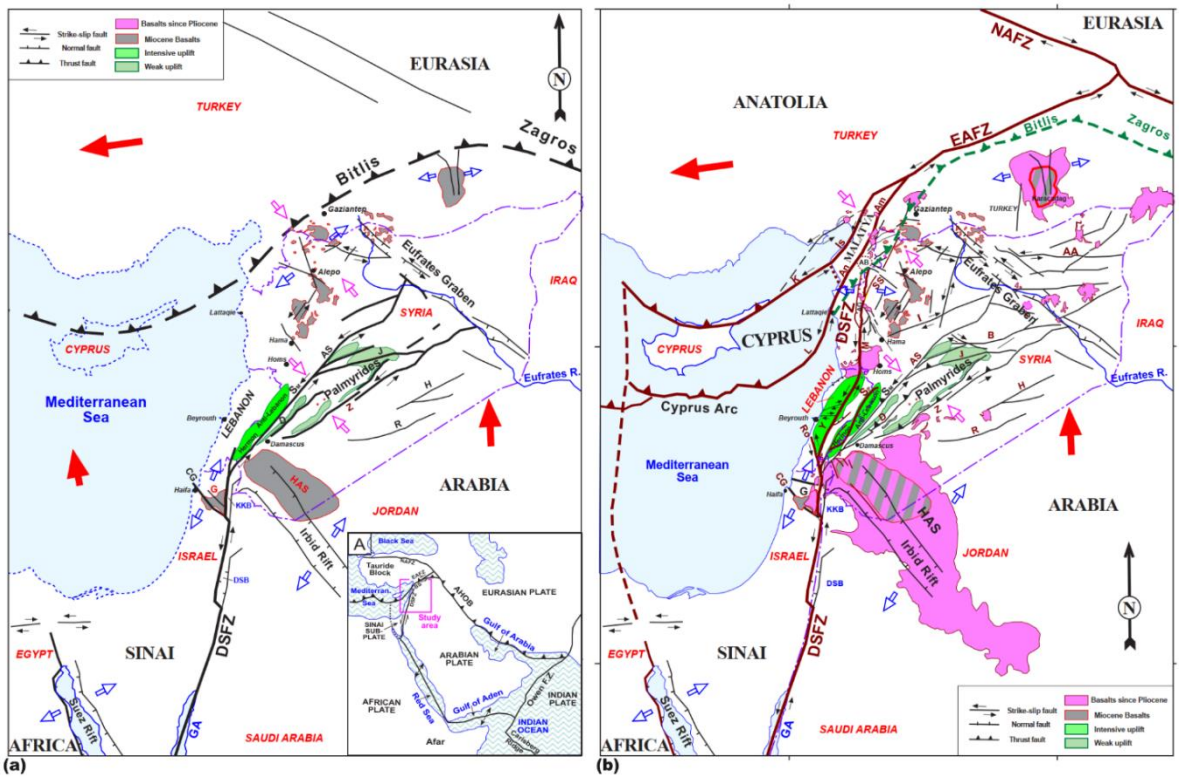

Figure 1. Development of the DSFS between (a) 20-5 Ma, and (b) 5-0 Ma.

The 66 Ma Chicxulub asteroid collision: a plate and plume geodynamic game changer

ההתנגשות של אסטרואיד צ'יקסולוב לפני 66 מיליון שנים: שינוי מוחלט בגיאודינאמיקה של לוחות טקטוניים ופלומים מעטפתיים

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At the end of the Cretaceous era, 66 Ma, the ~10 km Chicxulub asteroid hit the Yucatan Peninsula in Mexico, triggering global catastrophic environmental changes and mass extinction. Whether this event was also responsible for sudden changes in plate and plume geodynamics is not fully understood and has not been studied. We present a range of geological observations indicating that the impact marked a tectonic turning point in the behaviour of mantle plumes and plate motion, in the Caribbean region and beyond. At a regional scale, the impact coincides with the termination of seafloor spreading in the Caribbean Ridge. Shortly after the Cretaceous–Paleogene transition, magmatism associated with the Caribbean Large Igneous Province (CLIP) waned, whereas other plume-related magmatic provinces (e.g., Deccan, North Atlantic and High Arctic) experienced dramatic changes involving enhanced magmatism and abrupt migrations in plume locations. These events happened synchronously with anomalously high mid-ocean ridge magmatism worldwide and an abrupt change in the motion of South America relative to North America. Evidence for such abrupt changes in plate kinematics and plume behaviour raises the possibility that the Chicxulub impact triggered a chain of effects that modified melt reservoirs, subducting plates, mantle flows, and lithospheric deformation. To explain how the tectonic behaviour could be modified by an asteroid impact, we considered two end-member mechanisms: a quasi-static mechanism and a dynamic triggering mechanism. We designed a numerical model to investigate the strain field and the relative plate motion before and after the impact. The model predicts an enhanced deformation associated with the impact, which surficially tapers off a ~500 km away from the crater. The impact modifies the subjacent mantle flow field, contributing to long term mantle-driven dynamic changes. Additionally, deformation associated with seismic effects may have contributed to far-field effects and global changes. We conclude that large asteroid impacts, such as the Chicxulub collision, could trigger cascading effects sufficient to disrupt and significantly modify global geodynamics.

