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Life in the Valley of the "Dead"

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A SPECIAL ISSUE DEVOTED TO THE MCMURDO DRY VALLEYS, ANTARCTICA

When Captain Robert F. Scott first observed the upper Taylor Valley region of the McMurdo Dry Valleys in December 1903, he wrote, "It is worthy to record, too, that we have seen no living thing, not even a moss or a lichen; all that we did find, far inland amongst the moraine heaps, was the skeleton of a Weddell seal, and how that came there is beyond guessing. It is certainly a valley of the dead; even the great glacier which once pushed through it has withered away" (Scott 1905, p. 217). Little did Scott realize that life was teeming around him in the form of microbes within rocks, soils, dry streambeds, ice, and the liquid water beneath permanent lake ice.

The realization that there was life in this unique environment did not come to light until the seminal investigations of the late 1950s and early 1960s, which were initiated by the International Geophysical Year of 1958. Biological studies during this period were exploratory in nature, describing microbial life forms and their habitat. This early exploration paved the way for quantitative studies on the physiology and ecology of this microbially dominated system, which began in earnest in the late 1970s. Studies from the late 1970s through the early 1990s yielded many clues about the organisms present in the dry valleys, their survival strategies, and their roles in specific biogeochemical pathways. It soon became evident that a multidisciplinary effort among physical, chemical, and biological scientists was necessary to unravel the many variables controlling the structure and function of the dry valley ecosystem.

The National Science Foundation funded the McMurdo Long-Term Ecological Research (LTER) program in 1993 as an "end-member" ecosystem within the already well established network of sites. The focus of the first 6 years of the McMurdo LTER program was to examine how physical and chemical characteristics had molded the biology of the Taylor Valley and surrounding region. Near the end of this research period, it became apparent that the contemporary biological structure is a function of natural legacies left behind from periods when the climate was much different. Many of the organic carbon and nutrient pools that drive both autotrophic and heterotrophic processes in the McMurdo Dry Valleys were deposited approximately 10,000 years ago, when a large lake invaded the Taylor Valley. With this knowledge, the second 6-year research cycle for the McMurdo Dry Valley LTER is focusing on the role of natural resource legacy on contemporaneous ecosystem structure and function.

The five articles in this special issue were written by investigators involved with the McMurdo LTER project. All of these articles review past research in the McMurdo Dry Valleys and end with the current state of knowledge. Fountain et al. (1999) focus on the physical controls of the overall ecosystem and provide the spatial and temporal setting for the other articles. Wall and Virginia (1999), McKnight et al. (1999), and Priscu et al. (1999) examine the role of natural legacy on contemporaneous soil, stream, and lake processes, respectively. Finally, Moorhead et al. (1999) examine fluctuations in climate, geology, hydrology, and biogeochemistry in an effort to elucidate functional linkages between the modern-day ecosystem and the legacy left by the ecosystems of the past.

It is clear from the information in these articles that the present ecological setting in the McMurdo Dry Valleys is dependent on historical events in concert with current physical forces. The articles also show that the presence of liquid water in unique locations, and often in minute quantities, produces a cascade of ecological events that sustains life and produces the present-day ecosystem linkages described in this issue.

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