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Rediscovering pelagosite: a Mediterranean "microstromatolite" recording recent climate cycles

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Pelagosite was first reported by Marchesetti in 1876 on the remote Adriatic islet of Pelagosa (now Croatian Palagruza) as a hard, shiny, tar-looking mineral encrusting the dolomite cliffs of the island immediately above tide line. The report by Marchesetti was followed by 50 years of debate about the nature and origin of this mineral until 1926, when Onorato published a comprehensive paper on the morphological, mineralogical, physical, chemical, and biological characteristics of pelagosite from the Tremiti islands, which are located 75 km SW of Palagruza. Pelagosite turned out to be pisolitic aragonite, which, according to Onorato, is produced by Chroococcus (or Placoma?) and Scytonema "blue-green algae" (i.e., cyanobacteria) where the littoral rock is frequently wetted by sea aerosol. No relevant contributions about pelagosite were published following Onorato's paper and this biomineral seems to have fallen into almost total oblivion during the rest of 20th century. We revisited Palagruza and sampled pelagosite along a cliff section up to 10 m asl, to renew an interdisciplinary study of it. X-ray diffraction confirmed that pelagosite is pure aragonite, and preliminary U/Th dating yielded ages around 2,200 yrs for samples collected between 3 and 4 m asl, and 6,500 yrs for a sample from 6 m asl, suggesting that Palagruza is uplifting at a rate of about 2 mm/yr. Optical microscopy confirmed the pisolitic structure of pelagosite and showed that 2-3 mm thick alternating dark-light laminae are arranged

rhythmically through millimeter-thick sections of pelagosite crusts. Thicker laminae contain submicron-size inclusions of probable organic matter. By assuming that these laminae represent yearly accretions, and producing time series through laminated sections several hundred mm thick using a photo-image analysis technique, we have obtained FFT power spectra showing frequency peaks comparable to El Niño (ENSO) cycles. We then extended our study to pelagosite found along the limestone littoral of the Dalmatian island of Hvar, which, unlike Palagruza, is currently under a regime of tectonic subsidence. Power spectra of laminated sequences in several pisolites yielded frequency peaks consistent with ENSO and with the cyclicity of weather data (yearly precipitation and mean annual temperature) continuously recorded at the Meteorological Observatory of Hvar since 1859. While further U/Th dating, stable isotope, XRF main and trace element, and molecular microbiological analyses on pelagosite are still in progress, our preliminary results indicate that this biomineral is potentially a precise and accurate geochronometer for assessing neotectonic movements of rocky coasts throughout the Meditrerranean region, and a fine recorder of Holocene climate cycles.