



**BOLETÍN INFORMATIVO DE LA
COMISIÓN DE GEOSPELEOLOGÍA
Federación Espeleológica de América Latina
y el Caribe
-FEALC-**

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Coordinador: Prof. Dr. Franco Urbani
Sociedad Venezolana de Espeleología. Apartado 47.334, Caracas 1041A, Venezuela.
Telefax: (58)-212-272-0724, Correo-e: urbani@cantv.net

Boletín Informativo de la Comisión de Geoespeleología, Federación Espeleológica de América Latina y el Caribe (FEALC). *Esta publicación es de carácter informal y no arbitrada, preparada con el único objetivo de divulgar rápidamente las actividades geoespeleológicas en la región de la FEALC. Sólo se difunde por vía de correo electrónico. Es de libre copia y difusión y explícitamente se solicita a quienes lo reciban que a su vez lo reenvíen a otros posibles interesados, o lo incluyan en páginas web. Igualmente se pide que obtengan copias en papel para las bibliotecas de sus instituciones. Se solicitan contribuciones de cualquier tipo y extensión para su divulgación. Todos los números anteriores están disponibles en <http://www.fealc.org/geoespeleologia.htm> o solicitándolos a fealc-sve@cantv.net.*

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Some geoespeleological references from South America and the Caribbean.

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SOME GEOSPELEOLOGICAL REFERENCES FROM SOUTH AMERICA AND THE CARIBBEAN. Compiled from GEOREF.

- Aley-Thomas. Echinoliths; an important solution feature in the stream caves of Jamaica. *Cave Notes*. 6; 1, p. 3-5. 1964. Sharp edged country-rock remnants formed by solution in standing pockets of water are common features in intermittently flooded stream caves in the Jamaica tropical karstland. The name echinolith is introduced to designate these spine-like projections. Some develop on slopes, but more are found on floors of caves, especially where fractured. In Coffee River Cave the maximum relief is 3.5 feet.
- Aley-Thomas. Sea caves in the coastal karst of western Jamaica. *Cave Notes*. 6; 1, p. 1-3. 1964. A little south of Negril on the western end of Jamaica, sea caves in coral limestone occur where cliffs are from 30 to 50 feet high. Their orientation shows control by joints and fractures that have been widened initially by fresh-water solution. Their subsequent enlargement appears to be the result of stoping and wave action more than by salt-water solution. The collapse debris in some nearby caves that appear to be above the zone of wave action is the result of upward stoping by storm waves.
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- Bertaux-Jacques; Sondag-Francis; Santos-Roberto; Soubies-Francois; Causse-Christiane; Plagnes-Valerie; Le-Cornec-Florence; Seidel-Alexandre. Paleoclimatic record of speleothems in a tropical region; study of laminated sequences from a Holocene stalagmite in central-west Brazil. *Quaternary International*. 89; p. 3-16. 2002.
- Bertrand-Rollin. A review of the Quaternary of Jamaica. *Proceedings of a Workshop on the status of Jamaican geology*. Ahmad-R (editor). p. 331-339. 1986. *Geol. Soc. Jam.* Kingston, Jamaica. 1986.
- Bidegain-Juan-C; Cortelezzi-Cesar-R; Pittori-Carlos-A; Rico-Yamile. Registros paleomagneticos y paleontologicos en sedimentos loessoides del Pleistoceno-Holoceno en el "Estadio Ciudad de La Plata", provincia de Buenos Aires, Republica Argentina. *Revista de la Asociacion Geologica Argentina*. 57; 4, p. 404-414. 2002. Quaternary sediment layers exposed in a cave in the Estadio Ciudad de La Plata S34 degrees 57'00" W57 degrees 57'40", were studied by applying conventional palaeomagnetic methodology. Vertebrate fossils found at the base of the sedimentary sequence correspond to Scelidotheriinae ind., Doedicurus sp. and Panochthus intermedius. the last being the largest Glyptodontidae found in the area. Palaeomagnetic measurements carried out on the profile indicate that the mammal fossils occur within the Matuyama Reverse Polarity Chronozone (>0,78 Ma). The Brunhes/Matuyama boundary was identified at 4,6 m below the surface of the present soil, so this record of the Brunhes Zone is the shortest normal polarity record obtained in the area of La Plata. Just like in other studied localities, the Upper Matuyama Polarity Zone coincides with development of soils (humidity) and the lower Brunhes is represented by loess and loess-like deposits corresponding to drier climate associated with a glacial stage in the Cordillera and Patagonia.
- Boardman-Mark-R; Carew-James-L; Mylroie-John-E; Panuska-Bruce-C; Sealey-Neil-E; Voegeli-Vincent-J. The geology of Eleuthera Island, Bahamas; reinterpretation of megaboulder and oxygen isotope substage 5a deposits. *Abstracts with Programs - Geological Society of America*. 34; 6, p. 14. 2002. Eleuthera Island, Bahamas has outstanding outcrops important to understanding Bahamian geology. The island contains two exceptional exposures interpreted by Hearty (2000, QSR) to represent (1) megaboulders deposited by tsunami or super-storm

