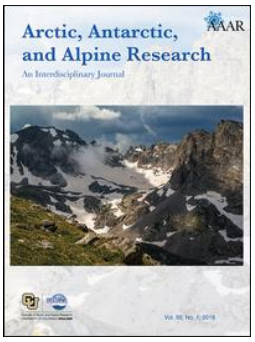


Arctic and Alpine Research

ISSN: 0004-0851 (Print) 2325-5153 (Online) Journal homepage: https://www.tandfonline.com/loi/uaar19

Preface

D. C. Ford

To cite this article: D. C. Ford (1983) Preface, Arctic and Alpine Research, 15:4, 425-426

To link to this article: https://doi.org/10.1080/00040851.1983.12004370

Arctic and Alpine Research, Vol. 15, No. 4, 1983, pp. 425–426

PREFACE

The essence of the karst geomorphic and hydrologic system is that runoff waters are routed underground via solutional conduits. This characteristic limits true karst development to comparatively soluble rocks: limestone and dolomite, gypsum and anhydrite, and salt. Perhaps because they are concerned with only a few rocks (primarily limestone), karst specialists have pressed farther than most the concept that land form, extent, and rate of genesis varies principally because of climatic variations from place to place. Three major climatic types of karst assemblage are recognized by a majority of authors: the humid tropical, the temperate and mediterranean, and the arctic and alpine. The last is held to be the most restricted in its nature and scale because of competing glacial and periglacial processes. Karst does, indeed, appear to be very limited in high arctic localities. However, it is now reported from limestone terrains in every alpine mountain region.

It is true to write that, in many respects, the karst about Castleguard Mountain, Banff National Park, Alberta, is the most important alpine karst known. It is the key locality. This is because more than half of the modern karst area is overlain by the characteristic suite of alpine glacial ice bodies, namely cirque and valley glaciers and a highland ice cap, and because it is possible to follow a great cave beneath them. Castleguard Cave ramifies for several kilometers underneath the Columbia Icefields, the largest remaining ice mass in the Rocky Mountains. At all other reported alpine karst sites, glaciers are now vestigial and decoupled from the karstic systems, or the ice is gone entirely. Researchers must infer glacial impacts upon, and interactions with, the karst from relict evidences only.

The first European visitors to the Castleguard area were explorers and mountaineers at the turn of the century. In 1918 it was well photographed by an Alberta–British Columbia boundary survey party. By 1923 the entrance to the cave was known, as was the fact that floods might spill suddenly and violently from the cave in summer. Big springs jetting from the rock 270 m below the cave were also found. These two places became regular stops on a popular pack train tour that passed up the Alexandra and Castleguard valleys, climbed to Castleguard Meadows, and returned to the Banff-Jasper road via Saskatchewan Glacier. The tours continued until the late 1960s, but accounts contain no more than cursory mention of the cave mouth and springs and no other description of the karst.

The first visit by McMaster University parties and associates was in July 1967. One hundred meters inside the cave is an 8-m shaft that appears to have stopped all previous visitors. This was descended, and a very grim, cold series of floodwater passages beyond was passed to gain a large, attractive cave. Returning from a penetration of 7 km, the two lead explorers were briefly trapped by a small rise of waters in the entrance area, and they and a rescue party very narrowly escaped prolonged trapping by a major flood that started 4 h later. Since that occasion, all exploration and topographic and scientific work in Castleguard Cave has been conducted in the winter months, usually April. There have been seven such expeditions since 1968, and an eighth is in progress as this Preface is being written.

Surface karst features were explored and studied in the summers of 1968 and 1969; results were reported in *Arctic and Alpine Research* in 1971. Some lesser surface work was done in following years, then in 1979 a major, instrumented study of the modern karst hydrology was launched.

Much data and opinion of diverse scientific interest were gathered by the successive summer and winter parties. At the 8th International Congress of Speleology (Kentucky, 1981) an attempt was made to bring it all together in a one-day symposium. The series of papers presented in this issue of *Arctic and Alpine Research* arise from our reflections upon that meeting, plus some later fieldwork and modeling that they stimulated.

The papers deal with one small geographical area and are presented in an ordered sequence. The first provides geographical background information. The next three deal with past conditions, treating the erosional genesis of the cave and karst, clastic fillings in the cave, and its antiquity as established by U-series and paleomagnetic analyses of calcite speleothems.

The remaining papers are concerned with modern conditions and processes in the karst. C. C. Smart summarizes and interprets the modern groundwater system. T. C. Atkinson and others describe and model the climate of the cave, introducing (among other features) the first applications of measured radon flux to cave climatology. R. S. Harmon and others survey the rich and diverse secondary mineralogy of the cave. This is an aesthetic delight, and a substantial scientific puzzle because deposits are growing vigorously in extreme limiting conditions where little or no deposition might be expected. J. Roberge and D. Caron interpret one nearly unique feature, a cluster of cubical "cave pearls." In separate papers, T. C. Atkinson and M. Gascoyne with D. E. Nelson then offer explanations for calcite deposition in rock overlain by temperate glaciers. J. Holsinger and others describe the cave-adapted aquatic fauna found in pools throughout the system. Again, these appear to be surviving in extreme limiting conditions, and it is suggested that they have done so for more than 100,000 years; a "subglacial refugium" hypothesis is offered.

