

Photosynthesis in extreme environments

M. Barták

2012

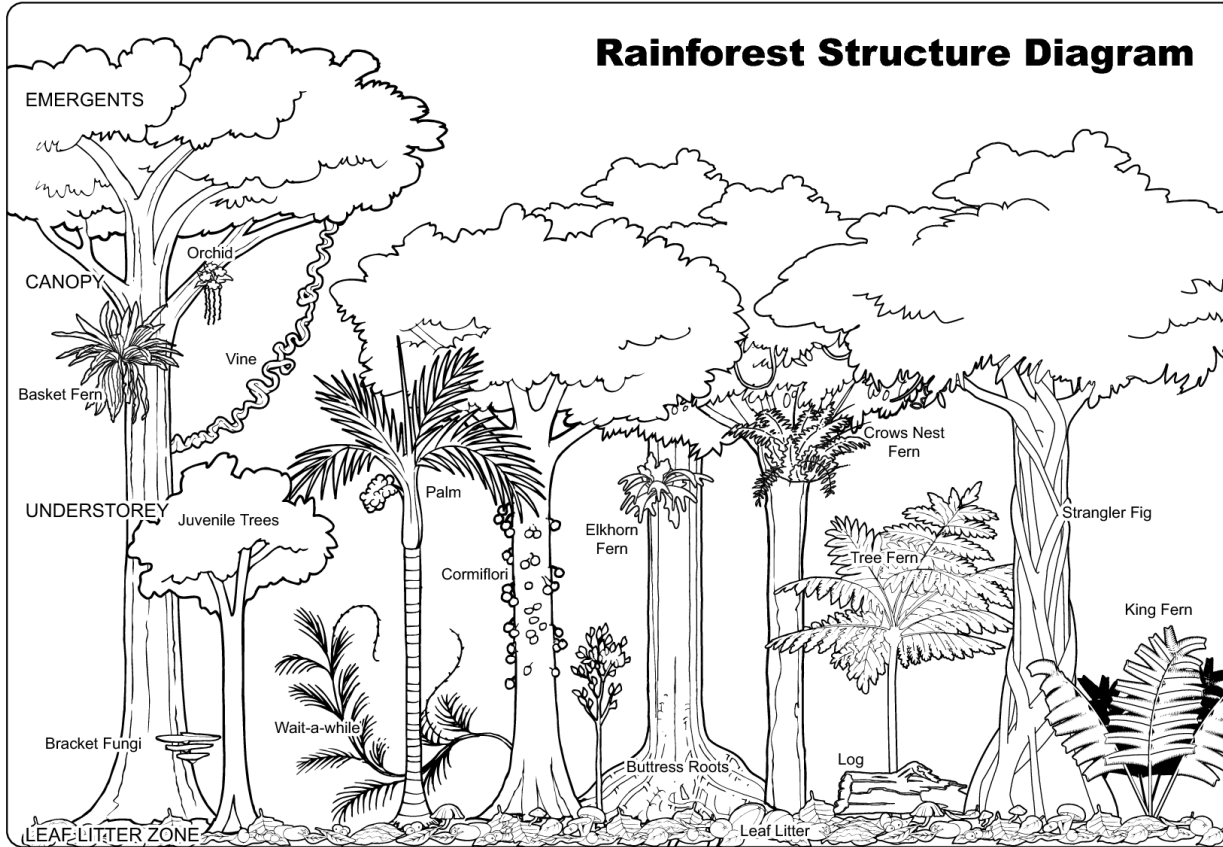
Tolerance ke stínu



Tropický deštný les

