A final criticism concerns the incompleteness of the bibliography. At many places, McGoogan quotes from books by members of Kane's second expedition, including Robert Goodfellow, Hans Hendrick, Christopher Hicky, and Amos Bonsall, but not one of these works appears in the bibliography. Admittedly this is termed a "Select Bibliography," but it certainly ought to contain all the works from which McGoogan has quoted.

In short, while the uncritical reader may perhaps find this "a good read," the discerning reader will soon detect that this biography has been rather carelessly researched.

REFERENCES

Blake, E.V., ed. 1874. Arctic experiences: Containing Capt. George E. Tyson's wonderful drift on the ice-floe, a history of the *Polaris* expedition, the cruise of the *Tigress* and rescue of the *Polaris* survivors. New York: Harper & Brothers.

Bolles, E.B. 1999. The ice finders: How a poet, a professor and a politician discovered the Ice Age. Washington, D.C.: Counterpoint.

Chorley, R.J., Dunn, A.J., and Beckinsale, R.P. 1964. The history of the study of landforms, Vol. 1. London: Methuen & Co.

De Veer, G. 1876. The three voyages of Willem Barents to the Arctic regions (1594, 1595, and 1596), 2nd ed. London: Hakluyt Society.

Imbrie, J., and Imbrie, K.P. 1979. Ice ages: Solving the mystery. Cambridge, Massachusetts: Harvard University Press.

Kane, E.K. 1853. The U.S. Grinnell Expedition in search of Sir John Franklin: A personal narrative. New York: Harper & Brothers.

———. 1856. Arctic explorations: The second Grinnell Expedition in search of Sir John Franklin, 1853, '54, '55. Philadelphia: Childs & Peterson.

Payer, J. 1876. New lands within the Arctic Circle. Narrative of the discoveries of the Austrian ship "Tegetthoff" in the years 1872–1874. London: Macmillan.

William Barr
The Arctic Institute of North America
University of Calgary
Calgary, Alberta T2N 1N4, Canada
wbarr@ucalgary.ca

RIVER ICE BREAKUP. Edited by SPYROS BELTAOS. Highlands Ranch, Colorado: Water Resources Publications, LLC, 2008. ISBN 978-1-887201-50-6. xvi + 462 p., colour & b&w illus., references, index. Hardbound. US$85.00.

This publication was sponsored by the Canadian Society for Civil Engineering and Canadian Committee on River Ice Processes and the Environment (Hydrology Section of the Canadian Geophysical Union). The intent of this book was to update an earlier (1995) publication and bring together a substantial body of knowledge that had been published in a wide assortment of conference proceedings, technical reports, scientific journal articles, and books and to identify key gaps in current knowledge.

The book attempts to bridge the gap between earlier, largely empirical, approaches to studying river ice breakup and more recent theoretical approaches, with emphasis on prediction. The theoretical approach uses quantitative application of the thermodynamics of heat transfer, hydrology, hydraulics, and ice mechanics. Beltaos acknowledges both the complexity of predicting these processes and the typical lack of detailed information on channel geometry, bathymetry, stream bed slope and tortuosity, hydraulics, and hydrology, which require a balance between using quantitative approaches and applying qualitative or empirical relations. Engineers and water resource managers will find many examples of how to apply quantitative approaches using approximations or empirical relations to estimate requisite variables where local data are lacking. In this sense, the book succeeds in its primary objective of providing a framework for obtaining and applying a better understanding of river ice breakup that can be practically applied even when data are incomplete.