activity; and (2) a demonstrable contact between carbonate units deposited during oxygen isotope substages 5a and 5e. The evidence Hearty used to support the boulder hypothesis is: (1) the dips of the bedding within the eolianite boulders is variable and sometimes steeper than eolian deposition allows; (2) the boulders rest on top of a pre-existing paleosol surface; and (3) amino acid racemization [AAR] data indicate the boulders are older than the units they rest upon. Our field investigation in the spring of 2002 indicates that the purported megaboulders do not exhibit the widely variable dips reported. Rather, the dips are consistent with eolian deposition, and are consistent with the dips of the surrounding and underlying eolianites. The "boulders" also have well-developed phreatic cave systems in their bases, which contradicts the boulder hypothesis. We regard the "boulders" to be residual karst towers, which explains the presence of the caves. This reinterpretation indicates that AAR whole rock data from eolianites are not a reliable age indicator. The purported oxygen isotope substage 5a/5e contact cited by Hearty occurs between overlying eolianites and underlying intertidal calcarenites. Hearty identified a reddish rubble layer that appears to separate the two units as a paleosol. Hearty interpreted whole-rock AAR data from the eolianite to represent deposition during the time of substage 5a. We found that the red rubble unit is not laterally extensive, and is only associated with dissolution conduits developed in a swale along the eolianite/intertidal calcarenite contact. Elsewhere in the nearby vicinity the eolianite rests directly on the intertidal calcarenite with no intervening paleosol. We regard the hypothesized paleosol to be a cave sediment deposit. We believe that the outcrops in question represent a regressive-phase substage 5e eolianite overlying substage 5e intertidal calcarenites. This reinterpretation further indicates that AAR whole rock data from eolianites are not a reliable age indicator, especially at the resolution applied here.

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Brodkorb-William-Pierce. Recently described birds and mammals from Cuban caves. *Journal of Paleontology*. 35; 3, p. 633-635. 1961.

Brown-Martin. Paleoenvironment and environmental degradation of a tropical island; evidence from cave calcites. 2000. Master's. Carleton University. Ottawa, ON, Canada. Pages: unpaginated. 2000. Isotopic (oxygen and carbon) and petrographic (crystal length and roundness) analyses were performed on two speleothem from the tropical island of Mona, Puerto Rico, which grew over the last 1.5 k yrs of the Late Holocene in order to determine if they contain a recognizable paleoenvironmental signal and signs of the historically documented human-induced environmental degradation of the island through extensive guano mining. These records were compared to the nearest well-documented high-resolution proxy, the Quelccaya Ice Core. Carbon and oxygen isotopes are shown to respond mainly to paleotemperature changes in the pre-1510 timeframe of relative climate stability and for most of the Little Ice Age. For both isotopes, the higher the temperature, the greater the depletion (caused by the cave temperature effect for delta (super 18) O and the biological effect for delta (super 13) C). Paleoprecipitation becomes a dominant control only in droughts. Crystal morphology is shown to indicate extreme environmental events such as droughts (hot or cold) and hot-wet events. Both of the isotopes and crystallographic records clearly indicate anthropogenically-induced environmental change.

Brown-M-C; Ford-D-C. Caves and groundwater patterns in a tropical karst environment; Jamaica, West Indies. *American Journal of Science*. 273; 7, p. 622-633. 1973.

Bryan-Alan-L; Gruhn-Ruth. Stone and bone artifacts with Pleistocene fauna in two cave sites in interior Bahia, Northeast Brazil. *Current Research in the Pleistocene*. 2; p. 7-9. 1985.

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Buster-Noreen-A; Reich-Christopher-D; Holmes-Charles-W; Shinn-Eugene-A; Hickey-T-Donald. Carbonate storm deposits and varve-like sediments within the Great Blue Hole on Lighthouse Reef Atoll, Belize, Central America. *Abstracts with Programs - Geological Society of America*. 34; 6, p. 14. 2002. Vibracores taken within the oceanic blue hole located on Lighthouse Reef atoll, Belize, provide a continuous record of carbonate sedimentation. The blue hole is rimmed by coral reef with the exception of two shallow (<6 m) inlets and is approximately 300 m in diameter with vertical walls reaching depths greater than 120 m. At depths between 30-40 m, an overhang with stalagmites and a series of caves represents a time when this area was subaerially exposed (approximately 18 ka). The cores were described and sampled to obtain carbon and oxygen isotopes, radiocarbon ages and trace element geochemistry data. The sediments are organized into distinct packages of finely laminated alternating light and dark colored muds and coarser storm deposits of varying thicknesses. Water in the blue hole lacks circulation,

becomes anoxic at approximately 95 m, and allows deposition of finely laminated mud that resembles deposition in a lacustrine environment. It is possible that the sediments in the blue hole are varved, punctuated only by events such as storms or minor debris flows. Trace element analyses record different signatures for the laminated mud and storm deposits. Some elements switch correlation patterns in the upper portion of the longest core denoting a change in the chemical nature of younger versus older sediments. The shift from negative to positive correlation coefficients may be the result of changes in atmospheric controls, source material, water chemistry, diagenetic alteration or anthropogenic influence. Radiocarbon ages and differences in sedimentary packages in cores taken from the perimeter toward the center of the hole, suggest either a slightly dipping floor or mounds of deposition close to the walls, with the highest topography closer to the inlets of the blue hole. As the perimeter of the blue hole receives coarser sediment more frequently, the center of the blue hole is characterized primarily by laminated mud with finer grained storm detritus layers. With geochronological control, these sediments may provide insight to storm frequency and intensity in the western Caribbean for the past 2700 years.

Carew-James-L; Carrasquillo-Ramon; Taggart-Bruce-E; Troester-Flank margin cave development, Isla de Mona, Puerto Rico. Joseph-W; Frank-Edward-F; Mylroie-John-E. *The NSS Bulletin*. 56; 2, p. 111. 1994.

Carew-James-L; Mylroie-John-E. Quaternary tectonic stability of the Bahamian Archipelago; evidence from fossil coral reefs and flank margin caves. *Quaternary Science Reviews*. 14; 2, p. 145-153. 1995.

Carew-James-L; Mylroie-John-E. Stratigraphy, depositional history, and karst of San Salvador Island, Bahamas. Sedimentation and stratigraphy of carbonate rock sequences; Volume 2, Pleistocene and Holocene carbonate environments on San Salvador Island, Bahamas. Curran-H-Allen (editor)

Carew-James-L; Mylroie-John-E. Subaerial fossil reefs and phreatic dissolution caves; indicators of late Quaternary sea level and the tectonic stability of the Bahamas. *Abstracts with Programs - Geological Society of America*. 24; 1, p. 6. 1992.

