

DISTRIBUTION OF HERMATYPIC CORALS AND CRUSTAL MOVEMENT

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ABSTRACT: Comprehensive study of hermatypic corals throughout geological time indicates that they commonly occurred in the northern hemisphere during the Paleozoic and that they migrated regularly and gradually southward. The distribution of Tabulata, in particular, is related to paleolatitude (Wang Baoyu 1994). This paper discusses the relationship between crustal movement and the distribution of hermatypic corals.

**BIOMINERALIZATION AND PHYTOKARST DEVELOPMENT ON CAVERNOUS
QUATERNARY CARBONATE TERRACES, MOHAMMEDIA, NORTHWEST
MOROCCO**

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ABSTRACT: Subaerial Quaternary limestones exposed on raised beach terraces on the Atlantic coastline north of Casablanca, Morocco, are undergoing rapid denudation by fungal and cyanobacterial destructive processes. Erosion is accomplished by penetration of the substrate by mycelia, including dissolution of carbonate substrate which subsequently becomes trapped in the biofilms in the photic zone along the terraces. The cyanobacteria cause biophysical disintegration, redistribution and biosynthesis of mineral components. Invasion of the pore space created by cyanobacteria is followed by microbially mediated carbonate cementation, beginning with the precipitation of several generations of crystallographically diverse carbonate cements. The microcaves exhibit a range of features dominated by speleothemic calcite, microborings, algal filaments, hyphae, and calcite spherulites, which support the role of micro-organisms in the bioerosion and subsequent cementation of carbonate rocks in the terrestrial environment.

**THE NATURE AND POSSIBLE ORIGIN OF DOLOMITE IN AR RUB' AL KHALI, THE
UAE**

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ABSTRACT: Surface and near-surface sediments in southeastern part of the United Arab Emirates show extensive development of dolomite that is characterized by whitish, dense rocks, partially dissected by veinlets of gypsum and well-developed coarse calcite crystals. The dolomite reveals

rather monotonous aphanocrystalline to very finely crystalline crystals (2-20 μm) composed of idiopathic or planar dolomite fabric. Densely packed dolomite aggregates of clotted texture are observed. Moreover, several horizons of peloidal textures are recognized. The fossil content includes freshwater molluscs, foraminifera and gastropods embedded in very fine dolomite crystals, whereas dolomite forming the skeletal grains is considerably coarser (about 40 μm). The most common carbonate porosity type is fossil moldic followed by vug and channel porosity. Interparticle and intraparticle porosity, that may suggest possible dissolution by later diagenetic fluids, are only locally significant. Vari-sized blocky sparry calcite crystals are frequently observed as pore-filling cement.

Authigenic palygorskite of long and short-fiber variety is commonly associated with the dolomite. The fibers generally occur as compacted and dense bundles that show some orientation in the form of thick continuous mats composed of approximately parallel strips. The palygorskite does not show petrographic evidence of precursor carbonate or of any replacement feature.

Chemical analyses of dolomite show that the iron content (between 0.22 to 3.99%) is generally too high to have formed under oxygenated conditions, but are compatible with mixing-zone fluids. Na_2O values are relatively low (0.13-0.88%), and Sr generally between 135 to 484 ppm. The Na and Sr values are similar to examples interpreted as non-evaporitic or mixing-zone in origin.

The dolomite described here clearly formed in a near-surface setting and due to the lack of evidence of replacement of precursor grains or minerals, it appears that the dolomite precipitated directly. Occurrence of very finely crystalline dolomite originated by concentration of Mg-enriched brines through evaporation results from slow crystallization from highly dilute solutions. Presence of coarse sparry calcite filling pores in dolomite indicates predominance of freshwater conditions after precipitation of dolomite. Alternation between freshwater and hypersaline conditions may occur frequently.

COLLAPSE AND SUBSIDENCE ASSOCIATED WITH SALT KARSTIFICATION ALONG THE DEAD SEA

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ABSTRACT: Two types of sinkholes are observed along the Dead Sea shore, Israel. The first is associated with vadose dissolution in Mount Sedom salt diapir. The second is associated with dissolution under the watertable along the retreating Dead Sea shore. The Dead Sea level is falling dramatically, mainly because of human activity. Simultaneously, the lake shores suffer tremendous impact since the late 1980s: The ground is collapsing and subsiding in hundreds of points along the lake, with people, roads and property being swallowed in the more catastrophic events. The collapse

is believed to result from dissolution of salt by aggressive groundwater, following the retreat of Dead Sea level and the groundwater halocline. Geological evidence suggests that a previous major lake level fall occurred *naturally* ~2000 BCE. This may provide a new explanation for a curious historical-geological phrase in the book of Genesis, suggested to record formation of collapse sinkholes which occurred in response to the historic falling lake level, associated with climatic desiccation.