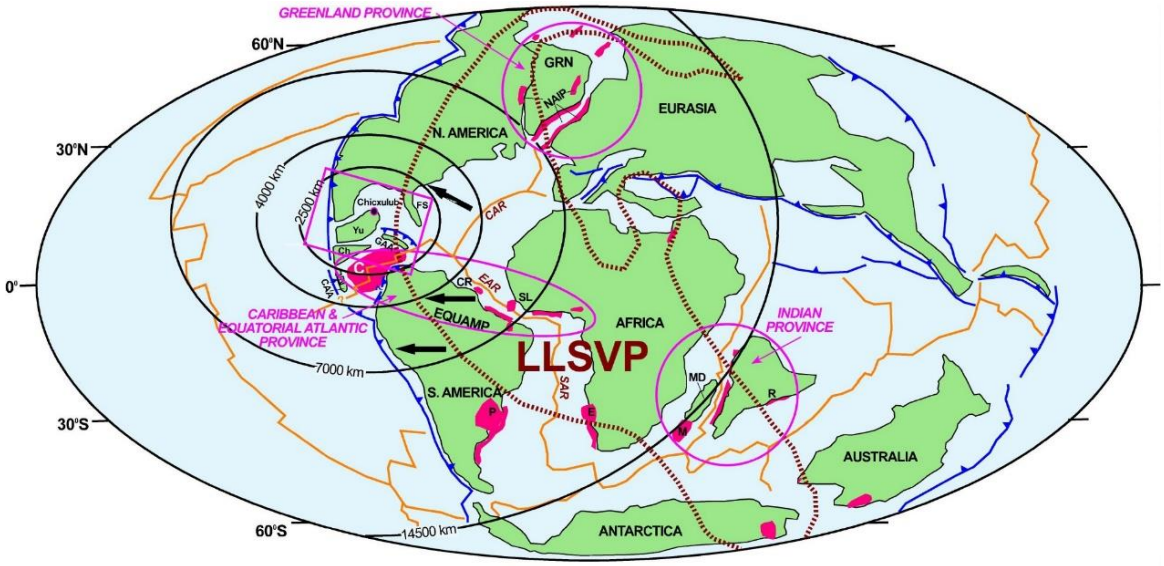

Figure 1. Map showing the Caribbean region (magenta rectangle) in a plate reconstruction at 75 ± 5 Ma (modified after Müller et al., 2019). Orange lines are oceanic spreading centers and blue lines are subduction zones. Red regions surrounded by magenta circle are Cretaceous plume provinces (Segev, 2002; Gaina et al., 2014; Ernst et al., 2021). The large low shear-wave velocity province (LLSVP) beneath Africa is marked by a thick dashed brown line. The margins of the LLSVP are suggested to be the plume generation zones (e.g., Torsvik et al., 2010; Koppers et al., 2021). Distant seismic effects of the Chicxulub impact (2500 km and 7000 km radius rings) represent outer limits of evidence for Cretaceous–Paleogene boundary deposits (KPBD), liquefaction, and slope instability associated with the impact (modified after Day and Maslin, 2005). Plate motion vectors (black arrow) of South and North America plates are after Boschman et al. (2014), Doubrovine et al. (2012) and van der Meer et al. (2010). **Abbreviations**: GRN- Greenland; CAA-Central America arc; GAA-Greater Antilles arc; Ch-Chortis; Yucatan; FS-Florida Straits. Plumes: NAIP-North Atlantic igneous province; HALIP-High Arctic igneous province; SL- Sierra Leone; CR-Ceara Rise; C-Caribbean; P-Parana; E- Etendeka; EQUAMP- Equatorial Atlantic magmatic province; D-Deccan; M-Madagascar; R-Rajmahal; Ridges: SAR-South Atlantic; EAR- Equatorial Atlantic; CAR-Central Atlantic; NAT-North Atlantic.

