PALEOECOLOGICAL IMPLICATIONS OF DRILLING PREDATION PATTERNS AMONG BIVALVE MOLLUSKS FROM THE BRAZILIAN SHELF

RODRIGUES, S.C.[1,2]; LEME, J.M.[1,2]; STÜKER, F.[3]; NEVES, J.P.[2]; KOTZIAN, C.B.[3]; SIMOES, M.G.[2];KOWALEWSKI, M.[4]; CORRÊA, I.C.S.[5]

[1] Depto. Geol. Sedimentar, USP, PG/GSA, São Paulo, SP, scoelho@usp.br; leme@usp.br
[2] Depto. Zoologia, IBB-UNESP/Botucatu, Botucatu, SP, btsimoes@ibb.unesp.br, dollybio@hotmail.com
[3] Depto. de Biologia, UFSM, Santa Maria, RS, mickey@ccne.ufsm.br, fecasminf@yahoo.com.br
[4] Department of Geosciences, Virginia Tech, Blacksburg, VA 2406, michalk@vt.edu
[5] CECO, Inst. Geociências, UFRGS, Porto Alegre, RS, iran.correa@ufrgs.br

High rates of drilling predation (drilling intensity=17.24%) were recorded in present-day assemblages of juvenile/minute bivalve mollusks from sub-tropical waters of South Atlantic from the states of Santa Catarina (26°32', n=16 stations) and Rio Grande do Sul (34°22'5", n=74 stations), encompassing the depth range from 17 to 2900 meters. The evidence discussed here suggests that competition among predators was intense. For this project, samples from death assemblages were obtained using Van Veen and Dietz Lafond grab samplers. Out of 90 sampling stations, 52 yielded bivalve shells (depth range: 17 to 677 meters), and 35 provided drilled shells. A total of 4521 bivalve specimens were studied, and 433 specimens were drilled (DI=9.58%). Drilled specimens included infaunal (n=416, 96.07%), semi-infaunal (n=1, 0.23%) and epifaunal (n=16, 3.7%) shells. The great majority of perforated shells yielded a single drill hole (n=424, 97.92%), but 9 specimens (2.08%) showed multiple traces (2 drill holes). In the studied material, two types of drilling perforation can be easily recognized: "edge drilling" and "wall drilling". Edge drilling is a hole that penetrates across the commissure and is bored through edges of both valves of a bivalve shell. In contrast, wall drilling is a hole drilled through the shell wall of one valve. In 433 drilled specimens, 442 drill holes were recorded (wall drilling=94.8%, and edge drilling=5.2%). Pooling the data from sampling stations, wall drillings occurred in bivalves from all sampling stations, whereas edge drillings were common on shells sampled at 17, 20, 22, 130, 135, 148, 149, 150, 153, 200, and 201 meters of depth, being more frequent (n=16, 69.57%) on shells from the deeper stations (130-201 meters). Our data have obvious paleoecological implications. First, experimental predation data with living venerid bivalves (*Chione elevata*) from northeastern Gulf of Mexico showed convincingly that muricid gastropods penetrate the prey shell faster when employing edge-drilling strategy (Dietl and collaborators, Science, December of 2004). Hence, edge drilling is advantageous in environments where predators face high risks while feeding, and competition is intense. Second, despite time-averaging that could affect our data, the edge-drilling frequency of 5.20% reported here is similar to the frequency reported by the above authors for Pliocene venerid bivalve assemblages (5.7%). That Pliocene (pre-extinction) frequency was relatively high (perhaps reflecting elevated risks to predators) when compared with much lower edge-drilling frequencies observed following the Plio-Pleistocene mass extinction. The edge-drilling frequency observed here for the Brazilian mollusks suggests that predators are experiencing risks comparable to Pliocene drillers from pre-extinction settings. However, spatial variation in frequencies of edge drilling suggests that elevated risks to predators are not homogeneous across sites. This study represents one of the few well-documented cases of edge drilling in Holocene mollusks, colonizing natural marine bottoms. The study also shows that edge drilling is not only common in shallow waters, as previously thought (notable occurrences of edge drilling were reported here for mollusk assemblages found in waters as deep as ~200 meters). This suggests that predators in deeper-water assemblages may also be subjected to risks (e.g., predation, competition, abiotic disturbances) comparable to those found in shallow water settings.