Carew-James-L; Mylroie-John-E. Subaerial fossil reefs and phreatic dissolution caves; indicators of late Quaternary sea level and the tectonic stability of the Bahamas. *Abstracts with Programs - Geological Society of America*. 24; 1, p. 6. 1992.

Carew-James-L; Mylroie-John-E; Schwabe-Stephanie-J. The geology of South Andros Island, Bahamas; a reconnaissance report. *Cave and Karst Science*. 25; 2, p. 57-66. 1998. The surficial rocks of South Andros Island consist almost entirely of the Grotto Beach Formation (French Bay and Cockburn Town members), that was deposited during the last interglacial sea-level highstand (oxygen isotope substage 5e approximately 125 ka). Scattered transgressive-phase aeolian calcarenites of the French Bay Member are the oldest rocks exposed on the island and offshore cays. At High Cay, these aeolianites are truncated and encrusted by fossil corals of the Cockburn Town Member, at elevations of up to 2 m. The entire sequence is capped by a single terra rossa palaeosol. The majority of the island below 5 to 6 m elevation consists of ooid shoals and lagoonal deposits of the Cockburn Town Member. All higher ground consists of aeolianite ridges. The more significant aeolianite ridges trend approximately parallel to the shore of the Tongue of the Ocean, but lie 100 m to 1 km or more inland. At all localities the rocks are covered by a palaeosol or its remnants. Whereas modern sediments are common, there are few lithified Holocene rocks (Rice Bay Formation). Rocks demonstrably older than the Grotto Beach Formation (i.e. Owl's Hole Formation) are absent. The island surface has been modified extensively by karst processes. Karst features range from an extensive epikarst with small pits, to banana holes, blue holes and flank margin caves. Most blue holes are developed along a fracture zone that is parallel to the bank margin. Locally, fracturing has produced graben-like features and roofed collapses. Small flank margin caves are found on the banks of the numerous tidal creeks that penetrate into the island. Banana holes are abundant, and locally form very dense concentrations of more than 1000/km (super 2) . Pit caves are restricted to aeolianite ridges and the higher ooid shoals (above 4 m). South Andros Island surface geology and karst development is similar to that found throughout the Bahamian archipelago, but the geology is less diverse. The one exception is the many deep and complex blue holes that exist along the bank-margin fracture zone.

Carew-James-L; Wehmiller-John-F; Mylroie-John-E; Lively-Richard-S. Estimates of late Pleistocene sea level high stands from San Salvador, Bahamas. *Proceedings of the second symposium on the geology of the Bahamas*. Teeter-James-W (editor). p. 153-175. 1984.