This book synthesizes a large body of scientific work on river ice dynamics, with chapters written by experts in their respective disciplines. The book begins with an introduction describing the significance of ice breakup and the potential for flooding and risks to public safety and infrastructure. The following chapters give qualitative descriptions of the river ice cycle on Canadian rivers (Chapter 2), the breakup process (Chapter 3), and heat transfer and ice decay (Chapter 4). Chapters 5 to 8 describe and quantify the processes of pre-breakup, the onset of breakup, ice jamming, and ice jam releases. Particularly informative is Chapter 6 on the onset of breakup, which draws heavily on early Russian literature that would be difficult for most readers to access. The conditions favoring formation of ice jams and subsequent dynamic ice structural failure, breakup, and potential flooding are described in detail and in contrast to the conditions favoring a more gradual thermal decay. The chapters on ice jamming and breakup contain many excellent figures illustrating the physical concepts discussed. Of special significance is the discussion of the potentially very destructive flood waves (javes) that can accompany breakup of major river ice jams.

Chapter 9 deals with the development of ice-affected river stage (water level) frequency curves, or the probability that a given stage will be exceeded. It is noteworthy that the presence of ice can result in stages well above those predicted during open water conditions, and consequently, the presence of ice can greatly increase the risk of flooding. Chapter 10 is a synthesis of the previous chapters towards the ultimate goal of forecasting ice breakup. The final two chapters deal with ecological effects (Chapter 11) and river ice breakup in the context of a changing climate (Chapter 12).

The book contains many useful examples of practical implications of the quantitative relations governing ice

breakup. For example, in considering the importance of water level at time of freeze-up for the severity of eventual ice breakup, Beltaos notes that when freeze-up occurs at low water levels, moderate to high spring flows will produce a breakup of moderate severity. However, freeze-up occurring at higher water levels, coupled with high spring runoff, can result in the most dangerous situation, since ice jams can persist until very high water levels and flows are attained during breakup. Another example is the computation of safe levels of flow release from upstream dams and reservoirs to avoid catastrophic jamming and breakup. It is noted that ice breakup can have dramatic effects on bank erosion and the mobilization and transport of sediments.

Although this book is comprehensive in its treatment of river ice breakup, coverage is weak in some areas, most notably in the discussion of impacts related to climate change. The potential impacts of dam regulation for management of hydroelectric power or dam removal are dealt with only superficially. Similarly, the chapter on river ice breakup and river ecology might be considered superficial, but, in defense of the book, apparently little work has been published on the geomorphology and aquatic biology of river ice breakup.

Chapter 12, which focuses on climate change and its impacts on river ice, is brief for such an important factor in river ice breakup. Readers would do well to supplement their reading on this topic by consulting recent publications of the IPCC (Lemke et al., 2007; Trenberth et al., 2007; Bates et al., 2008) or the Arctic Climate Impact Assessment (ACIA, 2004). There is a rich literature on climate change and hydrologic and cryospheric responses that is scarcely addressed in this chapter. Notable are the many examples of river ice regime responses, including trends in the timing and duration of seasonal river ice cover (Smith, 2000; Yoo and D'Odorico, 2002; Hodgkins et al., 2005; Jiang et al., 2008). There are also examples of trends in river ice thickness in apparent response to climate warming that are not mentioned in this chapter (Yang et al., 2002; Huntington et al., 2003; Punsalmaa et al., 2004). River water temperatures have also been shown to be increasing in some ice-affected rivers (Huntington et al., 2003; Webb and Nobilis, 2007). The ratio of snow to total precipitation has decreased in the United States (Huntington et al., 2005; Knowles et al., 2006) while in Canada this ratio has increased in most locations, but decreased in parts of southern Canada (Zhang et al., 2000). These trends in winter precipitation are likely to affect the timing, duration, and severity of breakup.

This book is well written, informative, and very accessible to a diverse readership. The printing of text, figures, and illustrations is of consistently high quality throughout. The book contains many interesting photographs, some in color, as well as scientific figures, equations, and schematic diagrams. The index and the extensive and diverse bibliography will be particularly useful to readers. I would recommend this book for students, water resource managers and engineers, emergency management officials, and those concerned with the planning and management of river corridors where ice breakup is an issue.

REFERENCES

ACIA. 2004. Impacts of a warming Arctic: Arctic climate impact assessment. Cambridge: Cambridge University Press. 139 p.

