Kürzlich entdeckte 90.000 Jahre alte menschliche Fußabdrücke zeigen, wie viel höher der Meeresspiegel früher lag

geschrieben von Chris Frey | 11. Mai 2024

Kenneth Richard

Menschliche Fußabdrücke, die in den Felsen eines ehemaligen Sandstrandes an der Grenze zwischen Schwemmstrom und Flut eingebettet sind, liegen 20 bis 30 Meter über dem heutigen Meeresspiegel. Die Fußabdrücke werden auf die Zeit vor etwa 90 000 Jahren datiert.

Man schätzt, dass der Meeresspiegel während der letzten Zwischeneiszeit (vor ca. 130 000 bis 115 000 Jahren), als der CO2-Gehalt vermutlich einen Rekordwert von 275 ppm erreichte, weltweit etwa 6 bis 9 Meter höher lag als heute (Sommers et al., 2022).

Paleoceanography and Paleoclimatology

Retreat and Regrowth of the Greenland Ice Sheet During the Last Interglacial as Simulated by the CESM2-CISM2 Coupled Climate–Ice Sheet Model

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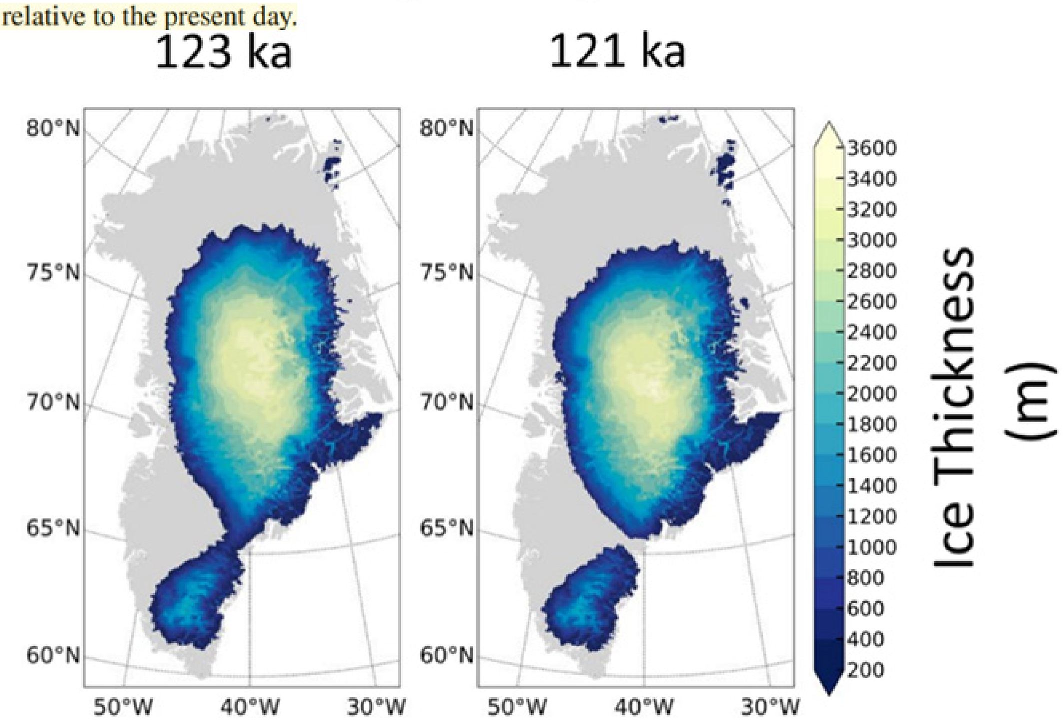
Global mean sea level during the LIG was likely 6–9 m higher than present (Dutton et al., 2015; Kopp et al., 2009, 2013).

Atmospheric CO_2 concentration is held constant at 275 ppm from 127 to 119 ka, the value adopted by Otto-Bliesner et al. (2017, see their Table 1) for the CMIP6 *lig127k* experiment.

Compared to the initial GrIS at 127 ka, which contains 8.2 m SLE, the transient simulation yields a peak contribution of 3.8 m SLE during the Last Interglacial relative to our initial ice sheet volume, or 3.0 m SLE relative to the present day.