Unit 1 - Activity 7 Rainforest Structure Diagram

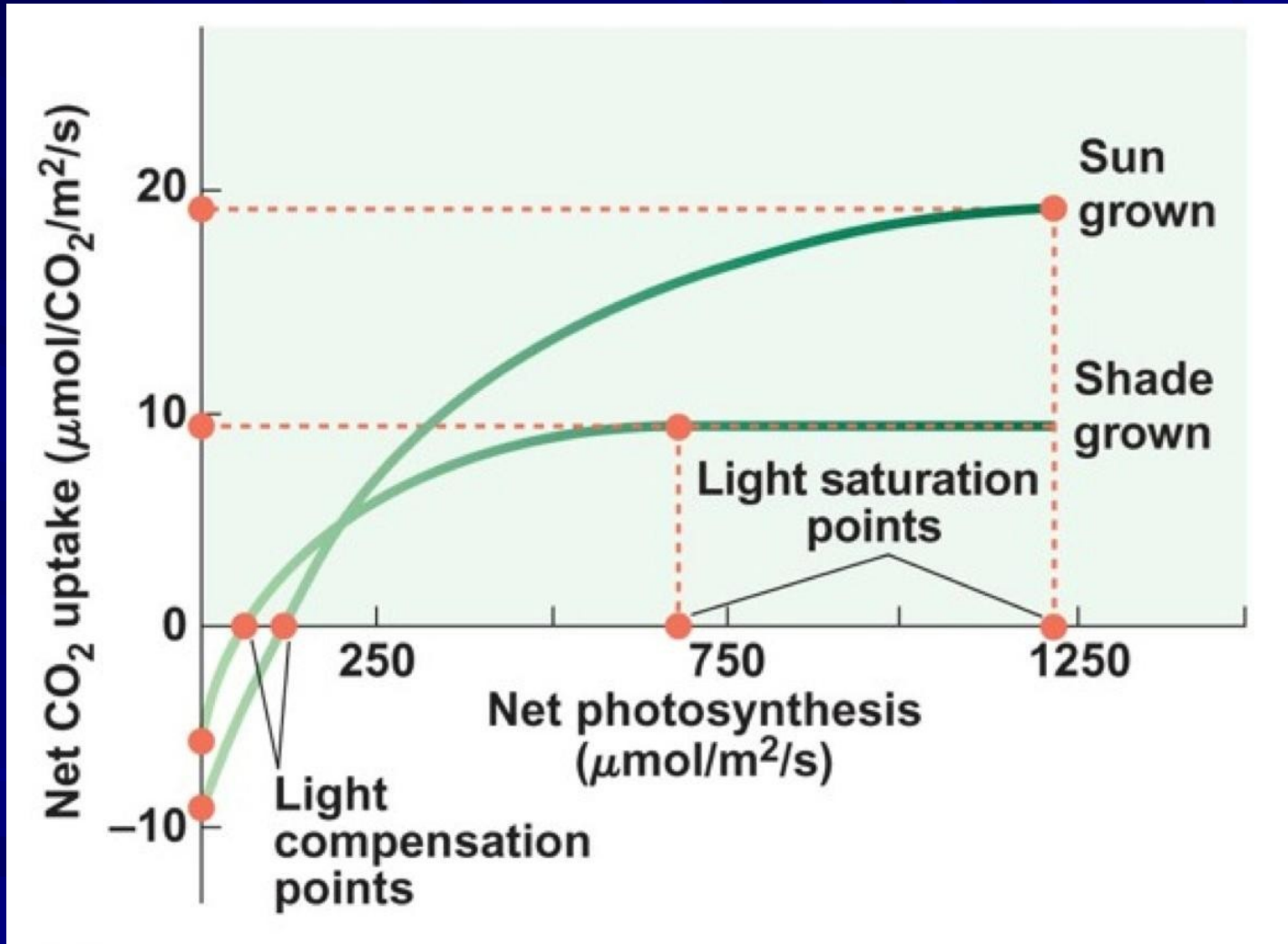
Rainforest Structure Diagram



Wet Tropics Management Authority - Rainforest Explorer



Jak posoudit toleranci na stín



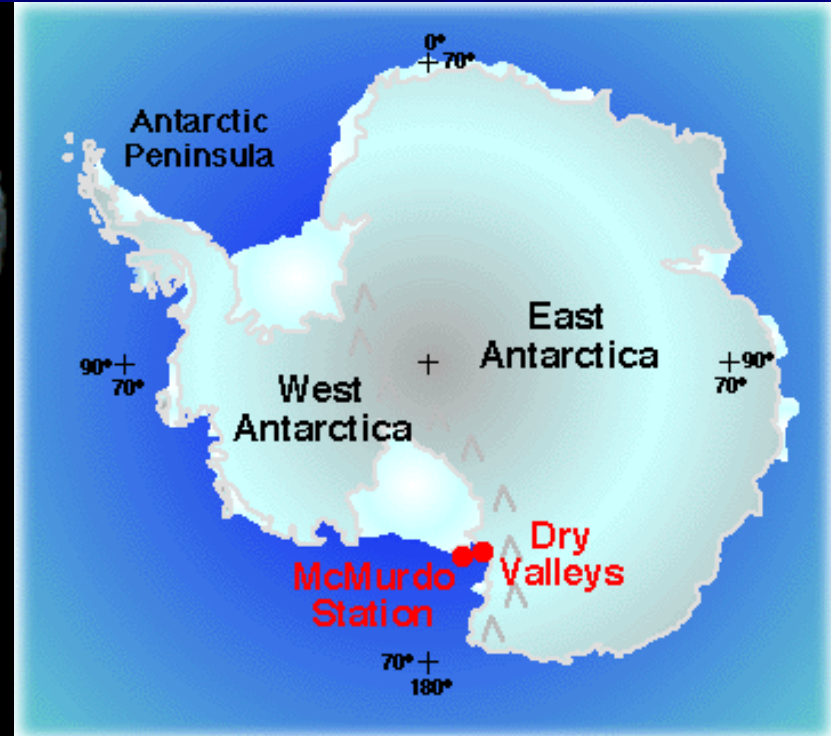
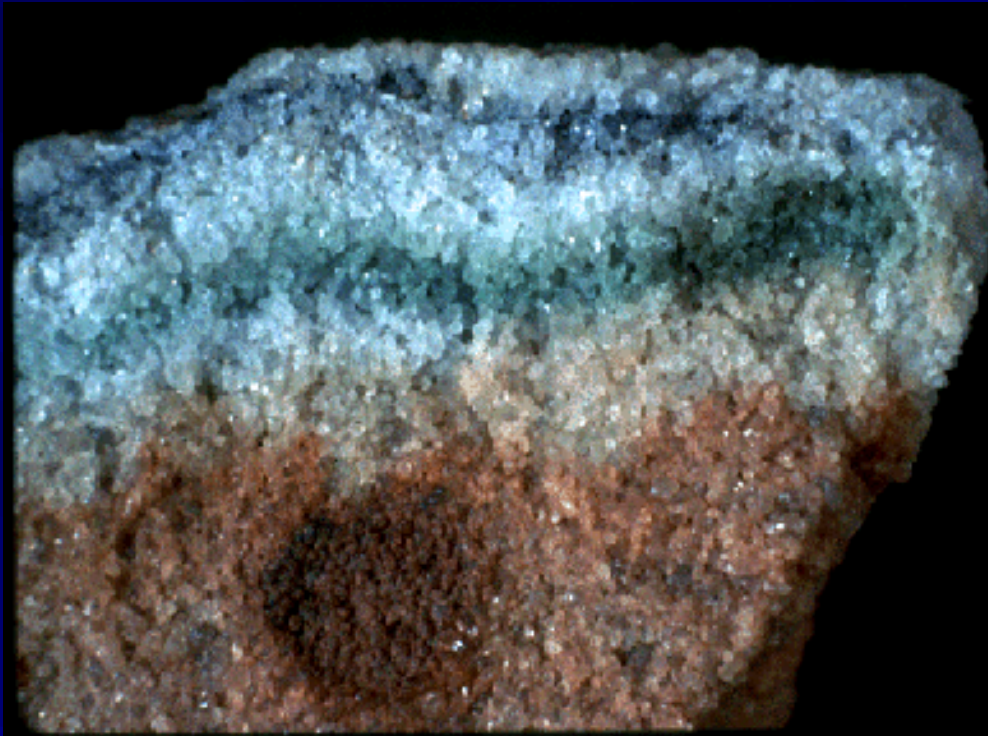