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- Carew-J-L; Mylroie-John-E; Schmoll-B-S. Petrologic study of cave-wall rocks, Isla de Mona, Puerto Rico. Abstracts with Programs - Geological Society of America. 30; 7, p. 333. 1998. Isla de Mona is a tectonically uplifted island composed primarily of Mio-Pliocene carbonates, with a limited low-lying coastal plain of late Pleistocene (substage 5e) reefal deposits. The many flank margin caves exposed on the island were developed in the mixing-zone along the distal margins of past fresh-water lenses. The wall rocks of Cueva del Aleman consist of
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- Donovan-Stephen-K. A karst of thousands; Jamaica's limestone scenery. *Geology Today*. 18; 4, p. 143-151. 2002. About two-thirds of the surface-rock outcrop of Jamaica consists of Cretaceous and Cenozoic, particularly mid-Tertiary, limestones. The island has been subaerially exposed for less than 10 million years. During this time, a combination of high tropical temperatures and high seasonal rainfall, coupled with widespread jointing and faulting related to the island's position within the North Caribbean Plate Boundary Zone, has led to the development of an impressive karst topography over much of Jamaica.
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- Gomez-Roger-B; Gonzalez-Luis-A; Asmerom-Yemane; Reagan-Mark-K. Assessing Caribbean climate variability from Jamaican speleothems. Abstracts with Programs - Geological Society of America. 32; 7, p. 94-95. 2000. Because the Caribbean climate is controlled by the interaction of the North Atlantic subtropical high sea level pressure (SLP) system and the eastern Pacific intertropical convergence zone (ITCZ), high-resolution paleoclimatic/paleoenvironmental reconstructions can greatly improve our understanding of century to millennia scale variability in these systems. Jamaica, two-thirds covered by karsted limestone and located in the north-central portion of the Caribbean, is an ideal site to utilize speleothem (secondary carbonate cave deposits) based paleoclimatic/paleoenvironmental reconstructions to improve our understanding of long-term climatic variability in the Caribbean. Fluctuations in SLP between the eastern Pacific and the tropical Atlantic result in changes in sea surface temperature (SST) of the Caribbean and rainfall variability. This variability should cause changes in vegetation activity and rainfall delta (super 18) O, and should be recorded in stalagmite delta (super 13) C and delta (super 18) O compositions. We have collected stalagmites from two Jamaican caves, one in the central mountainous region and one at the west coast. Carbon isotopic excursions in the two stalagmites from these two caves imply shifts in vegetation activity controlled by soil moisture content at the cave surface. The west coast cave, lying in the rain shadow region, exhibits major shifts in delta (super 13) C (6 to 8 per mil) suggesting major increases in C4 activity and reduced C3 contribution during drier periods. In the mountainous region, the shifts in delta (super 13) C are less pronounced (1 to 3 per mil) suggesting only minimal increases in C4 vegetation activity. Stalagmite delta (super 18) O long-term excursions (decades to centuries) in both the coastal and mountain caves are similar in magnitude (1 to 2 per mil). However, the coastal region stalagmites contain more short-lived excursions (1 to 5 year duration), suggesting greater sensitivity to storms/hurricanes (negative excursions), and pre-infiltration evaporative effects (positive excursions). High-resolution mass spectrometry dating and annual growth band counting is underway to improve chronology of samples.
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- Gurnee-Russell; Gurnee-Jeanne. Discovery at the Rio Camuy; the finding and exploring of one of the largest caves in the Western world. Crown Publishers, Inc. Pages: 183. 1974.
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- Herrero-Silvana-A. Tafonizacion en las areniscas del Cerro Colorado (Sierra Norte, Provincia de Cordoba), con especial referencia a los aleros con pinturas rupestres. Revista de la Asociacion Geologica Argentina. 54; 2, p. 123-131. 1999. Analysis of the weathering of stratified sandstones from Cerro Colorado, Cordoba Province (Argentina) shows that stratification surfaces and weathering appear to constitute the major control in the development of cliff-foot caves (tafonis) and associated landforms (honeycombs). Percolating waters activate the hydrolysis of feldspars, the dissolution of soluble materials and redox processes. The net effect of these processes is the precipitation of salts (gypsum, anhydrite, etc.) and rock exfoliation which in turn deteriorates ancient indigenous (600-1,000 yr. B.P.) rockpaintings on the tafoni walls.
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- Jones-Brian. Processes associated with microbial biofilms in the twilight zone of caves; examples from the Cayman Islands. *Journal of Sedimentary Research, Section A: Sedimentary Petrology and Processes*. 65; 3, p. 552-560. 1995.
- Karmann-Ivo; Sanchez-Luis-Enrique; Fairchild-Thomas-Rich. Caverna Dos Ecos (Central Brazil); Genesis and geomorphologic context of a cave developed in schist, quartzite, and marble. *Journal of Cave and Karst Studies*. 63; 1, p. 41-47. 2001. Caverna dos Ecos (Echoes Cave) occurs in low-grade metamorphic rocks of the Mesoproterozoic Canastra Group, 60 km west of Brasilia, and exhibits a total linear development of 1600 m and a depth of 140 m, with halls up to 100 m across and 35 m high, a gallery 350 m long and 70 m wide, and at its lowest point, a lake 280 m long and 10 m deep. What makes this cave so unusual is that approximately 70% of its large volume is presently developed within schist and quartzite. Detailed structural study, together with speleomorphologic analysis, revealed two phases of speleogenesis: the first, typical of carbonate rocks, created phreatic tubes along the intersections of fractures and bedding planes, whereas the second involved breakdown processes that opened up large vadose cavities in the overlying schist and quartzite but without producing any indication of karstic relief in the overlying topography.
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- Koopman-Karl-Friedrich; Williams-Ernest-E. Fossil Chiroptera collected by H. E. Anthony in Jamaica, 1919-1920. *American Museum Novitates*. 1519; 1951. American Museum of Natural History. New York, NY, United States. Pages: 29. 1951. stalagmite subsamples from caves in semiarid northern Bahia state, northeastern Brazil. In this location, speleothem deposition does not presently occur, which delineates any dated subsample as a time when climate was wetter than today. Determined with mass spectrometric techniques, our preliminary analysis of sample ages shows that all speleothems grew during glacial periods. The pattern of speleothem growth indicates that pluvial phases in semiarid northeastern Brazil are coincident with higher insolation at 10 degrees S during the austral summer. In addition, short speleothem growth intervals show millennial-scale changes, which can be correlated to periods of cold and dry stadials in Greenland ice core records, such as Heinrich events 1, 4 and 6. This correlation may indicate a climatic teleconnection between the tropics and northern high latitudes. Abruptly enhanced precipitation in this region is generally in accordance with dramatically weakened North Brazil Current observed in the continental margin sediment cores. This may be due to the southward shift of tropical Atlantic warm water associated with thermohaline circulation shutdown. In combination with increased insolation, this shift may cause positive anomalies on sea surface temperatures in the southwestern tropical Atlantic, change easterly trade wind strength and enhance zonal moisture transport to the continental areas. Synchronicity between these Brazilian pluvial phases and times of relatively weak East Asian summer monsoon (recorded in Chinese speleothems) further illustrates the significant contribution the tropics give to these abrupt climate variations, acting either as one of control sources or as an amplifier.
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- Lundberg-Joyce; Toscano-Marguerite-A. Caves and coral; high precision dating of flowstone and coral reefs constraining the 5e sea level in SE Florida and the Bahamas. *Climate change; the karst record*. Lauritzen-Stein-Erik (editor). Karst Waters Institute Special Publication. 2; p. 101-103. 1996.
- MacPhee-R-D-E. Quaternary mammal localities and heptaxodontid rodents of Jamaica. *American Museum Novitates*. 2803; Pages: 34. 1984.
- Martinez-Salcedo-Jesus. Espeleothemas y niveles marinos pleistocenicos en la unidad litoestratigrafica Canimar, norte de Matanzas, Cuba. III Congreso cubano de geologia y mineria. CA: Cuba, Sociedad Cubana de Geologia, Cuba. *Mineria y Geologia*. 15; 3, p. 59-68. 1998. In carbonate karst region, near the shorelines, there is a remarkable relationship between the sea and phreatic levels. These oscillations during the Cuban Pleistocene occurred very often and controlled the level of underground phreatic lakes in caves of the Matanzas north coastal terraces. Into these lakes, under subphreatic conditions, were formed a lot of unique and specific speleothems which remained as testimonies of at least three flooding episodes during Pleistocene. This results are well known from his internal structure study. These secondary formations are named "Hongos de Zinolita" (Zinolite Mushrooms), which appear only in the Santa Catalina Cave, Matanzas province.
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- McFarlane-D-A; Gledhill-R-E. The Quaternary bone caves at Wallinford, Jamaica. *Cave Science* (1982). 12; 4, p. 127-128. 1985.
- McFarlane-D-A; Lundberg-J; Fincham-A-G. A late Quaternary paleoecological record from caves of southern Jamaica, West Indies. *Journal of Cave and Karst Studies*. 64; 2, p. 117-125. 2002. Studies of an unusual and diverse system of caves in coastal southern Jamaica have yielded a paleoclimatic record associated with a fossil vertebrate record that provides useful insights into the poorly documented paleoecology of latest Wisconsinan and Holocene Jamaica. Episodes of significantly increased precipitation during the Holocene have left characteristic deposits of speleothems, and have supported both faunal and archaeological communities that were dependent on these mesic conditions. Deposits of fossil bat guano preserved in the caves provide a delta (super 13) C record of alternating mesic and xeric climatic episodes that supports the interpretation of the faunal and archaeological record.
- McFarlane-Donald-A; Lundberg-Joyce. Last interglacial flood deposits and vertebrate paleontology of West Indian caves. Abstracts with Programs - Geological Society of America. 31; 7, p. 90. 1999. Recent efforts to extend the terrestrial vertebrate paleontological record of the West Indies have resulted in the discovery of distinctive last-Interglacial (Sangamon) cave deposits on the islands of Jamaica, Anguilla, Hispaniola and Puerto Rico. Each of these deposits apparently represents debris (including vertebrate bone) emplaced by catastrophic flooding during last Interglacial time. These are the only late Quaternary vertebrate fossil cave localities to have been dated beyond the late Pleistocene (i.e., older than 35 ka). However, sites from the interval 35-100 ka have not yet been found suggesting that conditions which resulted in the formation of these flood deposits have been rare or absent in post-Sangamon time. We postulate that this pattern is indicative of an episode of severe climate (perhaps dramatically increased hurricane frequency) that may have occurred during isotope stage 5e. This interpretation would be consistent with recent reports of dramatic storm-emplaced dune and reef-debris deposits in the Bahamas, and elsewhere, in both the Sangamon and Holocene interglacials. There has been an ongoing argument about the nature of many marine deposits emplaced in anomalous positions, especially in Bermuda and the Bahamas; earlier interpretations focused on storm activity while later interpretations used the same deposits as evidence for sea-level change. It may be time to re-assess some of the published data in light of this much less equivocal evidence for flood-emplaced cave deposits.
- McFarlane-Donald-A; MacPhee-Ross-D-E. A late Quaternary paleoecological record from caves in southern Jamaica. Geological Society of America, 1995 annual meeting. Anonymous. Abstracts with Programs - Geological Society of America. 27; 6, p. 386. 1995.
- McFarlane-Donald-A; MacPhee-Ross-D-E; Flemming-Clare. A late Quaternary paleoecological record from Jamaica. *Journal of Vertebrate Paleontology*. 17; 3, Suppl., p. 64. 1997.
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- Myroie-John-E. Karst of San Salvador. Field guide to the karst geology of San Salvador Island, Bahamas. Myroie-John-E (editor). p. 17-44. 1988.
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- Myroie-John-E; Carew-James-L. Land use and carbonate island karst. The engineering geology and hydrogeology of karst terranes. Proceedings - Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst. 6; p. 3-12. 1997. A.A. Balkema. Rotterdam - Boston, United States. 1997.
- Myroie-John-E; Carew-James-L; Vacher-H-L. Karst development in the Bahamas and Bermuda. Special Paper - Geological Society of America. 300; p. 251-267. 1995.
- Myroie-John-E; Harris-Jonathan-G; Carew-James-L. Karst as a land use hazard in Quaternary carbonate islands. Abstracts with Programs - Geological Society of America. 28; 2, p. 39. 1996. Geological Society of America (GSA). Boulder, CO, United States. 1996.
- Myroie-John-E; Myroie-Joan-R. Carbonate island karst and the Quaternary paleoclimate record. Congress of the International Union for Quaternary Research. 16; p. 225. 2003. The oceanic setting of carbonate islands creates a karst record of Quaternary climatic change, primarily through sea-level change. Sea-level highstands are also indicated by carbonate sediment depositional cycles. Fossil coral reefs in the tectonically-stable Bahamas define the last interglacial highstand (oxygen isotope substage 5e) as approximately 12,000 years in duration by U/Th dates (131,000 to 119,000 years ago). Flank margin caves develop at the edge of the fresh-water lens, thus their magnitude and lateral extent are a measure of the duration of sea level position, and fresh-water lens position, at the time of cave formation. Sea-level lowstands result in speleothem growth in caves drained by sea-level fall. Bahamian flank margin caves formed during the last interglacial sea-level highstand time window of 12,000 years, proven by the lack of stalagmites older than 100,000 years. Blue holes, with depths over 100 m below modern sea level, are older and contain stalagmites in >350,000 years of age, indicating numerous marine fill and drain cycles caused by glacioeustasy. On tectonically uplifted carbonate islands, caves and speleothems avoid fresh or marine phreatic water overprints, and may detail aspects of climatic change by stable isotope variation. Paleomagnetic records of cave deposits provide minimum ages for caves, and show that some flank margin caves such as Cueva del Aleman on uplifted Isla de Mona, Puerto Rico, developed approximately 2 million years ago, before the onset of rapid glacioeustasy in the early Pleistocene. Paleosols entomb paleokarsts, and through paleomagnetic measurements of secular variation, can provide an independent chronology of karst formation. Carbonate dissolution/deposition cycles affect CO (sub 2) flux ($\text{Ca}(\text{super } ++)$ + $2\text{HCO}(\text{sub } 3)(\text{super } -)$ <----> $\text{CaCO}(\text{U}(\text{sub } 2)) + \text{H}(\text{sub } 2)\text{O} + \text{CO}(\text{sub } 2)$). Karst denudation of exposed carbonate platforms during glacioeustatic sea-level lowstands results in CO (sub 2) sequestering of potentially 1.1×10^{13} g/y carbon, while carbonate deposition during highstands results in a potential CO (sub 2) release of 1.2×10^{14} g/y carbon. Quaternary sea-level lowstands sufficient to expose carbonate banks are about ten times longer than highstands that flood the banks (100,000 years versus 10,000 years), creating a carbonate flux that is approximately balanced (1.2×10^{18} g carbon versus 1.1×10^{18} g carbon, respectively).
- Nami-Hugo-G; Case-Ana-M. The raw material used by the Paleoindians of the Cueva del Medio, Ultima Esperanza, Chile. Current Research in the Pleistocene. 5; p. 31-32. 1988.
- Nemec-Frantisek; Panos-Vladimir; Stelcl-Otakar. Dute aragonitove stalagmity z jeskyne 'La Gran Caverna de Santos Tomas' na zapadni Kube. Ceskoslovensky Kras. 19; p. 101-105. 1968. The Grand Cavern of St. Thomas in West Cuba (Sierra de Quemado Mts., Pinar del Rio Province) displays hollow aragonite stalagmites, the morphology of which is akin to geyser stalagmites known from Czechoslovakian and Hungarian caves of hydrothermal origin. However, petrographic and mineralogic analyses show that the Cuban hollow stalagmites develop from saturated karst water pushed up through the capillaries and cracks in the sinter crust covering the permeable fluvial deposits on the cave bottom. The rising of the solution is caused by sudden increase of the karst water level during heavy tropical showers, and the formation of aragonite is supported by the high temperature of the cave medium. Consequently, the hollow stalagmites do not represent forms of hydrothermal origin. The term 'capillary stalagmites' is recommended for them.
- Nunez-Lautaro; Grosjean-Martin; Cartajena-Isabel. Human occupations and climate change in the Puna de Atacama, Chile. Science. 298; 5594, p. 821-824. 2002. Widespread evidence for human occupation of the Atacama Desert, 20 degrees to 25 degrees S in northern Chile, has been found from 13,000 calibrated (super 14) C years before the present (cal yr B.P.) to 9500 cal yr B.P., and again after 4500 cal yr B.P. Initial human occupation coincided with a change from very dry environments to humid environments. More than 39 open early Archaic campsites at elevations above 3600 meters show that hunters lived around late glacial/early Holocene paleolakes on the Altiplano. Cessation of the use of the sites between 9500 and 4500 cal yr B.P. is associated with drying of the lakes. The mid-Holocene collapse of human occupation is also recorded in cave deposits. One cave contained Pleistocene fauna associated with human artifacts. Faunal diversity was highest during the humid early Holocene.