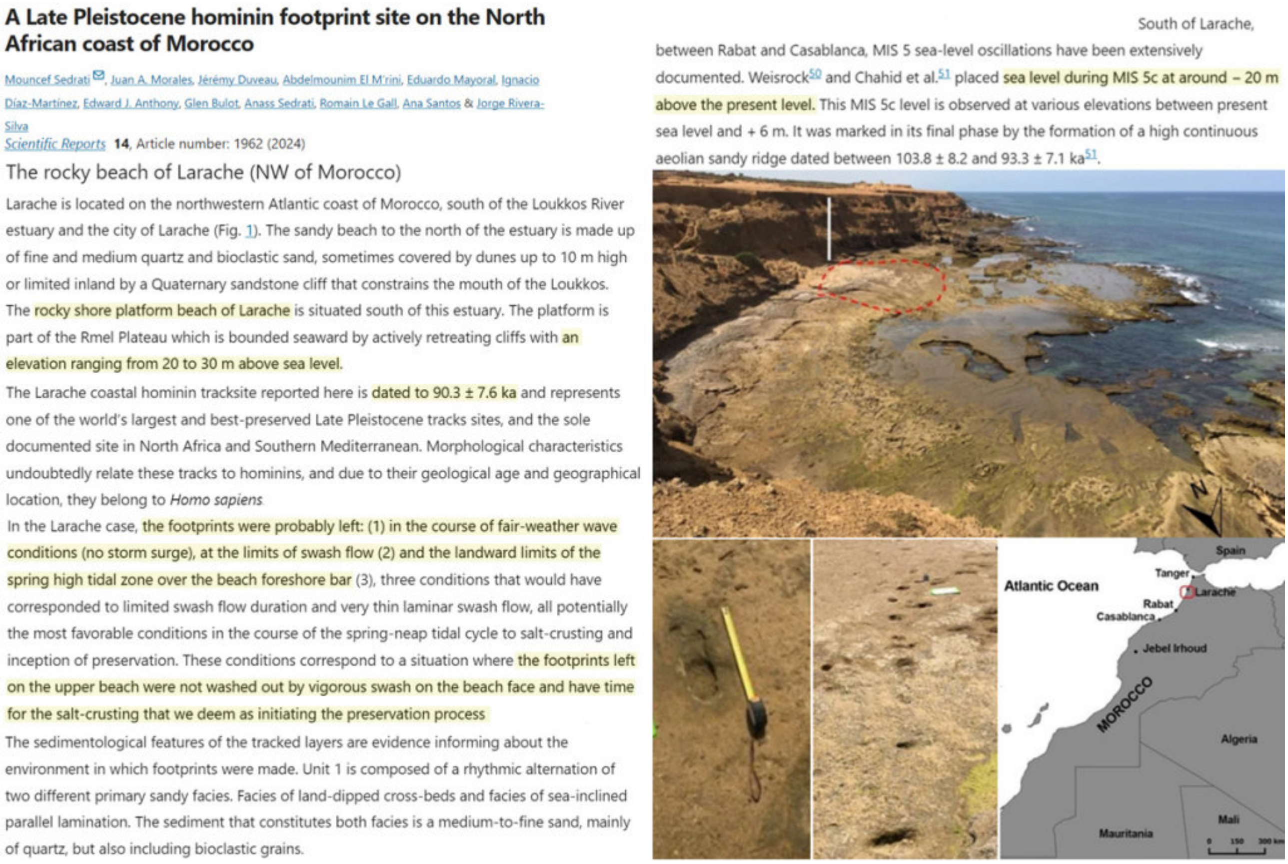
Bildquelle: Sommers et al., 2022

Funde an den Küsten Nordafrikas (Marokko) deuten darauf hin, dass der Meeresspiegel vor etwa 95 000 Jahren (MIS 5c) „20 m über dem heutigen Niveau“ lag.

Dies stimmt mit einer neuen Studie überein, wonach menschliche Fußabdrücke, die in einem felsigen Strand „20 bis 30 m über dem Meeresspiegel“ eingebettet und erhalten sind, auf vor 90,3 ±7,6 Tausend Jahren datiert werden können.

Es ist sehr wahrscheinlich, dass die Wassergrenze bzw. die Küstenlinie zu dieser Zeit diese Höhe erreichte, da die Voraussetzungen für die „Salzkruste“, die Erhaltung der Fußabdrücke, eine Lage an der „landwärtigen Grenze der Springflutzone“ und an den „Grenzen der

Schwemmströmung“ erfordern.