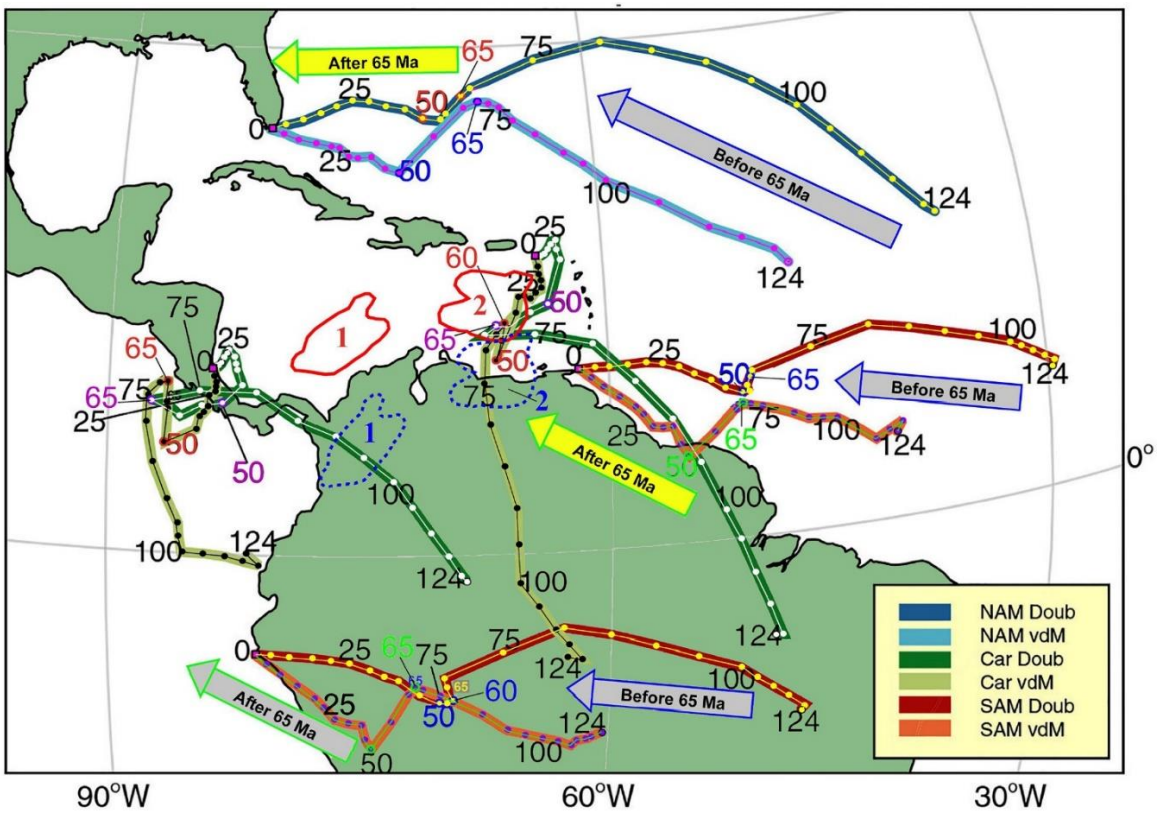

Figure 2. Absolute plate motions of the Caribbean (Car), South American and North American plates, modified after Boschman et al. (2014), based on the global moving hotspot reference frame of Doubrovine et al. (2012) (Doub), and the slab-fitted mantle reference frame of van der Meer et al. (2010) (vdM). Arrows represent mean motion vectors for each of the three localities before 65 Ma (blue) and after 65 Ma (green). Note that the pre-65 Ma motion vectors for North America and South America are diverging, whereas the post-65 Ma vectors are converging. The polygons (1- beneath Colombian Basin; 2- beneath Venezuela Basin) represent plan projections of the inferred Caribbean Large Igneous Province (CLIP) conduits at present (red) and at ~75 Ma (blue dash) (after Gómez-García et al., 2021).

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Groundwater flow modeling in two-story perched aquifers feeding dozens of springs

מידול זרימת מי תהום במערכת אקוויפרים דו-קומתית המזינה עשרות מעיינות

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A mountain ridge in southwest Jerusalem, Israel, is surrounded by two-story springs that emerge from two perched aquifers, one above the other, within a thick unsaturated zone. Despite the shortage of data, based on rational assumptions, we were able to introduce a 3D hydrogeological process-based numerical flow model (FEFLOW) that quantitatively describes the rainwater infiltration, the flow of groundwater in both perched aquifers and through the in-between unsaturated zones, the transient spring's discharges (5% and 2% of the total water that seeps from the land surface and emerges in the upper and lower level springs, respectively), and the enrichment of the deep regional aquifer (93% of the total water that percolates from the land surface). The model, which considers the complex geological structure, including folds, faults, stratification, and karst, was calibrated using rainfall records, and a few measured spring hydrographs. This study demonstrates how the flow field in the large-scale vadose zone can be approximated and modeled, even though such a system is usually an ungauged hydrologic one. It illustrates the perched aquifers' heterogeneity and discontinuity (the saturated zones extend, in practice, only on 30% and 15% of the total potential area of the upper and lower aquitards, respectively) and defines each perched spring's feeding zone. Furthermore, this model enabled the quantification of the two enrichment processes of the deep aquifer through fractures (30%) and leaking aquitards (70%).

Glass implanted 210Po as a method of defining long-term retrospective exposure to radon: First experiments in Israel

עקבות ביקוע של Po210 בזכוכית כשיטה להגדרת חשיפה רטרוספקטיבית ארוכת טווח לראדון: ניסויים ראשונים בישראל

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In most epidemiological studies, contemporary radon measurements are used as a proxy for radon concentrations during the latency period even though changes in radon levels may have occurred. Airborne radon decay products are deposited and implanted through alpha recoil into exposed glass surfaces providing a measure of time-integrated retrospective radon concentration in the environment in which the glass has been located. Glass implanted 210Po was measured in order to estimate the cumulative exposure to radon and radon progeny. Measurements using Solid State Nuclear Track Detectors (SSNTD - CR-39) were performed on three different exposed glasses and on one non-exposed window glass. The exposed glasses were: [1] a glass cover of a picture hanging in a home in Ma'ale Adumim (a known radon-prone region), [2] jars containing uranium bearing phosphate ore, and [3] a glass windowpane from a warehouse in which uranium bearing rocks are stored. Alpha spectrometry measurements showed unequivocally the presence of 210Po in the glass surface as the sole contributor to the recorded alpha tracks. A calibration factor for the SSNTD measured alpha track concentration per day of exposure and indoor radon concentration for the three experiments was found to be in the range of 24 to 51 (Bq/m3/year)/(pits/cm2/day). The results of these experiments clearly justify the use of this technique whenever information on retrospective radon levels is required for epidemiological studies.

Exploring the Evolution of Normal Fault Systems: Dating Syn-Tectonic Breccia and Reconstructing Long-Term Fault Slip Rate, Zurim Escarpment, Northern Israel

התפתחות של מערכות העתקים נורמליים: תיארוך ברקציה סין-טקטונית ושחזור קצב החלקה ארוך טווח על העתק, מתלול צורים, הגליל, ישראל