SHELL BED STACKING PATTERNS IN THE CHACHAO FORMATION (EARLY VALANGINIAN) IN MALARGÜE AREA, MENDOZA PROVINCE, NEUQUEN BASIN- ARGENTINA

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ABSTRACT: The Lower Cretaceous Chachao Formation in the Malargüe anticline area consists of wackestone, packstone, and minor grainstone and mudstone rich in benthic fauna which were deposited in a shallow carbonate ramp. These shell beds are composed of a low-diversity molluscan fauna mostly dominated by oysters, other benthic pelecypods (*Eryphila* sp., *Ptychomya* sp., *Pecten* sp., *Pinna* sp., *Trigonia* sp., *Cucullaea* sp.), serpulids (*Sarcinella* sp., *Parsimonia* sp.), and occasional ammonites (*Olcosthepanus curacoensis*).

Most skeletal accumulations range from 15 to 70 cm in thickness. Shell beds exhibit a sharp, flat and commonly undulating base. In some cases the tops were bioturbated principally by *Thalassinoides* isp. Some shell beds show a densely packed biofabric (bioclastic-supported) but most of them have dispersed or loosely packed biofabric (mud-supported). Bioclasts include articulated or disarticulated shells, fragmented valves and shell debris. The analysis of shell concentrations of the Chachao Formation allow to recognize four taphofacies according to their taphonomic attributes.

Different kind of processes, such as low-energy storm currents and waves, were interpreted, whose deposits are arranged into a coarsening- and thickening-upward and then fining- and thinning upward trends. According to their biostratigraphic features shell beds of Chachao Formation have been interpreted as parautochthonous to autochthonous skeletal concentrations, mainly of sedimentologic origin.

Towards the end of the Valanginian, the drowning of the carbonate ramp took place, related to a relative sea level rise and environmental stress. This drowning event was recorded by the alternating thin- to medium bedded dark gray carbonate and black shales (Agridio Formation) of Late Valanginian-Late Hauterivian age.

REEF MORPHOLOGY AND SEDIMENT ATTRIBUTES, ROATAN, BAY ISLANDS,

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ABSTRACT: A reef monitoring program off Roatan, Bay Islands, Honduras has produced base line data for platform bathymetry, major macrofauna distribution, and sediment attributes. Because erosion accompanying accelerated island development will be increasing in the near future, measurements of total suspended solids and sedimentation rate were made. Results show TSS range from 8 to 70 mg/l in the summer and 30 to 222mg/l in the winter. Sedimentation rates in the fore reef, where finer-grained terrigenous material would potentially accumulate, are 0.14mg/cm²/day to 7.07mg/cm²/day in the summer and 41 to 71mg/cm²/day in the winter. The summer values are well within the ranges of published results from other Caribbean carbonate platforms, however winter values are up to ten times that of other localities.

KEY WORDS: coral reefs, Roatan, Honduras, carbonate platforms, sedimentation rates

C AND Sr ISOTOPIC EVOLUTION OF CARBONATE SEQUENCES IN NW ARGENTINA: IMPLICATIONS FOR A PROBABLE PRECAMBRIAN-CAMBRIAN TRANSITION

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ABSTRACT: Upper Precambrian-Lower Cambrian sequences in the Tucuman, Salta and Jujuy provinces, NW Argentina, comprise sandstone, slate, conglomerate and black limestone (Las Tienditas/Volcan Fms.) with abundant Vendian/Tommotian trace fossils in the clastic facies rocks. The Precordillera basin, San Juan province, represents a continuous carbonate sequence belonging to the Lower to Middle Cambrian La Laja Fm. The Pie-de-Palo Range, Pampean Range, characterized by carbonates intercalated with greenschist/amphibolite facies metaclastic rocks, forms a part of the Precordillera basement. The $\delta^{13}\text{C}$ values in carbonates of the Las Tienditas Fm. show a gradual decrease from the base (+3.4 ‰PDB) to the top with a minimum of -1.6‰ observed at ~15m from the top, the latter having a higher clay content. Carbonates in a 700m thick section within La Laja Fm. is marked by a slightly positive $\delta^{13}\text{C}$ values at the base (marly) with a negative anomaly (-2.0‰) at

~20 m above, followed by a small positive anomaly (+0.5‰) ~100 m from the base. All the values above this point are around -0.5‰ with a negative anomaly (-2.0‰) recorded at ~240m above the base.

