

## IN MEMORIAM

**Benjamin Elazari Volcani, 1915–1999**

On February 6, 1999, Benjamin Elazari Volcani died in La Jolla, CA, of kidney failure at the age of 84.

With the death of Ben Volcani, the halophile community has lost one of its most illustrious members. It was Ben Volcani who first showed that the Dead Sea is not a sterile lake, too salty to sustain life, but is inhabited by a variety of microorganisms. Under the title “Life in the Dead Sea,” Volcani (then named Wilkansky) published a short note in *Nature* in 1936, describing the isolation of the first halophilic microorganisms from the lake. His studies for a Ph.D. degree in microbiology at the Hebrew University of Jerusalem led to the discovery of different types of bacteria, unicellular algae, and even several kinds of protozoa adapted to life in the Dead Sea. His thesis “Studies on the microflora of the Dead Sea” (1940) was the first thesis ever written in Hebrew.

Among the novel microorganisms isolated by Volcani from the Dead Sea are the archaeon *Haloarcula* (formerly named *Halobacterium*) *marismortui* and several Bacteria, including *Chromohalobacter marismortui* (Ventosa et al. 1989) and *Halomonas halmophila* (Dobson et al. 1990). The generic name *Halobacterium* was first used by Volcani in his Ph.D. thesis, and he consolidated the nomenclature of the genus in his contribution to the 7th edition of *Bergey's Manual for Determinative Bacteriology* in 1957.

In 1939, Ben Volcani became a member of the Sieff Institute in Rehovot, later renamed the Weizmann Institute of Science; he headed its laboratory of microbiology until 1959, when he joined the faculty of the Scripps Institution of Oceanography, University of California at San Diego, where he remained as professor of marine biology until his retirement in 1985. During sabbatical and other leaves he was a research associate at the Institut Pasteur in Paris (1951) and at the University of California, Berkeley (1956–1959), as well as a research fellow at the Hopkins Marine Station of Stanford University, Pacific Grove, CA, the California Institute of Technology, Pasadena, and the University of Wisconsin, Madison. For the past 35 years Ben Volcani's research has been focused on the biological role of silicon in diatoms. He showed that silicon, long thought to be biologically inert, is not only active but is in fact the



basis for a hitherto unknown system of biological mineralization, and is essential in diatoms not only for formation of the siliceous shell but for DNA synthesis itself. His work constituted an exhaustive exploration of the role of silicon in diatoms, from electron microscopy of the shell to the isolation of genes specifying the proteins that transport silicon into the cell.

In his retirement, Ben Volcani returned to research on his beloved Dead Sea and its biota. Bottles with old enrichment cultures that dated from the 1930s and had been stored in his laboratory at Scripps for more than 50 years were opened, and these appeared still to contain a variety of viable microorganisms. Characterization of these cultures was undertaken in collaboration with the group of Antonio Ventosa and David R. Arahal in Seville, Spain, using both classical microbiological techniques and molecular biological tools. These studies have recently led to a number of interesting publications, showing that our understanding of the biodiversity of one of the most extremely hypersaline environments on Earth is still far from com-



Prof. Volcani in his laboratory in 1938

plete. A new species, *Bacillus marismortui*, isolated from these cultures, is described in the April 1999 issue of the *International Journal of Systematic Bacteriology* in a paper coauthored by Ben Volcani (Arahal et al. 1999). Sixty-three years separate the first and the last of Volcani's publications on the forms of life in the Dead Sea. Few scientists can boast such a long and active career.

To honor Volcani's achievements the eubacterial genus *Volcaniella* (Quesada et al. 1990) and the archaeal species *Haloferax volcanii* (Mullakhanbhai and Larsen 1975) have been named after him. His name will thus forever remain linked to two taxa of his beloved halophilic microorganisms.

Ben Volcani is survived by his wife of 50 years, Toni, a son, Yanon, and a grandson.