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Normal fault systems within extensional domains, such as the Zurim Escarpment in northern Israel, often exhibit steep mountain fronts above fault scarps. They develop by repeated movement along the fault during seismic events. The resulting substantial topography often leads to the accumulation of colluvial breccia at the base of the slope on the hanging-wall. Both the slope itself and the breccia hold information about the timing and nature of normal fault activity. This study focuses on the Sajur fault segment, and the colluvial breccia extending along its hanging-wall. This breccia shows several deposition generations. We utilize in-situ 36Cl cosmogenic dating method on the carbonate units of the mountain front to reconstruct long-term fault slip rate, extending the temporal scope beyond the limitations of traditional fault scarps analysis. This is done using a forward numerical MATLAB model to simulate the 36Cl buildup on the mountain front based on a gradual exposure of the samples resulting from fault slip and denudation. Additionally, U-Pb dating of secondary calcite veins and optically stimulated luminescence dating of quartz minerals within the breccia matrix are used to constrain the age of the breccia and enhance its temporal relationship with fault activity. Preliminary results of the U-Pb dating indicate an upper boundary age of 2.33 Ma for the breccia. Clast provenance analysis and the absence of Deir Hana clasts in the breccia suggest that during the deposition of the first phase of the breccia, the relief of the escarpment was at least ~280 meter lower. This enables the calculation of long-term slip rate of 0.120 mm/year since the sedimentation of the first phase of the breccia. The methods employed in this study, focusing on the Sajur block, can be later applied to other fault segments within the Zurim Escarpment system, and similar carbonate extensional terrains worldwide.

Lithology and the distribution of Early Roman-era tombs in Jerusalem's necropolis

גיאומורפולוגיה בשירות נקרוגיאוגרפיה: ליתוליגיה ותפוצת הקברים בנקרופוליס של ירושלים בימי בית שני

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During the last 150 years, various archaeological excavations and surveys revealed approximately 900 rock-cut tombs in the extensive necropolis surrounding ancient Jerusalem, dated to the late Hellenistic and Early Roman periods. The research goals are to examine the spatial distribution of these tombs in relation to the lithological units and rock hardness and to examine the diverse methods by which the ancient masons solved various lithological defects they encountered during the tomb excavation. We used field observations and Schmidt hammer tests to determine the rock hardness and the lithological properties. Our study demonstrates that the substrate played a crucial role in the establishment of the city and residents' living conditions and that the presence or absence of caves in certain areas can be explained lithologically. Most tombs found west of the city were excavated in the Weradim Formation (13.7%); those found north of the city were mainly hewn into the well-bedded Nezer Formation (20.7%); and the tombs hewn east or south of the ancient city mainly met the soft Menuha Formation (56%). Excavating in the hard limestone of the Shivta Formation required high levels of effort and funding and, therefore, the number of tombs is limited (3%). In some cases, owners of estates located in soft lithologies granted burial rights to additional families, as proved by the large number of tombs and the clusters of burial systems in the Menuha Formation. Rock surfaces are mostly decayed by chemical dissolution, enhanced by structural fissures in the rock. Condensation corrosion and excess moisture were observed on the ceilings of some structures, along with bio-erosion. Two types of defects are common in the local rock: (a) major defects, endangering the stability of the rock-cut chamber that required complementary building with ashlar stones and (b) superficial defects that required only aesthetic solutions.

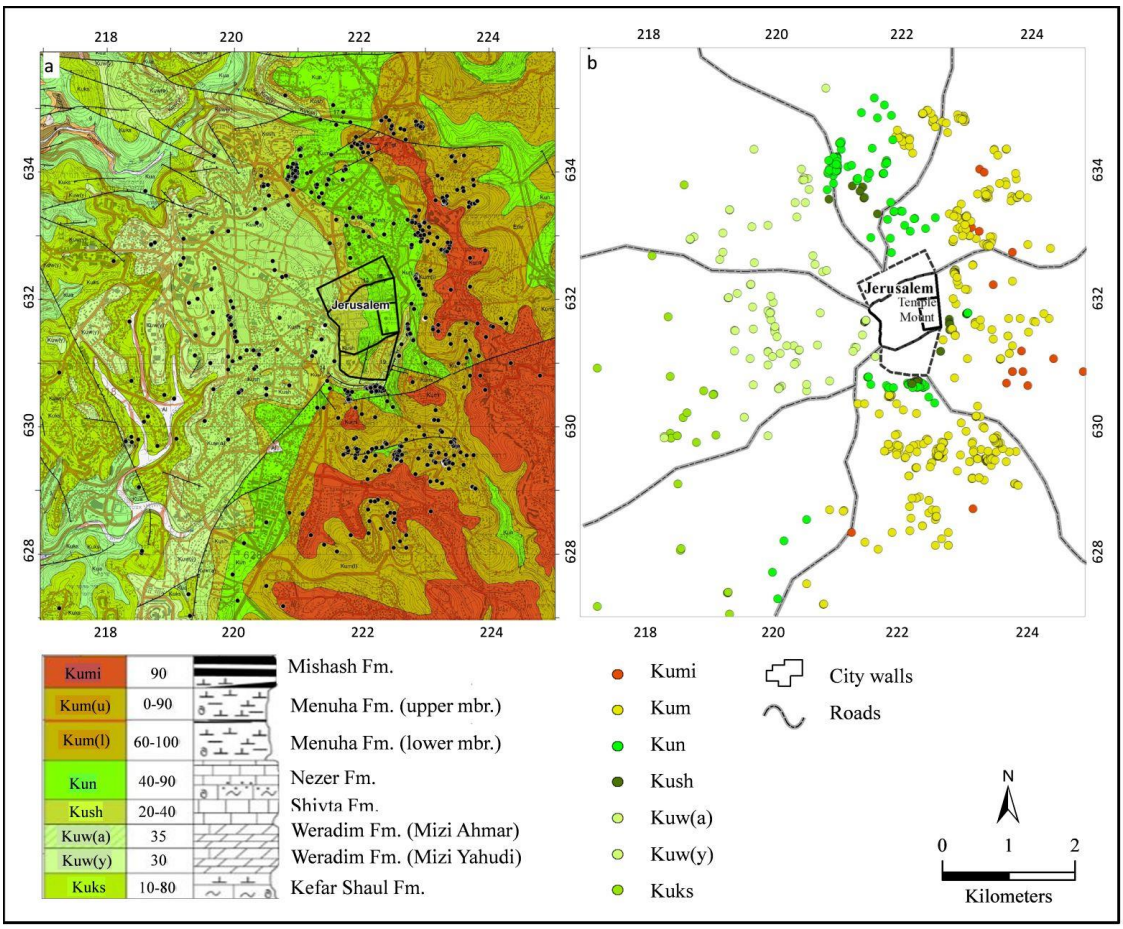

Figure 1. The ancient necropolis of Jerusalem during the Hellenistic and early Roman periods; (a) Tombs are marked black over the geological map; (b) Distribution of tombs by geological formation (Geological map modified from Sneh and Avni, 2011).