Seawater $^{87}\text{Sr}/^{86}\text{Sr}$ values define a non-monotonic increase (0.70870 - 0.71082) through the carbonates in Las Tienditas Fm. while the La Laja Fm carbonates vary from 0.70926 to 0.71030, with higher values at the base. C and Sr isotopes, thus suggest that the Las Tienditas carbonates record the Precambrian-Cambrian transition (~15m from the top of studied section). The same is also evident at ~30 m from the base of the La Laja Fm. The narrow range of $\delta^{13}\text{C}$ variation (-1.4 to +1.3‰) and $^{87}\text{Sr}/^{86}\text{Sr}$ in the 0.709-0.710 range for the Caucete Group carbonates of the Pie-de-Palo Range, although unequivocally, appear to be in consonance with a Vendian to Tommotian age, reinforced by the presence of the trace fossils *Didymaulichnus* and *Gordia*.

KEY WORDS: C & Sr isotopes, carbonates, Neoproterozoic-Cambrian, Argentina.

CHRONOLOGY OF DISCONTINUITIES AND PETROLOGY OF SPELEOTHEMS AS PALEOCLIMATIC INDICATORS OF THE KLAMATH MOUNTAINS, SOUTHWEST OREGON, USA

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ABSTRACT: Speleothems from Oregon Caves National Monument, a dissolutional cave system located in the Klamath Mountains of southwest Oregon, are composed mainly (>90%) of columnar calcite crystals. Columnar calcites form through syndepositional lateral coalescence of crystallites and precipitate under stable hydrodynamic conditions in humid, temperate climates. Numerous discontinuities from short-lived events (<100 years) punctuate the calcites. Minor fabrics, such as transitional- and randomly-oriented elongate calcites are seeded on these discontinuities and detrital layers. Columnar calcites eventually overrun sub-horizontally oriented crystals as a result of competitive growth. Large ($\approx 750\ \mu\text{m}$) crystal terminations indicate growth under increased water film resulting from greater flow and/or ponding. 14 U-series dates provide mean growth rates of 5.6 to 27.9 mm/ka during interglacial periods (marine isotope stages 11 through 9, substage 5e, and late stage 2 through stage 1), and indicate short growth intervals during early- to mid-interglacial periods. Several outcrop-scale discontinuities represent periods of prolonged growth stoppage. Growth cessation occurred during the colder phases of stages 8-9 and 6-7, which translate into hiatuses of 77.5 and 99 ka respectively. Given the sensitivity of alpine regions to climate change and the lack of evidence for continental or alpine glaciation, the hiatuses are presumed to be caused by groundwater freezing during extended periglacial conditions, triggered by the lowering of periglacial thresholds by as much as 1800 m during glacial periods.

**CARBONATE MUD FLOWS AND OTHER INDICATORS OF EXCESS PORE-FLUID
PRESSURE IN THE MACUMBER FORMATION (LOWER CARBONIFEROUS, VISÉAN)
AT INGONISH, NOVA SCOTIA, CANADA**

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ABSTRACT: The Ingonish area of northern Nova Scotia offers the most extensive exposure of the Macumber Formation, the basal carbonate unit of the Lower Carboniferous (Middle Viséan) Windsor Group of Nova Scotia and New Brunswick. The area also shows tectonic-free sedimentary characteristics of this unit. The formation consists of two principal lithologic units, a basal, black, earthy, carbonaceous limestone normally about 0.5 m thick and a thinly stratified, peloidal dolomudstone up to 17.5 m thick. At Burke Head, the dolomudstone is cut by at least 25 massive tufa mounds, elongated in cross-section and intersecting their surrounding strata by rising northeastward at angles of 15 to 25 degrees. At east Ingonish Island the basal unit is anomalous in being both dolomitized and thicker (5 m); there, both units are cut by at least 20 smaller massive tufa mounds. The mounds at both localities formed over deep-water hydrothermal vents, i.e., marine hot springs; the fossils of abundant chemosynthetic tubeworms surround the lower mounds on east Ingonish Island. The Macumber Formation overlies Horton Group braided-stream facies sandstones, and presumably underlies nearby, thick gypsum deposits of the Windsor Group.

Features in the formation indicating excess pore-fluid pressure include voluminous vugs and widespread subaqueous sediment flows. Miniature pockmarks, sedimentary volcanoes, and shafts show the release of small quantities of pore fluids. Larger quantities of pore fluids exited through tufa mounds and geyser-like shafts. The pressure generated mudflows; eruption of pore fluids brecciated some of their flanks.

The general environment of rift tectonics was conducive to active hydrology. The seasonal semi-arid climate caused changes in pore-fluid pressures, due to episodic aqueous and sedimentary loading of basin floors. Igneous activity, either at the same time or before deposition of the Windsor Group, created significant geothermal gradients to drive hydrothermal circulation and increase pore-fluid pressures.

Textures and structures of the Macumber Formation in the Ingonish area are due to syndepositional processes, driven by initial, high pore-fluid pressures.