A Late Pleistocene hominin footprint site on the North African coast of Morocco

Mouncef Sedrati, Juan A. Morales, Jérémy Duveau, Abdelmounim El M'rini, Eduardo Mayoral, Ignacio Díaz-Martínez, Edward J. Anthony, Glen Bulot, Anass Sedrati, Romain Le Gall, Ana Santos & Jorge Rivera-Silva

Scientific Reports **14**, Article number: 1962 (2024)

The rocky beach of Larache (NW of Morocco)

Larache is located on the northwestern Atlantic coast of Morocco, south of the Loukkos River estuary and the city of Larache (Fig. 1). The sandy beach to the north of the estuary is made up of fine and medium quartz and bioclastic sand, sometimes covered by dunes up to 10 m high or limited inland by a Quaternary sandstone cliff that constrains the mouth of the Loukkos. The rocky shore platform beach of Larache is situated south of this estuary. The platform is part of the Rmel Plateau which is bounded seaward by actively retreating cliffs with an elevation ranging from 20 to 30 m above sea level.

The Larache coastal hominin tracksite reported here is dated to 90.3 ± 7.6 ka and represents one of the world's largest and best-preserved Late Pleistocene tracks sites, and the sole documented site in North Africa and Southern Mediterranean. Morphological characteristics undoubtedly relate these tracks to hominins, and due to their geological age and geographical location, they belong to *Homo sapiens*

In the Larache case, the footprints were probably left: (1) in the course of fair-weather wave conditions (no storm surge), at the limits of swash flow (2) and the landward limits of the spring high tidal zone over the beach foreshore bar (3), three conditions that would have corresponded to limited swash flow duration and very thin laminar swash flow, all potentially the most favorable conditions in the course of the spring-neap tidal cycle to salt-crusting and inception of preservation. These conditions correspond to a situation where the footprints left on the upper beach were not washed out by vigorous swash on the beach face and have time for the salt-crusting that we deem as initiating the preservation process

The sedimentological features of the tracked layers are evidence informing about the environment in which footprints were made. Unit 1 is composed of a rhythmic alternation of two different primary sandy facies. Facies of land-dipped cross-beds and facies of sea-inclined parallel lamination. The sediment that constitutes both facies is a medium-to-fine sand, mainly of quartz, but also including bioclastic grains.

South of Larache, between Rabat and Casablanca, MIS 5 sea-level oscillations have been extensively documented. Weisrock[50] and Chahid et al.[51] placed sea level during MIS 5c at around − 20 m above the present level. This MIS 5c level is observed at various elevations between present sea level and + 6 m. It was marked in its final phase by the formation of a high continuous aeolian sandy ridge dated between 103.8 ± 8.2 and 93.3 ± 7.1 ka[51].

Bildquelle: Sedrati et al., 2024

Interessanterweise ist die Küstenlinie derselben marokkanischen Region in den letzten Jahrzehnten stabil geblieben und hat sich mit einer Rate von +0,89 m pro Jahr seewärts bewegt (Amara Zenati et al., 2024). Dies steht im Widerspruch zu der Ansicht, dass der Anstieg des Meeresspiegels die Küsten der Erde überfluten und die Küstenlinien schrumpfen wird.

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Multi-decadal Assessment of Shoreline Changes Along the Ksar Esghir Coast, Morocco: Implications for Coastal Management