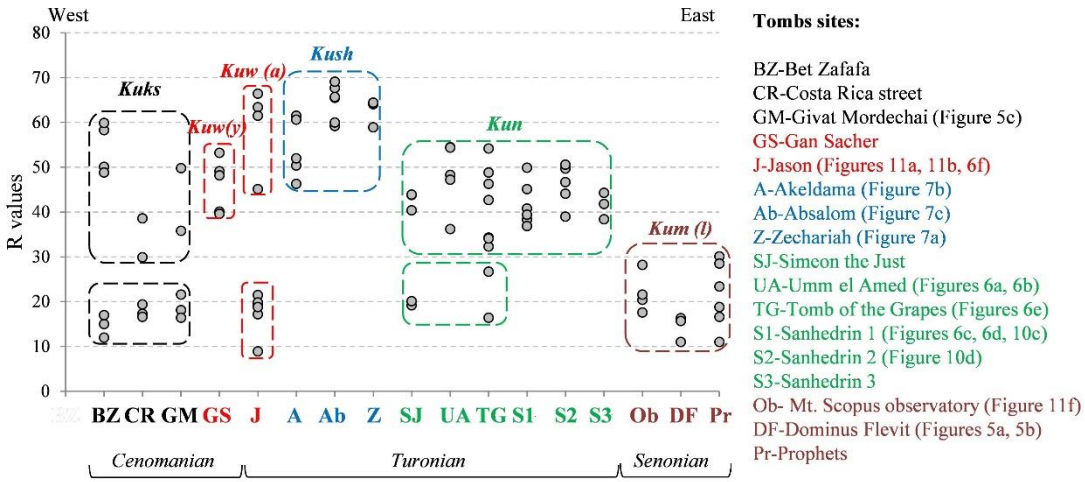

Figure 2. The Schmidt hammer values obtained for 17 tombs in five geological formations. Kuks=Kefar Shaul Fm.; Kuw(y)=Weradim Fm. (Mizi Yahudi); Kuw(a)=Weradim Fm. (Mizi Ahmar); Kush=Shivta Fm.; Kun=Nezer Fm.; Kum= Menuha Fm.; Kumi=Mishash Fm.

Submarine groundwater discharge enhances seawater acidification along the northern Mediterranean coast of Israel

שפיעת מי תהום מגבירה את קצב החמצת מי הים באזורים חופיים לאורך צפון החוף הישראל בים התיכון

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In the oligotrophic Southeastern Mediterranean Sea (SEMS), it has been shown that dissolved inorganic nutrient (DIN) from fresh submarine groundwater discharge (FSGD) enhances primary production in coastal waters. In this study pH, TA and DIN of seawater and fresh water in a sea-cave in the northern part of the Israeli Mediterranean coast and a nearby contact spring, respectively, were measured during October 2018 – March 2020. The results show gradients of measured salinity, TA, pH and DIN along the cave axis year-round, suggesting that they are influenced by FSGD. The seawater near the back of the cave was supersaturated with respect to atmospheric CO2 nearly year-round and there is a strong positive divergence from its regional open-water thermal dependence, which suggests that FSGD is also a source of atmospheric CO2 in this region. Comparison of TA, salinity and pCO2 from the back of the sea cave to their corresponding values from an abrasion platform monitoring site, ca. 3 km south of the cave, suggests that FSGD is occurring along the entire shoreline in this region. Thus, despite the increased productivity due to FSGD mediated nutrient enrichment of adjacent coastal waters of the oligotrophic SEMS, they are still a source of atmospheric CO2 nearly year-round. Finally, the apparent trends of seawater acidification (ΔpH/Δt = -0.006 yr-1) and pCO2 increase (+8 ppmV yr-1) observed at the nearby monitoring site since 2013 are explained by increased groundwater recharge and resulting FSGD total alkalinity compared to dissolved inorganic carbon inputs (ΔTA/ΔDIC=1:1.2).

