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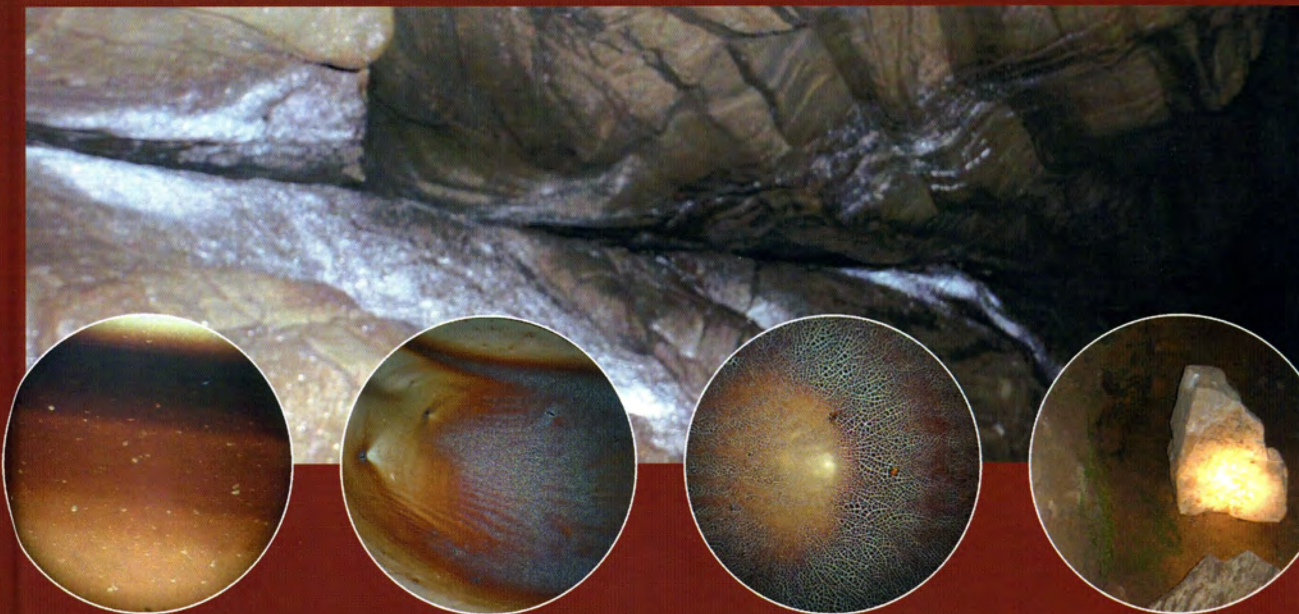

EXTREMOPHILES

Sustainable Resources and Biotechnological Implications

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12

THE USE OF EXTREMOPHILIC MICROORGANISMS IN THE INDUSTRIAL RECOVERY OF METALS

Carlos A. Jerez

Laboratory of Molecular Microbiology and Biotechnology, Department of Biology, and Millennium Institute for Cell Dynamics and Biotechnology, Faculty of Sciences, University of Chile, Santiago, Chile

12.1. INTRODUCTION

The bioleaching of ores, or *biomining*, is the industrial microbial solubilization of ores to extract metals such as copper, gold, uranium, and others (Rawlings, 2005; Watling, 2006; Watling et al., 2010; Jerez, 2011). This process is done using extremophilic chemolithoautotrophic microorganisms that live in extremely acidic conditions (pH 1 to 3.0) and in the presence of very high toxic heavy metal concentrations. When acidophiles oxidize elemental sulfur and reduced sulfur species such as sulfides, sulfites, or polisulfides, they generate sulfuric acid, which acidifies their environment to pH values between 1 and 2 (Suzuki, 1999; Rohwerder et al., 2003). As a consequence, these microorganisms may also have an important impact on the environment, generating serious contamination with acid and toxic metals that can get into water sources as acid mine drainage (AMD) (Schippers, 2007; Jerez, 2009; Mohapatra et al., 2011).

A great variety of microorganisms are present in biomining commercial operations and at AMD sites. Figure 12.1 illustrates hypothetical behavior and the environmental adaptations with which a biomining community of microorganisms is confronted. The detailed molecular knowledge of the physiology of these extremophiles has greatly advanced in recent years, and it is expected that application of these new findings will improve biomining operations (Cárdenas et al., 2010; Watling et al., 2010; Jerez, 2011).

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