

Evaporites, Water, and Life, Part I

Complex Morphological Variability in Complex Evaporitic Systems: Thermal Spring Snails from the Chihuahuan Desert, Mexico

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ABSTRACT

Thermal springs in evaporitic environments provide a unique biological laboratory in which to study natural selection and evolutionary diversification. These isolated systems may be an analogue for conditions in early Earth or Mars history. One modern example of such a system can be found in the Chihuahuan Desert of north-central Mexico. The Cuatro Ciénegas basin hosts a series of thermal springs that form a complex of aquatic ecosystems under a range of environmental conditions. Using landmark-based morphometric techniques, we have quantified an unusually high level of morphological variability in the endemic gastropod *Mexipyrghus* from Cuatro Ciénegas. The differentiation is seen both within and between hydrological systems. Our results suggest that this type of environmental system is capable of producing and maintaining a high level of morphological diversity on small spatial scales, and thus should be a target for future astrobiological research. **Key Words:** Mollusca—Evolutionary biology—Hydrobiidae—Morphometrics. *Astrobiology* 3, xxx–xxx.

INTRODUCTION

EVAPORITIC SYSTEMS are a primary target for astrobiological research because they may have been and still may be a significant environment on Mars and other bodies in the Solar System (for example, Bridges and Grady, 1999; see other papers in this volume of *Astrobiology*). Thermal springs have also been a major target for astrobiological research because of the likelihood of abundant thermal spring environments on early Earth and Mars, the theoretically large range of physiological strategies employed by inhabitants, the high potential for their fossilization, and our

ability to identify these systems through remote sensing (Walter and Des Marais, 1993; Farmer and Des Marais, 1994). Some have even proposed a more recent presence of springs on the surface of Mars (Malin and Edgett, 2000). In addition, both evaporitic and thermal spring systems represent extreme environments, and as such help us to understand the environmental parameters within which life may exist.

In the Chihuahuan desert of Mexico, there is a thermal spring system located within an evaporite basin; while these environments may have been present throughout Earth history, today Cuatro Ciénegas is one of the few desert aquatic sys-