Biostratigraphy reconstruction of the Eocene of the Israeli continental shelf

שחזור ביוסטרטיגרפי של חתך האיאוקן במדף היבשת של ישראל

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The stratigraphic succession of Eocene to Miocene carbonate rocks across the Israeli continental shelf is documented through the analysis of offshore boreholes, Ashqelon 1, Yam 2, and Yam West-1. A comprehensive sampling yielded a total of 102 samples from these boreholes, facilitating microscopic analysis aimed at reconstructing the biostratigraphy of the Eocene Israeli continental shelf. The stratigraphic succession within the Eocene period is meticulously delineated sedimentation pattern encompassing the Early, Middle, and Late Eocene with high planktic to benthic ratio. The Eocene sequence is demarcated by the P zones (P6 to P9), (P10 to P15), and (P16-P17). Late Eocene to Early Mid-Oligocene (O1 to O5) and Miocene interval is documented as M1 to M5 by distinct planktic foraminiferal species assemblages. Interestingly, a hiatus is observed, signifying a late Oligocene unconformity across boreholes Yam-2 and Yam West-1, with thickness of 3 and 25 m respectively. The correlation among the three boreholes, utilizing the Miocene sequence base as a reference point, reveals sedimentation occurring within a submarine tectonic framework. Notably, the intervals of the Eocene P zones exhibit a differential thickness geometry: Throughout the Middle Eocene, there is a thickening trend from the Yam-2 borehole (ca 60 m) SE towards the shoreline (150 m, Ashqelon 1) and NW basin ward (100 m, Yam-West 1). A similar trend is observed in the Late Eocene interval. This pattern aligns with the prevailing anticline/syncline structure of the eastern Mediterranean Sea, indicating sediment accumulation during folding across the Eocene time. The shift in bedding geometry, transitioning from folding of the Eocene to E ward tapering of the Oligocene, suggests syn-tectonic sedimentation during eastward regional uplifting concurrent with the major Arabian Shield uplift during the Oligocene, sea level fall, caused widespread mass transportation, stimulating the formation of submarine canyons.

Quaternary paleo-Shorelines from 3D seismic data, indicators for glacial low stands?

פאליאו-קונטורים מנתונים סייסמיים תלת-מימדיים בקצה מדף היבשת: סמני חוף מעידני קרח?

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Fluid Low sea levels correlate with cold, dry climactic conditions; such an event is the last glacial maximum (LGM, 25Kya) which conforms with a global sea level of 120-130m below the present one. Emery and Neev (1960) first identified an erosive surface named “surface A” as a marker for the LGM. Further works such as Hübscher et al., 2016; Schattner et al., 2010, 2015 mapped this major surface on 2D seismic sections. This research integrates seismic interpretation and machine learning to investigate the evolution of Israel's western coastline during the last glacial periods. Recognizing the pivotal role of coastal evolution in understanding climate change and tectonic activities, our research aims to delineate ancient shorelines, offering a window into past sea levels and sedimentary processes. Through the analysis of depth contours at ~129 and ~159 meters, where strata pinch out shoreward, we align our findings with predicted transgressive glacial shorelines. Validated through seismic attributes, these contours offer new insights into global climate studies and recent tectonic activities. Furthermore, our study is a contribution to a collaboration with a computer-vision team for the automation of geological tasks in seismic data interpretation using Convolutional Neural Networks (CNNs). This should facilitate the tracing of shorelines in 3D space with high-resolution seismic surveys. This automation can contribute to our understanding of global glaciation history by allowing the exploration of fossil shorelines from glacial periods. By organizing automatically detected shorelines in a chrono-stratigraphic sequence and correlating them with extrema in eustatic curves, we may establish an age model for the relative sea-level curve, constraining histories of global and local geological processes during the Quaternary period. The method will also contribute to tectonics: each detected shoreline intersected by faults provides piercing points for structural reconstructions.

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Karstic Drywells as a tool for Urban Stormwater Management and Aquifer Recharge: Field Results from Injection Tests and Runoff Collection

קידוחים יבשים בתוך קרסטי ככלי לניהול נגר עירוני והעשרת אקוויפרים: תוצאות שדה ממבחני החדרה ומאיסוף נגר טבעי

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Large and excess volumes of runoff, which overload the drainage systems and sometimes cause flooding, are a challenge for planners and an opportunity to utilize them for the enrichment and preservation of groundwater. In urban areas overlying karst landscapes, the recharge of runoff water into the unsaturated zone through drywells may allow an effective method for replenishing the underlying aquifer, to compensate for the loss of permeable surfaces or as a solution to conserve and manage runoff. The karst system comprises random voids and conduits that constitute a storage volume and significant flow paths. Near the well, these features can enhance the flow of the injected water, substantially increasing the well's infiltration capacity. To examine the effectiveness of karstic drywells, we conducted several injection tests with direct water supply in three dry boreholes in Jerusalem. During the injection tests, the medium showed a relatively high infiltration capacity, which was expressed in low water levels compared to the high injection rates. In addition, a research site was constructed in Jerusalem to test the injection of natural runoff in practice, utilizing one of the boreholes as the basis. The site serves as a pilot system where runoff water is collected, filtered through a granular bed, and then injected into the aquifer through the drywell. The system is equipped with a flow meter to measure runoff inflow, a pressure transducer for monitoring water levels in the drywell during injection, and a rain gauge to provide a comprehensive hydrological overview. All data is continuously monitored and transmitted. In this work, we will demonstrate the capability to recharge large volumes of water at high rates into the unsaturated zone of a karstic aquifer through drywells. Additionally, we will provide detailed results of active injection tests in comparison to the injection of natural runoff through the pilot system.

Reconstruction of diagenesis in Israeli Eocene sedimentary rocks by Laser-Ablation-Mass-Spectrometric (LA-MS) U-Pb chronology

שחזור הדיאגנזה בסלעים סדימנטריים מגיל איאוקן בישראל בעזרת תיארוך אורניום-עופרת בשיטת מס-ספקטרומטריה עם דיגום לייזר