Cryptoendolithic vegetation



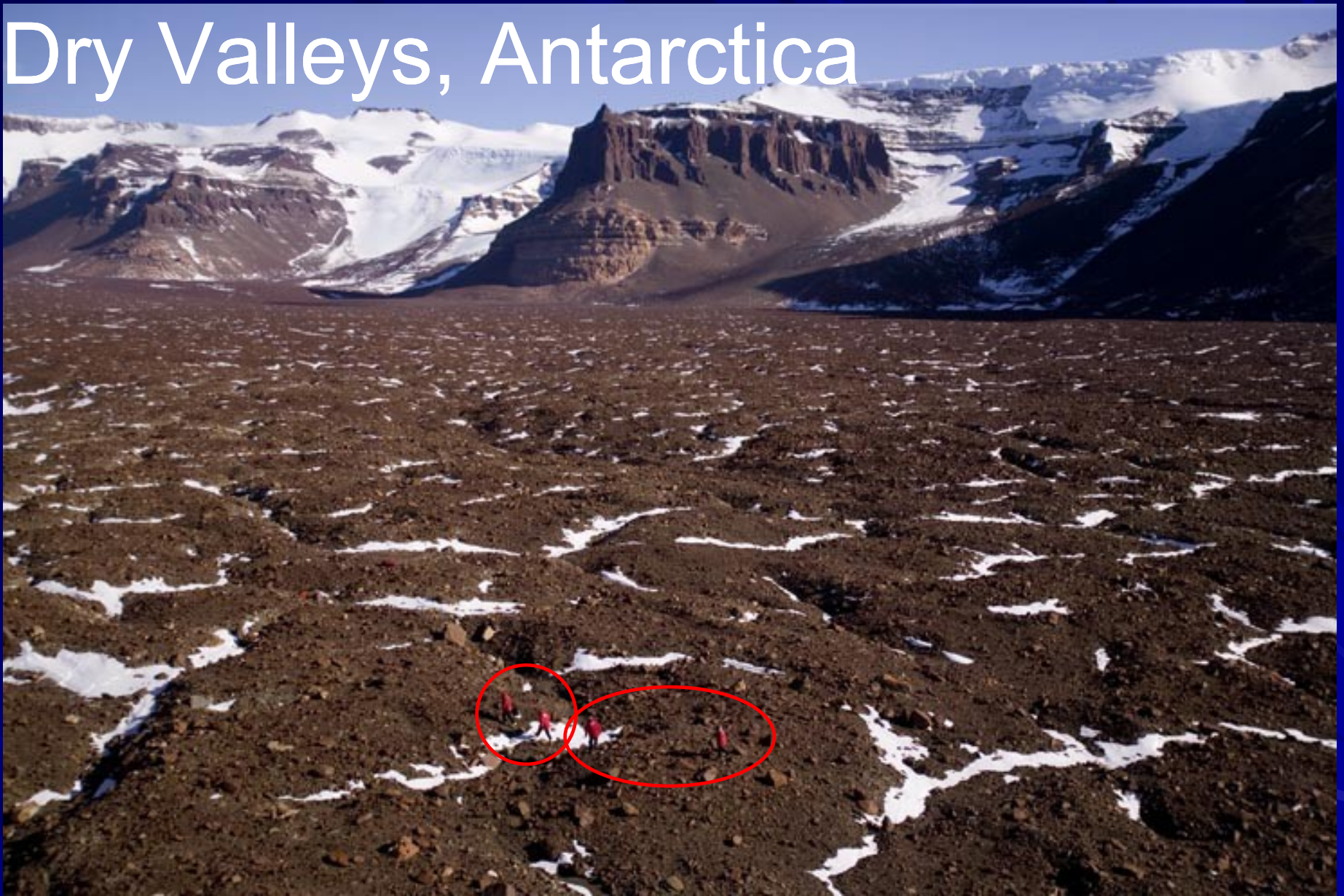
It is a whole ecosystem growing *inside* clear rocks, just a few millimeters under the surface and includes an association of bacteria and algae. It is visible as the green stripe on this split rock. Enough light and water gets through the rock for photosynthesis, and that's all you need to live, right ? Picture size about 5cm.

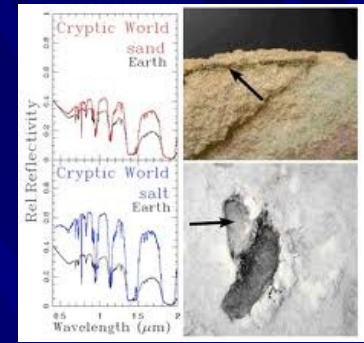
Beacon Sandstone, Dry Valleys, Antarctica



■ <http://www.nsf.gov/pubs/1998/nsf9824/ch7.htm>

Dry Valleys, Antarctica





- The antarctic cryptoendolithic microbial ecosystem lives under sandstone surfaces in the dry valley region (Friedmann and Ocampo, 1976; Friedmann, 1977). It is relatively simple, consisting of cyanobacterial or algal primary producers, fungal consumers, and bacterial decomposers. It lacks animals and, possibly, also archaea. With rock temperatures rising above 0 °C only for a few weeks in the austral summer to allow photosynthetic productivity, this ecosystem is permanently poised on the edge of existence.

Photosynthetic rates

■ Carl G Johnston, J Robie Vestal (1991)

■ Lichens: $4.5 \text{ ng C h}^{-1} \text{ m}^{-2}$

■ Cyanobacteria: $3.0 \text{ ng C h}^{-1} \text{ m}^{-2}$

Please note that sample temperature was 20-30 °C



Rio Tinto (Spain)



The red waters (pH~2) of the Rio Tinto, Spain, coloured red by jarosite [$\text{HFe}_3(\text{SO}_4)_2(\text{OH})_6$] formed by chemolithotrophic iron- and sulfur-oxidizing prokaryotes. Photograph: Extremophiles Lab, CAB, Madrid.