GENERAL ACKNOWLEDGMENTS

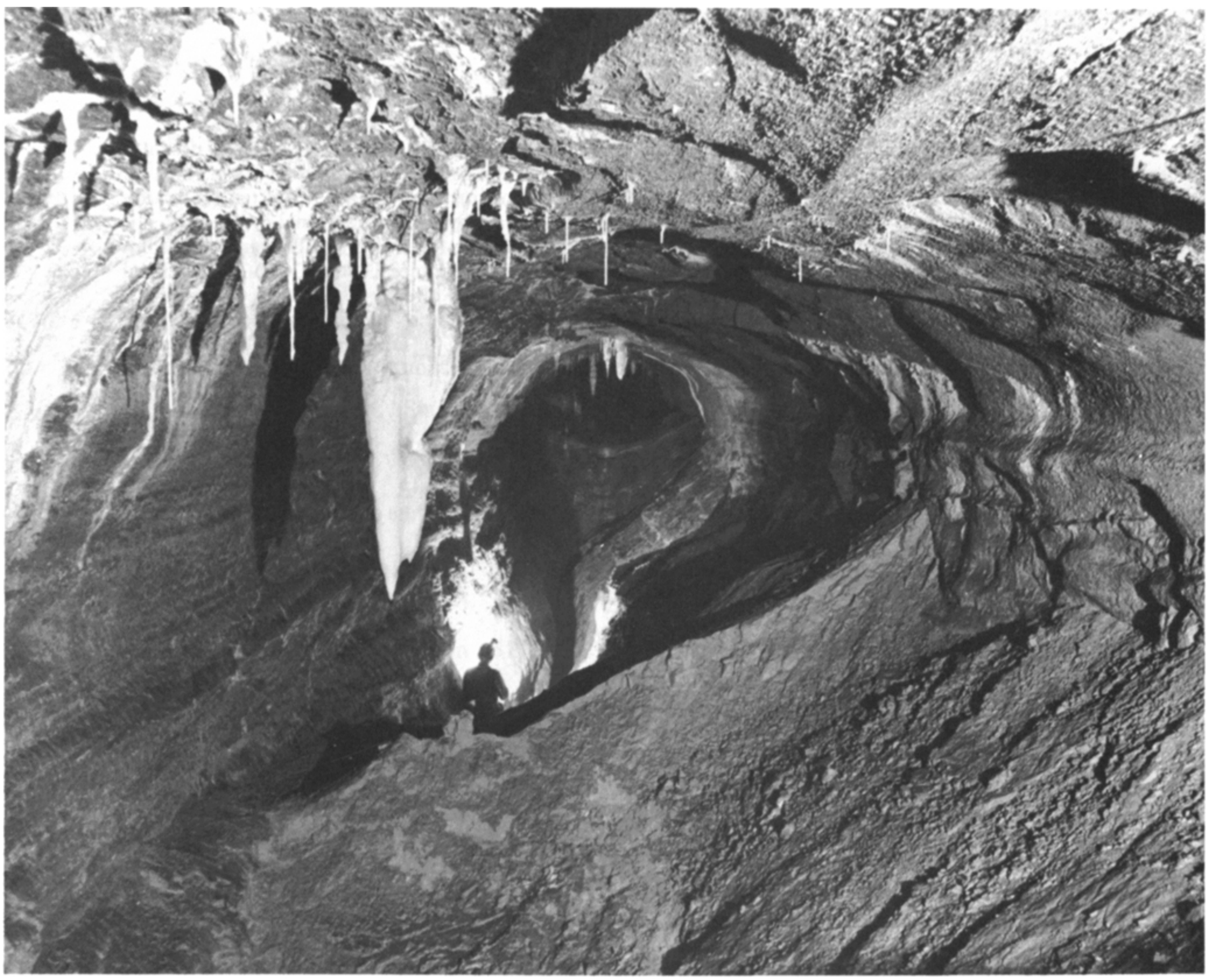
All authors will acknowledge their primary debt to their companions in the field, particularly in Castleguard Cave. It is a severe and dangerous place, yet there has never been a lack of volunteers to work very hard for no monetary gain. More than 50 different individuals have participated there. In particular we acknowledge the two principal explorers, Michael Boon and Peter Thompson. We remember with sadness Gary Pilkington and George Tracey, two good friends who were killed in mountaineering and caving accidents elsewhere.

Parks Canada officers at Banff, Calgary (Western headquarters) and Ottawa (national headquarters), have always been most helpful, although justifiably concerned as we took ourselves far beyond the reach of their mountain rescue services. Several Parks officers have been deep into the cave with us. In particular, we thank Tommy Ross of Banff Park and Dalton Muir, formerly with the headquarters staff.

Financial aid for the work has come primarily from the Natural Sciences and Engineering Research Council of Canada (former National Research Council), as research grants to Ford. Parks Canada were also generous in the earlier years and latterly have given aid in kind, such as the loan of base camp tents. A major scientific expedition to the cave in 1980 was generously supported by the Crestview Foundation of Calgary, Hudson's Bay Oil and Gas Company, and the Royal Geographical Society of Canada.

D. C. FORD

ARCTIC and ALPINE RESEARCH



Holes-in-the-Floor passage, Castleguard Cave, Banff National Park, Alberta. This scene is 500 m beneath a cirque glacier on the southwest side of Castleguard Mountain and abuts the Columbia Icefields. The passage is a multiphase feature comprising an upper phreatic tube that is entrenched by a later invasion water canyon. Canyon and tube contain the remains of at least three fillings with varved silts and clays. Large, ornate stalactites and smaller, soda-straw stalactites represent several phases of calcite deposition. (Photo by D. C. Ford.)