- Paez-Marta-Mercedes; Prieto-A-R; Mancini-M-V. Fossil pollen from Los Toldos locality; a record of the late-glacial transition in the Extra-Andean Patagonia. *Quaternary International*. 53-54; p. 69-75. 1999.
- Pajon-Jesus-M; Hernandez-Ismael; Ortega-Fernando; Macle-Jorge. Periods of wet climate in Cuba; evaluation of express in karst of Sierra de San Carlos. *Interhemispheric climate linkages*. Markgraf-Vera (editor). p. 217-226. 2001. Academic Press. San Diego, CA, United States. 2001. The goal of this chapter is to present a quantitative assessment of the paleoclimatic evolution and paleo-environmental processes in western Cuba during the Pleistocene, focusing on the interval from the Wisconsin to the present. The paleoclimatic data obtained are of regional relevance. Most geomorphologic and geo-dynamic features observed in Cuba are the result of Pleistocene changes in sea level, temperature, humidity, and rainfall, which played a major role in landscape genesis and evolution. Paleoflow, paleodrainage, and paleorainfall values for the western karst region of Cuba were estimated by using scallop analysis and fluvial load analysis in active and inactive galleries of caves. These galleries represent different levels in the cave system that formed in response to sea-level changes during the Pleistocene. The reconstructed paleorainfall values document pluvial phases during the late Pleistocene. An abrupt climatic warming that occurred at the beginning of the Holocene was dated by (super 14) C to 11,520+ or -50 years B.P. Based on the relationship of ca. 0.21 per mil per degree Celsius, the oxygen isotope composition of samples from one stalagmite suggests a temperature increase of about 9.5 degrees C since that time.
- Palmer-R-J. Preliminary studies of speleogenesis on Cat Island, Bahamas. *Cave Science* (1982). 13; 2, p. 79-82. 1986.
- Prous-Andre; Fogaca-Emilio. Archaeology of the Pleistocene-Holocene boundary in Brazil. *Quaternary International*. 53-54; p. 21-41. 1999.
- Pujos-Francois. Estudio geologico, estratigrafico y sedimentologico de la Cueva de mamiferos del Pleistoceno de Santa Rosa (Peru); interpretacion paleo-ambiental. *Bulletin de l'Institut Francais d'Etudes Andines = Boletin del Instituto Frances de Estudios Andinos*. 31; 1, p. 101-113. 2002. Remains of a Pleistocene (Lujanian) *Megatheriinae* specimen (Mammalia, *Xenarthra*) have recently been discovered in the Cave of Santa Rosa, northern Peru. The discovery of a subcomplete skeleton of *Gravigrada* is exceptional in the Andes. It represents a new *Megatherium* species. The sedimentological, petrographical, stratigraphic and palynological study shows that the cavity: - is part of a karst system (common in Peruvian Andes) hollowed out in limestone of the Celendin Formation (Coniacian - Lower Santonian); - the hollowing and filling mechanisms that have occurred are: 1) digging of the shelter and deposition of yellow calcareous-clayey sands due to the important erosion of calcareous mountain; 2) gullyng and erosion that provoked the collapse of the shelter roof; 3) deposition of brown calcareous-clayey sands bearing mammal remains (*Megatheriidae*, *Camelidae*, *Cervidae*, and *Muridae*) and numerous floral remains and local presence of pollen. Palynological elements can be partitioned into two groups: 1) fern spores from the surrounding areas; 2) rarer undifferentiated colonial spores of probable algae. These observations suggest cooler and wetter conditions than present.
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- Ruiz-H-M; Gonzalez-L-A; Budd-A-F; Guoqui-G; Monell-Gonzalez-Vanessa. Late Miocene (Tortonian to Messinian) mixing-zone diagenesis of the Mona reef complex, Isla de Mona, Puerto Rico. *Abstracts with Programs - Geological Society of America*. 25; 6, p. 228. 1993.
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- Santos-R-V; Soubies-F; Sondag-F. Paleoclimatic record of speleothems from central Brazil. *Congress of the International Union for Quaternary Research*. 16; p. 112-113. 2003. Records of millennial-scale climate oscillations from the southern tropics exist but are still sparse. More data are needed to establish a satisfactory mechanism for these variations. Speleothems of arid and semiarid regions may cease to grow during dry intervals