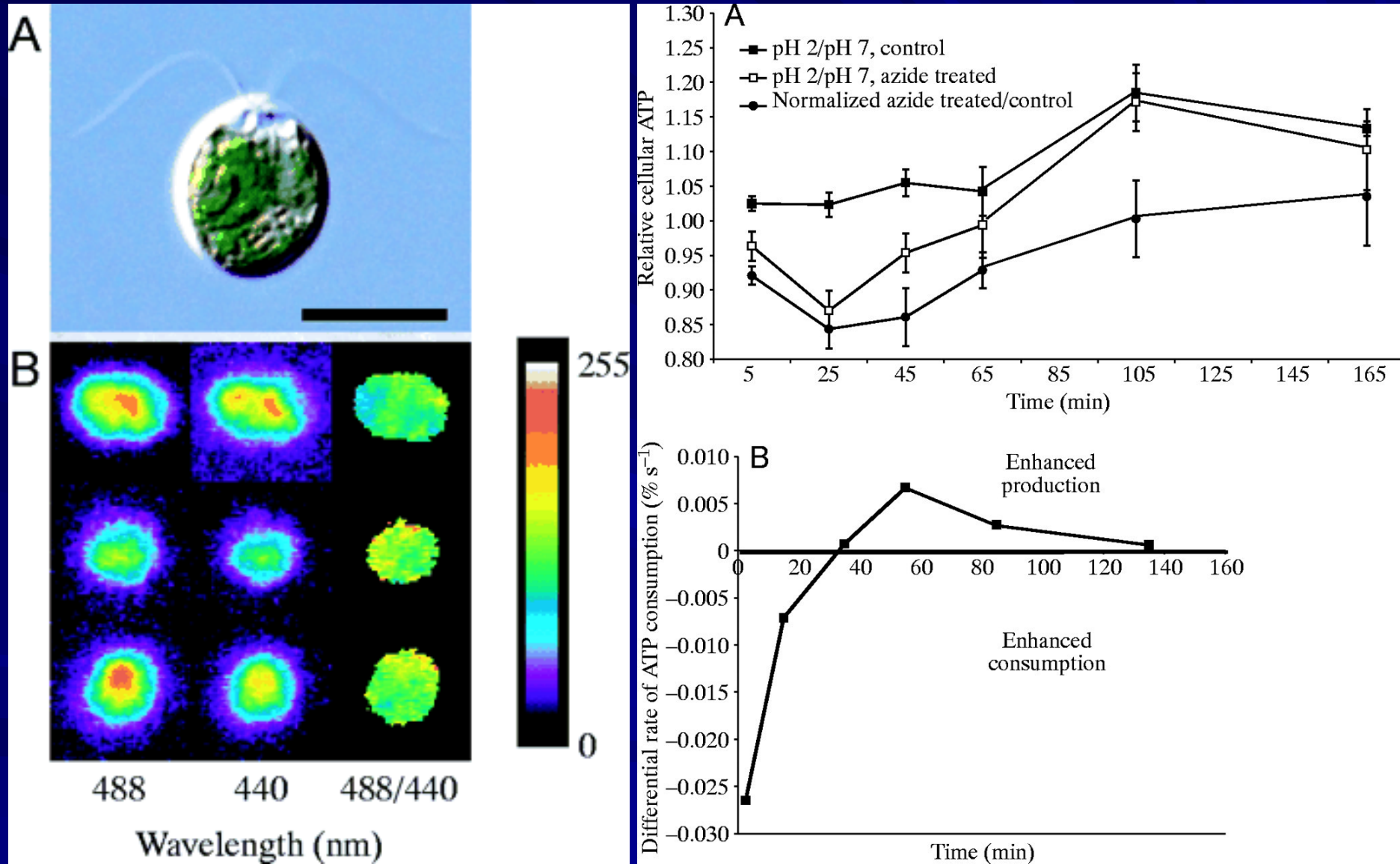
Acidophilic algae

The most important Photosynthetic Primary Producers in the Rio Tinto is Acidophilic Algae. These microbes also require special adaptations to withstand low pH and strong concentrations of heavy metals.

Acidophilic algae accounts for 65% of biomass within the Rio Tinto ecosystem. The organisms identified were

- Bacillariophyceae (Diatoms),
- Chlorophyta (*Chlamydomonas*, *Klebsormidium* and *Zignema*),
- Euglenozoa (*Euglena*),
- Rhodophyta (*Galdieria*)

Chlamydomonas sp. (Rio Tinto)



Messerli et al. (2005): Transmitted light image of *Chlamydomonas* sp. isolated from the Rio Tinto. (B) Pseudocolored images of BCECF fluorescence in *Chlamydomonas* sp.