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In this study we used LA-MS U-Pb chronology to reconstruct diagenesis of Eocene sedimentary carbonate rocks in Israel. This method enables timing of rock diagenetic events by dating micron-scale rock components in thin sections. Eastern Mediterranean Sea Eocene rocks have a potential for CO2 storage, therefore understanding their geological history is highly important. Age of nummulite benthic foraminifera in Eocene Mor Formation, southern Israel, is 52.76±4.56 Ma. The secondary cements in these rocks are 40.21±3.04 Ma, and 27.39±3.88 Ma - 24.91± 1.83 Ma old. The age of Bar-Kochba Formation in northern Israel is 43.4±5.34 Ma (nummulites), with calcite secondary cements dated to 36.35±4.83 Ma. The ages of Eocene Hursha Formation in southern Israel are 47.41±0.76 Ma and 46.9±0.72 Ma (nummulites). Matred Formation nummulites from southern Israel were dated to 35.42±5.7 Ma, 34.19±3.56 Ma and 33.59±2.25 Ma with secondary cements forming at 28.73±0.9 Ma - 25.23±0.98 Ma, 21±1.72 Ma and 17.54±1.92 Ma. Dating of Matred Formation in Arava Valley showed Oligocene ages (32.06±0.21 Ma - 25.5±3.7 Ma), both on planktonic foraminifera and on cements, indicating that the rocks were altered in Oligocene. Calcite cements and Amphistigina fossil in Miocene Sakiya Formation rock from Ashkelon-1 borehole yielded ages of 17.91±2.08 Ma and 15.73±2.33 Ma respectively. The results show that marine sedimentary rocks can be reliably dated. Most of the fossils have high content of non-radiogenic lead, reducing the accuracy and precision of ages, however some fossils are more radiogenic and can be dated very accurately. Secondary calcite cements are usually more radiogenic than the original rock components. Late Eocene – Early Oligocene alteration events in Eocene rocks could be a result of landslides on continental slope, releasing fluids that circulated through the rocks. Late Oligocene and Miocene alteration stages could occur as a result of karst processes after the sea regression.

Neoproterozoic Island Arc Evolution and Reworking in the Northern Arabian-Nubian Shield: U-Pb-Hf-O Isotopes in Detrital Zircons From Eilat Schist

התפתחות המגמטיזם של קשתות האיים הניאופרוטרוזואיות בצפון המסיב הערבו-נובי על פי איזוטופים של U-Pb-Hf-O בזירקון דטריטי מצפחות אילת

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The Arabian-Nubian Shield is a vast, juvenile continental crust province that formed during the Neoproterozoic by accretion of intra-oceanic island arcs. Sediments eroded from these arcs, including detrital zircons, are preserved in the Eilat Metamorphic Complex in the northernmost part of the Arabian-Nubian Shield. Here, we present a coupled U-Pb-Hf-O study of detrital zircons from Eilat Schist intended to assess the juvenile nature of the island arcs and to detect crustal recycling processes involved in their formation. Detrital zircon geochronology places the magmatic activity of island arcs in this region at 1040-720 Ma, peaking between 850-750 Ma. Arc crustal evolution is demonstrated by coupling Hf and O isotopes in the detrital zircons. Zircons with mantle-like δ18O (5.0-6.5‰) have mostly positive εHf(t) values, ranging between +1.7 and +10.8. They principally reflect juvenile Neoproterozoic crust formation in the northern Arabian-Nubian Shield. A temporally decreasing trend in εHf(t) values and a large gap between model and crystallization ages suggest at least 200 Ma of crustal reworking of the arcs. Distinguished elevated δ18O values, of up to 9.2‰, further indicate significant melt contamination by supra-crustal material starting from 920 Ma. These results imply that reworking of arc terranes and the incorporation of supra-crustal components played a fundamental role in the evolution of island arcs in this region of the Arabian-Nubian Shield.

Anthropogenic sedimentary impact on geochemical profiles offshore Haifa Bay, Israel

השפעות אנתרופוגניות וסדימנטולוגיות על פרופילים גיאוכימיים מול מפרץ חיפה, ישראל

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Flooding events, turbidities, wave action, adsorption/desorption, biological processes and anthropogenic activities influence transport, resuspension and settling of heavy metals (HMs) in bays and their eventual transport to the open sea. Haifa- Bay (HB), is a case study of an industrialized bay and a hotspot of HM pollution since the early 20th century. The history of HM fluctuations along with changes in sediment transport regime due to anthropogenic local and regional activities were investigated during this study. Six short cores were collected along the 60 m isobaths, west of HB and one core ca. 50 km NW at 1400 m bottom-depth. The 210Pb dated cores were analyzed for particle size distribution, major and trace element concentrations and Pb stable isotope ratios. Clear trends were observed between northern cores with relatively constant concentrations of HMs throughout the cores, and southern ones displaying a sharp decrease at the upper few cm correlated with Al decrease and Ca increase. Lead stable isotope ratios did not point to anthropogenic sources and mostly reflect variations in sediment supply, distance from shore, and atmospheric dust. Cores are dominated by a mixture of natural terrigenous suspension and atmospheric deposition in different ratios. Record is mostly impacted by anthropogenic activities as the erection of the Aswan Dam and construction and expansion of the Haifa-Port breakwater, limiting transport of fine sediment from the Nile River and Qishon stream, respectively. Sediment traps and plankton nets are currently studied as potential scavengers for the “missing” HMs.

Geoarchaeological analysis of suspected seismic event at the Roman Legionary Base in the Jezreel Valley, Israel

