Coral microatolls from the Triassic of Nevada: oldest scleractinians examples

Received: 1 September 2004 / Accepted: 18 January 2005 / Published online: 22 March 2005

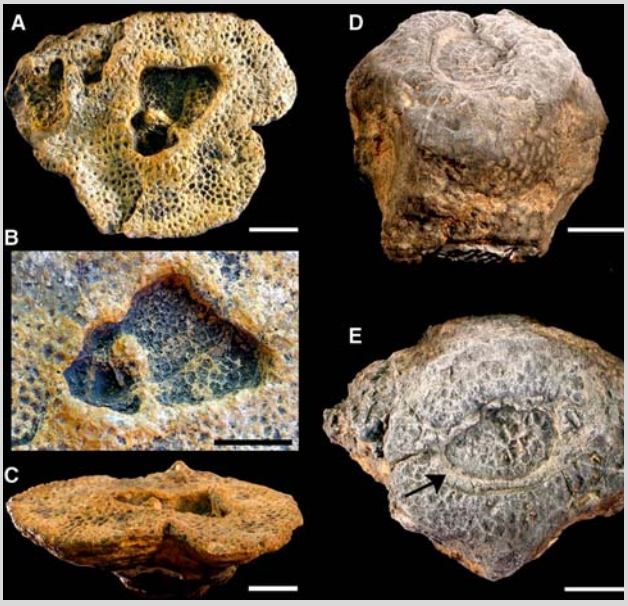

Fig. 1a Flat top of *Chondrochoenia schafhaeutli* (UMIP 6813). **b** Enlargment of A with central depression and dead corallites. **c** Side view of A. **d** Left, oblique view of a microatoll colony of *Ceriostella variabilis* (UMIP 20773), with well-preserved corallites on sides and rim but poorly preserved on top. **e** Right, top view of D illustrating the depressed center. Floor of the depression preserves region of dead corallites and red algal overgrowth (*arrow*). All *bar scales* equal to 1 cm

Flat-topped, elevated coral colonies with steep sides and depressed centers known as microatolls, were first described by Darwin (1842) and range in diameter from a few centimeters to over a meter. Microatolls occur in the intertidal zone in lagoons, reef flats, and channels between coral islands (Scoffin and Stoddart 1978) and are useful as indicators of sea-level change. The characteristic features of a microatoll are a flat top, which in many cases, appears to be planed off, irregular ring-like or donut-shaped with a depressed center. The origin and unique shape of coral microatolls reflects the upward growth and lateral expansion of a colony when it reaches sea level with subsequent death of the corallites on top due to prolonged exposure at low tide. Microatolls are well-known but restricted to zooxanthellate corals and hydrozoans on coral reefs. Ancient microatolls are exceedingly uncommon, but have been reported among Ordovician corals such as from the tabulate coral *Tetradium* (Kobluk and Noor 1990; Webb 1997). With the notable exception of the Miocene corals (Martin et al. 1989), no scleractinian examples have been reported from post-Neogene time.

Illustrated are two mesozoic examples of scleractinian microatolls. *Chondrochoenia schafhaeutli* from Upper Triassic rocks of the Pilot Mountains, west-central Nevada (collected from coral and sponge biostromes, Sandy and Stanley 1993) is a typical and widely distributed species in the former Tethys region of central Europe. The second example is *Ceriostella variabilis* (Roniewicz and Stanley 1998) from Middle Triassic rocks of central Nevada occurring in scleractinian-dominated biostromes.

Recognizing ancient sea level is among the most important yet elusive of goals for geologists. The two Triassic examples illustrated here are the oldest formed by scleractinians. Like modern counterparts, they were likely zooxanthellate and grew at sea level thereby resolving a controversy about whether the Nevada examples were of deeper or shallow-water origin (Stanley and Cairns 1988; Fig. 1).

Acknowledgements Thanks to Jen Nelson for preparation of the figures. Research supported by NSF EAR-0229795. Reviewed by Bernhard Riegl and Diethard Sanders.

References

Darwin CR (1842) The structure and distribution of coral reefs. Smith Elder, London

Kobluk DR, Noor I (1990) Coral microatoll and a probable Middle Ordovician example. J Paleontol 64:39–43

Martin JM, Braga JC, Rivas P (1989) Coral successions in Upper Tortonian reefs in southeastern Spain. Lethaia 22:271–286

Roniewicz E, Stanley GD Jr (1998) Middle Triassic cnidarians from the New Pass Range, central Nevada. J Paleontol 72:246–256

Sandy MR, Stanley GD (1993) Late Triassic brachiopods from the Luning Formation, Nevada, and their palaeobiogeographical significance. Palaeontology 36:439–480

Scoffin TP, Stoddart DR (1978) The nature and significance of microatolls. Phil Trans Roy Soc Lond series B 284:99–122

Stanley GD, Cairns SD (1988) Constructional azooxanthellate coral communities: an overview with implications for the fossil record. Palaios 3:233–242

Webb GE (1997) Middle Ordovician *Tetradium* microatolls and a possible bathymetric gradient in tetradiid morphology. Boletín de la Real Sociedad Española de Historia Natural 92(1–4):177–186

GD. Stanley Jr
Department of Geology, The University of Montana, MT, 59812, Missoula, USA
E-mail: george.stanley@umontana.edu

Reef sites

DOI 10.1007/s00338-005-0483-5