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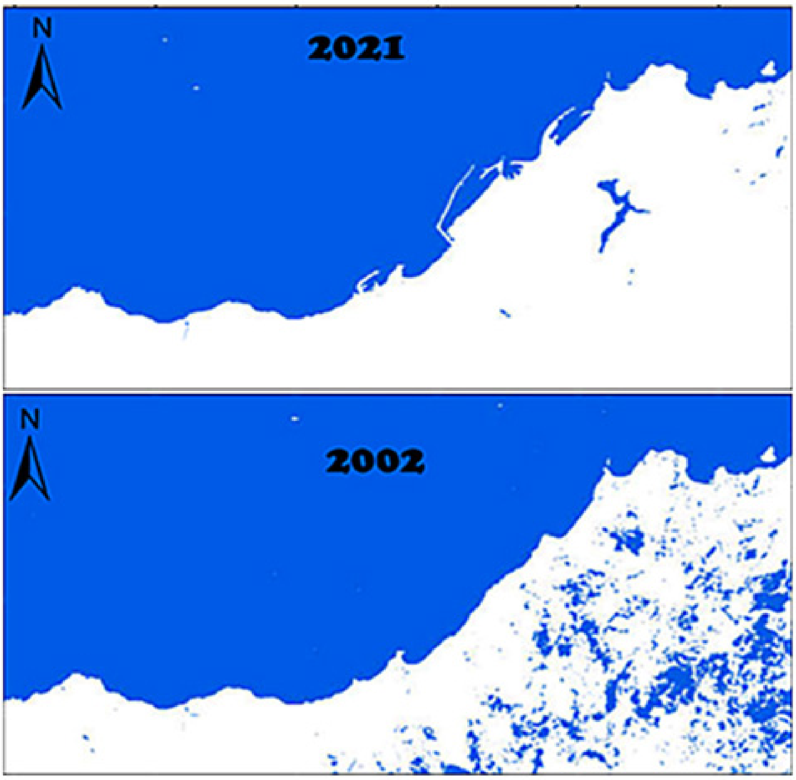
Coastal zones, as highly dynamic and complex environments, have substantial ecological and territorial implications for both government authorities and coastal managers. This research study investigated the impacts of port construction on shoreline dynamics along the coastal region of Ksar Esghir, located on the northern coast of Morocco, over a 19-year period (2002–2021). This study aimed to characterize the evolution of the coastline using high-resolution satellite images in a geographic information system (GIS) environment. Coastline evolution was assessed using GIS tools, particularly the digital shoreline analysis system (DSAS). Statistical approaches were used to determine the net rates of shoreline change, namely the end point rate (EPR) and net shoreline movement (NSM). Three main sectors were defined for the study area: The Eddallya sector, the western sector of Ksar Esghir and the port sector. As a result, two distinct zones have been identified in the Eddallya sector. Zone I shows an average accretion of +1.46 m/year, while zone II shows an erosion of -0.80 m/year. Analysis of the western sector of Oued Ksar Sghir revealed both erosion and accretion sites. Furthermore, the port sector showed positive values for shoreline evolution, with an average of +9.44 m and a rate of +0.49 m/year, signifying significant shoreline expansion over the study period. These findings highlight the dynamic and highly complex processes involved in coastal development in the study area. The results suggest that sediment dynamics, tidal regimes and potential anthropogenic influences have a significant impact on shoreline evolution, especially where port construction is concerned. The outcomes of this study provide helpful information for better and sustainable coastal management along the coastal area of Ksar Sghir.



The third zone, spanning from the 121st transect to the 148th transect, showcases a substantial accretion trend. Here, the shoreline has expanded by an average of approximately +16.38 m, with a rapid accretion rate of approximately +0.86 m/year. The coastal protection measures associated with the ports could have played a pivotal role in enhancing sediment deposition and fostering accretion in this area. The maximum net evolution observed at the 88th transect, where a significant accretion of approximately +62.54 m has occurred, equivalent to an annual accretion rate of about +3.23 m/year. This remarkable accretion may be a result of sediment deposition influenced by the nearby port infrastructure.