עדויות סייסמיות חדשות במחנה הלגיון הרומי, שולי עמק יזרעאל

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We present an integrated analysis within the recent archaeological excavation located along the Carmel-Gilboa Fault (CGF) in the Jezreel Valley. Current low-magnitude seismicity (M<4) is recorded in this area and past events were also documented, e.g. the fourth millennium BCE earthquake that devastated the Early Bronze age site at Tel Megiddo. We utilized geological and archaeological observations together with detailed geological mapping to study this area. Archaeological data identified a high intensity of tilted structures dated to the Roman period (2nd – 3rd centuries CE). All the structures are located within a small area (600x60 meters), south-east to Tel Megiddo, and are associated with the Roman Legionary Base Camp (Legio). The structures show a consistent tilt oriented to the SE (~150°), along with a consistent horizontal slip of 10-15 cm evident in some of them. Geological trenches at the site revealed the subsurface main lithology, namely Lower Basalt intruding Mount Scopus sediments (i.e., Menuha Fm.). Geological mapping identified a suspected fault line crossing the site and forming a morphological step. These results fall in line with previous studies conducted at Tel Megiddo indicating that the Carmel fault is the most plausible source for the damage, yet the Dead Sea Fault system cannot be precluded. Moreover, the observed deformation suggests that Jezreel Valley is a unique area, which experienced relatively high rates of subsidence or accelerated deformation during the last thousands of years. These results offer a new chronological understanding of the Roman area remains and the tempo-spatial constraint on the seismic activity of the Carmel-Gilboa Fault specifically the Yoqneam Fault. It further demonstrates the potential for future archaeoseismic research as well as the difficulties inherent within it.

Evaluating local sand contribution to Roman glass production-Tel Yavne as a case study

מחול לזכוכית-בחינה גיאוכימית של תעשיית הזכוכית הרומית בתל יבנה

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An ongoing archaeological excavation on the outskirts of Tel Yavne revealed a new primary and secondary glass production site, with remains of two furnaces dated to the Late Roman-Early Byzantine period. The site is located along the Soreq stream in close proximity to a range of sand sources, including the Mediterranean beach sand, 'Kurkar' ridges, and Palmachim dunes, offers a unique opportunity to study the entire chain of production from sand to glass. We aim to characterize possible sand sources for primary glass production in Yavne. To evaluate the possible linkages, we applied analytical methods comprising ICP-MS for major, minor, and trace elements of primary glass chunks and sand samples collected along a transect from the modern coast to the production site at Yavne, as well as conducted grain size distribution analyses and XRD for mineralogy. Our results indicate that the sands sampled in the vicinity of Yavne site could have been used for glass production. Different sand sources can be clearly distinguished by the major elements' content. We further found that the aluminium content in the examined glass chunks is higher than in the sand, which raises questions about its potential source. XRD and grain size distribution showed negligible presence of clay minerals in the sand sources. This study highlights the unique features of the Levantine Yavne glass group, proposes potential sources of sand, and outlines areas for future investigation. This research not only puts a significant newly discovered site on the map of ancient glass production but also advances our understanding of material sourcing and practices in glass production.

Updated source model for a new seismic hazard map for Israel

מודל סייסמו-טקטוני עדכני למפת סיכונים סייסמיים לישראל

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In Seismic hazard assessments and ground motion estimations are essential for the design of safe buildings and infrastructure. The state- of- the- practice in building standards is the use of a probabilistic approach, where all possible scenarios are taken into account, with their probability of occurrence. The Israeli seismic hazard model was last updated in 2013 with the state of the knowledge at the time. Since then, new data have been collected, the practice was updated, and following a roadmap workshop, a thorough update of the map and model is now performed. One of the major changes in the new hazard model is the source model – the model that characterizes the possible earthquake- generating sources. In the new model, well-characterized faults are defined as finite fault sources, with their best-known geometry and slip rate based primarily on geological-paleoseismological data, and geodetic measurements. For cases of off-fault seismicity, and when seismicity occurs on faults that are not well characterized, we use gridded seismicity, based on the seismic catalog. The magnitude – frequency distribution of events, i.e. the rate at which large and small events occur on the different sources, combines the Gutenberg-Richter distribution, as well as the characteristic model. The new model incorporates epistemic uncertainty, in the form of a logic tree, allowing a number of values for different parameters, which represent the acceptable range of estimations within the geological and seismological community. The calculation of the hazard in the new model includes over a hundred branches in the logic tree, rather than the single branch that is used today. The new model is expected to more realistically represent the seismicity of the region, and therefore the actual hazard in Israel, using an updated and universally accepted approach for seismic hazard estimation, while capturing the uncertainty that involves local parameter estimation.

Upper Pleistocene and Holocene Stream Routes on the Shallow Continental Shelf of Western Galilee

ערוצי נחלים במדף היבשת הרדוד של הגליל המערבי, בפליסטוקן העליון ובהולוקן

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The Western Galilee coastal plain is traversed by ephemeral streams, such as Nahal Yasaf, Nahal Beit HaEmek, and Nahal Gaaton, which drain the Galilee Mountains. Geological and geomorphological investigations have suggested that these streams align with faults trending east-west, as identified within the 'Judea Group' geological formation. Detailed bathymetric surveys of the Western Galilee continental shelf reveal elongated east-west oriented formations, traversing the submerged kurkar ridges and troughs. These formations extend from the nearshore to approximately 45 meters water depth, beyond which the seabed is covered by thin sediments. It has been suggested that these features represent submerged extensions of the coastal faults, likely active during the Late Pleistocene and Holocene. Furthermore, it was proposed that the streams exploited these structural weaknesses to channel their flow westward during periods of low sea levels.

Geological investigations in Western Galilee relied on field observations and drillings, while studies of the continental shelf predominantly utilized mainly bathymetry, lacking comprehensive coverage of the shallow waters (1 to 7 meters water depth). An innovative high-resolution coastal and marine paleogeographic study, which used the Leica Chiroptera 4X airborne bathymetric and topographic LiDAR system, provides detailed insights into the morphological characteristics of the shallow waters in Western Galilee, enabling a re-evaluation of the stream courses on the sea floor and their relationship with geological features. The research indicates that the streams Gaaton and Beit Ha'Emek were obstructed by the kurkar ridge and deviated from expected paths. Instead, they flowed south and north respectively, crossing the ridge through a canyon situated west of Ein Sarah, in south Nahariya coast.