and therefore record only periods of relatively wet climate. Constraints on these past pluvial periods are possible provided the ages of correlated speleothem growth can be accurately determined using U-series dating techniques. We have analyzed the Mio-Pliocene Lirio Limestone. The wall rocks of Cueva de Agua, Punte los Ingleses consist of rocks of the Lirio Limestone, and an infilling late Pleistocene reef rubble deposit. Thin section study indicates that the rocks contain abundant red algae, plus corals, molluscs, echinoderms, foraminifera, and green algae. Other workers have reported that the secondary porosity developed in outcrop exposures of the Lirio Limestone results largely from dissolution of aragonitic molluscs and corals, with little alteration of the theoretically less-stable high-Mg calcite red algae. In contrast, the cave-wall rocks of both Mio-Pliocene and Pleistocene age show preferential dissolution of the red algae, with lesser amounts of porosity developed by dissolution of aragonitic allochems. The difference in survival of the red algal allochems in surface exposures versus cave-wall rocks may result from the relative effects of microstructure and differential mineral stability in waters of different saturation states, as suggested by Walter (1985). That is, in surface rocks that are exposed to meteoric waters that are undersaturated with respect to calcite the dissolution of aragonitic grains with complex microstructures can occur faster than the dissolution of high-Mg calcite grains. In the caves, the rocks were probably exposed to groundwater that was supersaturated with respect to calcite, and either undersaturated or supersaturated with respect to aragonite. Those waters dissolved high-Mg calcite allochems faster than aragonite ones.