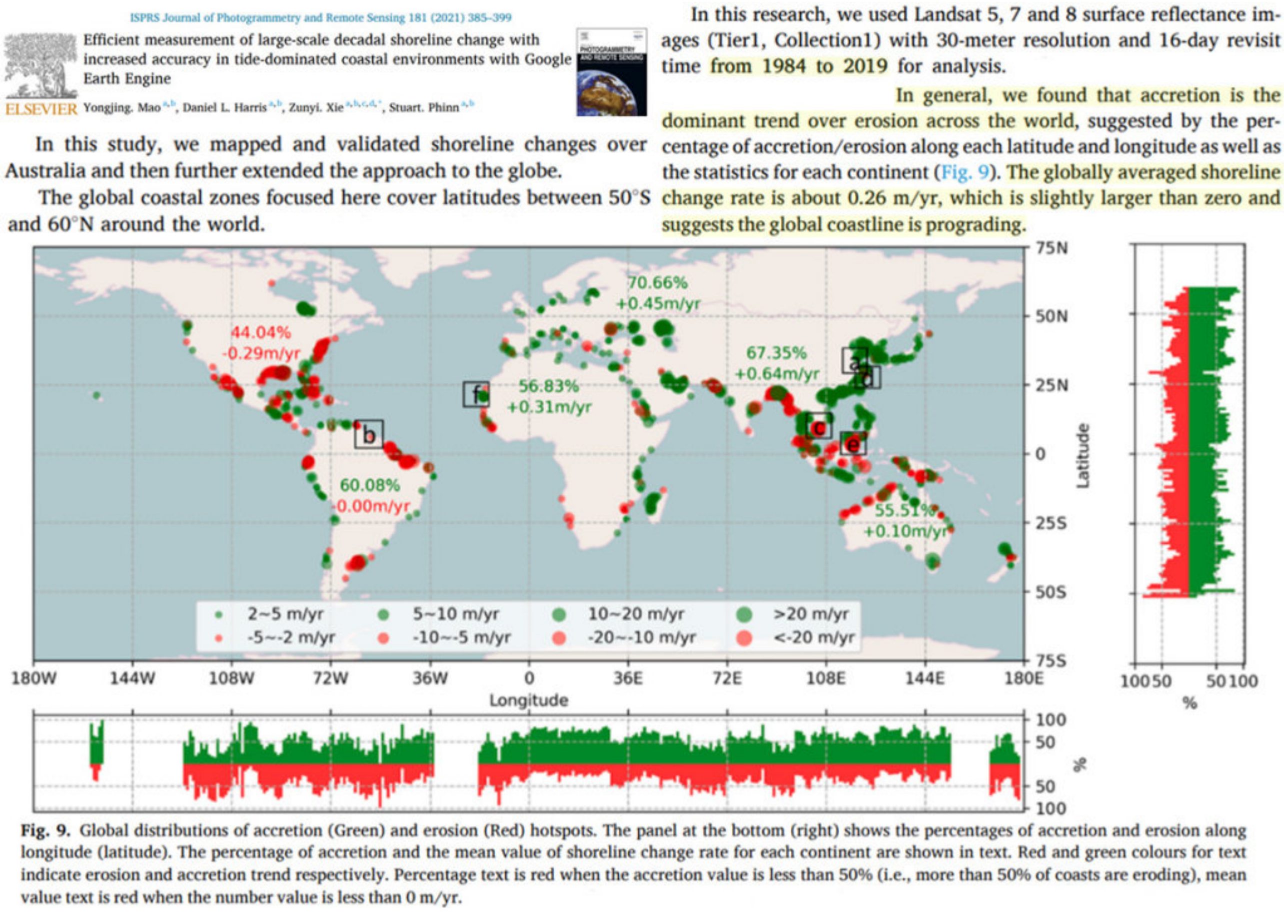
Moving towards Ksar Sghir Beach in the eastern part of Zone II, a notable stability of positive values is observed. These values fall within the range of +10 m (1 m/year) to +334 m (3 m/year), indicating a relatively stable shoreline with consistent accretion tendencies. This suggests that this portion of the coastline has experienced a consistent landward expansion over the study period.

A temporal analysis demonstrates that the years 2002, 2009, 2010, 2014, 2017, and 2021 experienced erosion, with an average rate of approximately -0.69 m/year, and accretion, with an average rate of approximately +0.89 m/year, across the entire study area.

Bildquelle: [Amara Zenati et al., 2024]

Und die Ausdehnung der Küsten ist nicht nur ein lokales Phänomen. Weltweit sind die Küstenlinien seit den 1980er Jahren mit einer Rate von

+0,26 m pro Jahr seewärts vorgerückt, denn trotz des Anstiegs des Meeresspiegels „wandert die globale Küstenlinie weiter“. (Mao et al., 2021).



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Efficient measurement of large-scale decadal shoreline change with increased accuracy in tide-dominated coastal environments with Google Earth Engine

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In this study, we mapped and validated shoreline changes over Australia and then further extended the approach to the globe.

The global coastal zones focused here cover latitudes between 50°S and 60°N around the world.

In this research, we used Landsat 5, 7 and 8 surface reflectance images (Tier1, Collection1) with 30-meter resolution and 16-day revisit time from 1984 to 2019 for analysis.

In general, we found that accretion is the dominant trend over erosion across the world, suggested by the percentage of accretion/erosion along each latitude and longitude as well as the statistics for each continent (Fig. 9). The globally averaged shoreline change rate is about 0.26 m/yr, which is slightly larger than zero and suggests the global coastline is prograding.

Fig. 9. Global distributions of accretion (Green) and erosion (Red) hotspots. The panel at the bottom (right) shows the percentages of accretion and erosion along longitude (latitude). The percentage of accretion and the mean value of shoreline change rate for each continent are shown in text. Red and green colours for text indicate erosion and accretion trend respectively. Percentage text is red when the accretion value is less than 50% (i.e., more than 50% of coasts are eroding), mean value text is red when the number value is less than 0 m/yr.

Bildquelle: Mao et al., 2021

Link:
https://notrickszone.com/2024/05/06/newly-discovered-90000-year-old-human-footprints-reveal-how-much-higher-sea-levels-used-to-be/

Übersetzt von Christian Freuer für das EIKE