Aharon Oren – Jerusalem, Israel

Antonio Ventosa – Seville, Spain

- Dobson SJ, James SR, Franzmann PD, McMeekin TA (1990) Emended description of *Halomonas halmophila* (NCMB 1971<sup>1</sup>). *Int J Syst Bacteriol* 40:462–463
- Mullakhanbhai ML, Larsen H (1975) *Halobacterium volcanii* spec. nov., a Dead Sea halobacterium with a moderate salt requirement. *Arch Microbiol* 104:207–214
- Quesada E, Valderrama MJ, Bejar V, Ventosa A, Gutierrez MC, Ruiz-Berraquero F, Ramos-Cormenzana A (1990) *Volcaniella euryhalina* gen. nov., sp. nov., a moderately halophilic nonmotile gram-negative rod. *Int J Syst Bacteriol* 40:261–267
- Ventosa A, Gutierrez MC, Garcia MT, Ruiz-Berraquero F (1989) Classification of “*Chromobacterium marismortui*” in a new genus, *Chromohalobacter* gen. nov., as *Chromohalobacter marismortui* comb. nov., nom. rev. *Int J Syst Bacteriol* 39:382–386

Volcani's publications relevant to the Dead Sea and its biota:

- Wilkansky B (1936) Life in the Dead Sea. *Nature (Lond)* 138:467
- Elazari-Volcani B (1940) Studies on the microflora of the Dead Sea (in Hebrew). Ph.D. thesis, The Hebrew University of Jerusalem, Israel
- Elazari-Volcani B (1940) Algae in the bed of the Dead Sea. *Nature (Lond)* 145:975
- Elazari-Volcani B (1943) Bacteria in the bottom sediments of the Dead Sea. *Nature (Lond)* 152:274–275
- Elazari-Volcani B (1943) A dimastigamoeba in the bed of the Dead Sea. *Nature (Lond)* 152:301–302
- Elazari-Volcani B (1944) A ciliate from the Dead Sea. *Nature (Lond)* 154:335–336
- Bloch MR, Littman HZ, Elazari-Volcani B (1944) Occasional whiteness of the Dead Sea. *Nature (Lond)* 154:402–403
- Bloch MR, Littman HZ, Elazari-Volcani B (1944) Whiteness phenomena at the Dead Sea (in Hebrew). *Hateva* 1:41–43
- Volcani BE (1944) The microorganisms of the Dead Sea. In: Papers collected to commemorate the 70th anniversary of Dr. Chaim Weizmann. Collective volume. Daniel Sieff Research Institute, Rehovoth, pp. 71–85
- Elazari-Volcani B (1957) Genus XII. *Halobacterium* Elazari-Volcani, 1940. In: Breed RS, Murray EGD, Smith NR (eds) *Bergey's manual of determinative bacteriology*, 7th edn. Williams & Wilkins, Baltimore, pp. 207–212
- Oren A, Ginzburg M, Ginzburg BZ, Hochstein LI, Volcani BE (1990) *Haloarcula marismortui* (Volcani) sp. nov., nom. rev., an extremely halophilic bacterium from the Dead Sea. *Int J Syst Bacteriol* 40:209–210
- Arahal DR, Dewhirst FE, Paster BE, Volcani BE, Ventosa A (1996) Phylogenetic analyses of some extremely halophilic Archaea isolated from Dead Sea water, determined on the basis of their 16S rRNA sequences. *Appl Environ Microbiol* 62:3779–3786
- Ventosa A, Arahal DR, Volcani BE (1997) Studies on the microbiota of the Dead Sea – fifty years later. In: Abstracts of the research workshop of the Israel Science Foundation on microbiology and biogeochemistry of hypersaline environments, Jerusalem, p. 34
- Ventosa A, Arahal DR, Volcani BE (1998) Microbial diversity in the Dead Sea in 1936. In: Abstracts of the eighth international symposium on microbial ecology, Halifax, p. 338
- Ventosa A, Arahal DR, Volcani BE (1999) Studies on the microbiota of the Dead Sea – 50 years later. In: Oren A (ed) *Microbiology and biogeochemistry of hypersaline environments*. CRC Press, Boca Raton, pp. 139–147
- Arahal DR, Márquez MC, Volcani BE, Schleifer KH, Ventosa A (1999) *Bacillus marismortui* sp. nov., a new moderately halophilic species from the Dead Sea. *Int J Syst Bacteriol* 49:521–530