Santos-R-V; Soubies-F; Sondag-F. Paleoclimatic record of speleothems from central Brazil. Brazil 2000; 31st international geological congress; abstracts volume.

Schmoll-Bradley-S; Mylroie-John-E; Carew-James-L. Petrologic analysis of Cueva de Agua, Punte Los Ingleses, Isla de Mona, Puerto Rico. Selected abstracts from the proceedings of the 9th symposium on the geology of the Bahamas and other carbonate regions. Curran-H-Allen (editor); Mylroie-John-E (editor). *Geo (super 2)* . 26; 2-3, p. 34-35. 1999. National Speleological Society. University Park, PA, United States. 1999.

Smart-Peter-L; Richards-David-A; Edwards-R-Larry. Uranium-series ages of speleothems from South Andros, Bahamas; implications for Quaternary sea-level history and palaeoclimate. *Cave and Karst Science*. 25; 2, p. 67-74. 1998. Speleothem samples were collected from fracture-guided blue holes on South Andros Island using mixed gas diving techniques. Uranium-series ages were determined using alpha-spectrometric and, for selected samples, thermal ionisation mass-spectrometric analysis. In situ speleothem was absent below 57 m depth suggesting that sea levels have fallen below this depth for only a limited period (although dissolution associated with present-day groundwater chemistry may also be a contributing factor). The oldest samples collected dated from Marine Isotope Stage (MIS) 6, and form false floors associated with oolitic sediments previously emplaced within the cave void. This implies latest ages of MIS 7 for the cave, and MIS 9 for the host rock. The general pattern of sea-level for MIS 4/3 defined by speleothem ages parallel the progressive lowering demonstrated by global ice volume records. Estimates of high-stands derived from Barbados and from earlier work in the Huon Peninsula agree well with the constraints provided by Bahamas speleothem, but the global ice volume and more recent estimates are somewhat lower. Speleothem growth on South Andros ceased before flooding of the caves by rising sea-levels, probably related to a regional decrease in precipitation associated with the discharge of melt-water into the Gulf of Mexico. Cessation of growth in MIS 6 may also be controlled by palaeoclimate, and suggests an early commencement of deglaciation.

Steadman-David-W; DeLeon-Valerie-Burke. First highly stratified prehistoric vertebrate sequence from the Galapagos Islands, Ecuador. *Pacific Science*. 53; 2, p. 129-143. 1999. We report an assemblage of ca. 6900 vertebrate fossils from a preliminary excavation at Barn Owl Cave, Isla Floreana, Galapagos Islands, Ecuador. Age of this stratified deposit ranges from historic times (less than 200 yr old) to the early Holocene (at least 8290+ or -70 radiocarbon years B.P., which equals 7485-7055 B.C.). Five of the 11 indigenous species identified thus far from the bone assemblage no longer occur on Floreana. Their extirpation is due to human influence over the past two centuries. The sedimentary and faunal compositions of the Barn Owl Cave bone deposit may reflect paleoclimatic changes, with relatively wet intervals indicated by darker, more clayey sediments and a relative scarcity of bones of the Floreana lava lizard (*Microlophus grayii*). Further excavation at Barn Owl Cave is likely to yield insights into the timing and extent of late Quaternary climatic and faunal changes in the Galapagos Islands.

