

## Climate-driven diversity changes of Mediterranean echinoids over the last 6 Ma

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Echinoids represent an important component of the Cenozoic marine benthic communities. Their diversity in the Mediterranean area is reviewed within the Late Miocene–Recent, a period of remarkable paleogeographic and paleoclimate changes. Of the 37 genera that lived during the Late Miocene, only *Holaster*, *Pliolampas*, and *Trachyaster* did not survive the Messinian Mediterranean salinity crisis (MSC), indicating that this event was not as drastic as for other marine groups. The presence of *Brissopsis* within the uppermost Messinian testifies to the existence of fully marine conditions at least towards the end of the MSC. Severe drops in the echinoid diversity, involving the loss of 40% of the Pliocene genera, occurred during the Piacenzian, likely because of the onset of the Northern Hemisphere glaciation. Most of the echinoid extinctions correlate with the crisis of the Mediterranean bivalve assemblage recorded at about 3 Ma. The Early Pleistocene progressive cooling caused the disappearance of further thermophilous shallow-water genera (*Clypeaster*, *Schizechinus*, *Echinolampas*) and allowed the entrance of temperate taxa (*Paracentrotus lividus*, *Placentinechinus davolii* and *Sphaerechinus granularis*) from the Atlantic. Some deep-water taxa (*Histocidaris sicula*, *Stirechinus scillae*, *Cidaris margaritifera*), whose Recent relatives are currently restricted to tropical areas, are not found in the area after the Calabrian possibly because of the disappearance of the psychrosphere. The extant Mediterranean echinoid fauna mainly derives from the Late Miocene fauna, reduced after several climatic changes by about 43% at the genus level. The recent increase of the sea surface temperatures allowed the entrance of the Lessepsian *Diadema setosum* and confined the deep-water species of *Holanthus* to the coldest areas of the basin, making this genus endangered.

**Key words:** Echinoidea, biodiversity, biogeography, paleoclimate, Mediterranean bioevents, Miocene salinity crisis, late Cenozoic.

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