St-Pierre-David; St-Pierre-Shirley. A bibliography of Puerto Rican caves, karst and limestone geology and the longest-caves list. *Geo (super 2)* . 11; 3, p. 47. 1984. National Speleological Society

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- Wade-G; Fincham-A-G; Draper-G. The caves of Jacksons Bay and the Cainozoic geology of southern Jamaica. *D.C. Speleograph*. 39; 7, p. 3-11. 1983. National Speleological Society, D.C. Grotto, United States. 1983.
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- White-William-B; Dunn-J-Robert. Notes on the caves of Jamaica. *The NSS Bulletin*. 24, Part 1; p. 9-24. 1962. Forty-nine caves have been reported on the island of Jamaica. Fourteen of these were investigated in 1957. Cave patterns in the tropical climate of Jamaica are similar to those of temperate climates. The skylight and ceiling pockets are very common features. Calcite is the most common cave mineral and is present chiefly as massive dripstone deposits, often eroded by bat urine. Hydroxy-apatite is also present. Kegalkarst and Tuermkarst are developed in Jamaica. The former is extensive and occurs in "Cockpit" country. Doline Karst is also extensive. Several poljes are developed in Jamaica.
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- Wiegand-Jens; Karmann-Ivo; Fey-Michael. The sandstone karst of the Chapada Diamantina, NE-Brazil. *Terra Nostra* (Bonn). 2000-1; p. 138. 2000. Sondag-Francis; van-Ruymbeke-Michel; Soubies-Francois; Santos-Roberto; Somerhausen-Andre; Seidel-Alexandre; Boggiani-Paulo. Monitoring present day climatic conditions in tropical caves using an Environmental Data Acquisition System (EDAS). *Journal of Hydrology*. 273; 1-4, p. 103-118. 2003. This paper presents data from automatic stations which have been installed for monitoring climatic parameters in caves in two areas of Brazil. These devices, initially developed at the Royal Observatory of Belgium to monitor environmental parameters in geophysical observatories, were adapted in our study to operate under tropical cave conditions and to measure temperature, atmospheric pressure and drip rate of stalactites. Similar devices were installed at the surface near to the caves to measure air temperature, atmospheric pressure and rainfall. The results reveal that the drip rate at the tip of stalactites is related to the effective rainfall (water excess). The stable drip regime observed during the dry season seems to be reproducible from one year to the other and could be related to the infiltration of water which has a long residence time in the aquifer. Regular pressure oscillations, with amplitude ranging between 1 and 2 mb, are observed in both of the monitored caves. Spectral analysis of the data suggests that these oscillations are linked to the diurnal and semi-diurnal solar tides (S1 and S2). In one cave, very small temperature variations (0.02-0.05 degrees C) are also observed with a similar diurnal and semi-diurnal pattern, and we argue that the generating process of the thermal components of the S1 and S2 frequencies is a mixture of thermal convection produced by the surface meteorological variations and of an adiabatic induction of the S2 atmospheric pressure modulation. A very large annual thermal amplitude (13 degrees

C) is observed in the other cave; this is a great motivation to study the stable isotope geochemistry of its speleothems as they probably have recorded past temperature fluctuations linked to paleoclimate variations in this area of south-western Brazil.

Wilson-Mark-A; Curran-H-Allen; White-Brian. Paleontological evidence of a brief global sea-level event during the last interglacial. *Lethaia*. 31; 3, p. 241-250. 1998. A gently undulating to flat erosion surface with shallow-water borings and burrows is present in the midst of a Sangamonian (Eemian; marine oxygen isotope substage 5e) reefal facies on the islands of San Salvador and Great Inagua, Bahamas. Precise U/Th dating of corals above and below this surface show that it formed around 125-124 ka, and that the sea-level regressive-transgressive cycle which produced it lasted for 1500 years or less. The surface occurs on entirely carbonate rocks and has a low relief punctuated by erosional channels and karstic caves formed during the sea-level lowstand. A terra rossa paleosol, developed during that lowstand, partially fills a set of large lithophagid bivalve borings (*Gastrochaenolites torpedo*), showing that they were excavated during the regression. Rhizomorphs formed by plant roots occur on the erosion surface at Great Inagua. Extensive boring of the upward-facing surfaces occurred during the ensuing transgression, including a smaller *G. torpedo* and a clionid sponge boring (*Entobia ovula*). The bored surface is encrusted by a variety of shallow-water corals and, eventually, the re-established bank-barrier coral reefs. A sparse assemblage of serpulid worm and vermicularid gastropod tubes encrusted the channel and cave walls. Robust Ophiomorpha burrow systems occur within pockets of sediment in the coral facies both below and above the erosion surface. The channels and caves are filled with transgressive calcarenitic sediments in which occur numerous Ophiomorpha and Skolithos burrows. The ichnofossils on, below, and above this erosion surface are prominent indicators of a short-lived but significant global sea-level event.

Wilson-W-L; Mylroie-J-E; Carew-J-L. Caves as a geologic hazard; a quantitative analysis from San Salvador Island, Bahamas. *Proceedings - Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst*. 5; p. 487-495. 1995. A.A. Balkema. Rotterdam - Boston, United States. 1995.

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Yager-Jill; Spokane-Robert-B. The biodiversity and water chemistry of an anchialine cave in the Bahamas. *Karst Waters Institute Special Publication*. 3; p. 108-110. 1997.

Zans-Verners-Aleksandrs. A note on Dunn's Hole and its cave [Jamaica]. *Geonotes*. Jamaica, 1; 4., p. 95-99. 1958.

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