Bates, B.C., Kundzewicz, Z.W., Wu, S., and Palutikof, J.P. 2008. Climate change and water. Technical Paper of the Intergovernmental Panel on Climate Change. Geneva: IPCC Secretariat. 210 p.

Hodgkins, G.A., Dudley, R.W., and Huntington, T.G. 2005. Changes in the number and timing of ice-affected flow days on New England rivers, 1930–2000. Climatic Change 71: 319–340.

Huntington, T.G., Hodgkins, G.A., and Dudley, R.W. 2003. Historical trend in river ice thickness and coherence in hydroclimatological trends in Maine. Climatic Change 61: 217–236.

Huntington, T.G., Hodgkins, G.A., Keim, B.D., and Dudley, R.W. 2005. Changes in the proportion of precipitation occurring as snow in New England (1949 to 2000). Journal of Climate 17:2626–2636.

Jiang, Y., Dong, W., Yang, S., and Ma, J. 2008. Long-term changes in ice phenology of the Yellow River in the past decades. Journal of Climate 21:4879–4886.

Knowles, N., Dettinger, M.D., and Cayan, D.R. 2006. Trends in snowfall versus rainfall for the western United States. Journal of Climate 19:4545–4559.

Lemke, P., Ren, J., Alley, R.B., Allison, I., Carrasco, J., Flato, G., Fujii, Y., et al. 2007. Observations: Changes in snow, ice and frozen ground. In: Climate change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.

Punsalmaa, B., Nyamsuren, B., and Buyndalai, B. 2004. Trends in river and lake ice in Mongolia. In: Assessments of impacts and adaptations to climate change (AIACC). Working Paper No. 4. Available at www.aiaccproject.org. Washington, D.C.: AIACC.

Smith, L.C. 2000. Trends in Russian Arctic river-ice formation and breakup, 1917 to 1994. Physical Geography 21:46–56.

Trenberth, K.E., Jones, P.D., Ambenje, P., Bojariu, R., Easterling, D., Tank, A.K., Parker, D., et al. 2007. Observations: Surface and atmospheric climate change. In: Climate change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press. 235–336.

Webb, B.W., and Nobilis, F. 2007. Long-term changes in river temperature and the influence of climatic and hydrologic factors. Hydrological Sciences Journal 52:74–85.

Yang, D., Kane, D.L., Hinzman, L., Zhang, X., Zhang, T., and Ye, H. 2002. Siberian Lena River hydrologic regime and recent change. Journal of Geophysical Research 107(D23), 4694, doi:10.1029/2002JD002542.

Yoo, J.C., and D'Odorico, P. 2002. Trends and fluctuations in the dates of ice break-up of lakes and rivers in northern Europe: The effect of the North Atlantic Oscillation. Journal of Hydrology 268:100–112.

Zhang, X., Vincent, L.A., Hogg, W.D., and Niitsoo, A. 2000. Temperature and precipitation trends in Canada during the 20th century. Atmosphere-Ocean 38:395–429.

Thomas Huntington
Bigelow Laboratory for Ocean Sciences
180 McKown Point Rd.
West Boothbay Harbor, Maine 04575, USA
thunting@usgs.gov

THE OLD WAY NORTH: FOLLOWING THE OBERHOLTZER-MAGEE EXPEDITION. By DAVID F. PELLY. St. Paul, Minnesota: Borealis Books, 2008. ISBN 978-0-87351-616-7. xvi + 197 p., maps, b&w illus., selected bib., index. Hardbound. US$27.95.

In 1912, a young American graduate of Harvard, Ernest Oberholtzer, along with an Anishinaabe man from the Rainy Lake District of Ontario, named Taytáhpahswáywetong, but called Billy Magee, made an extraordinary 2000-mile canoe journey beginning at The Pas, Manitoba. They went north up Reindeer Lake to Brochet, through the Barrens, paddling the length of Nueltin Lake and down the Thlewiaza River to Hudson Bay, where they turned south and finally reached Gimli, Manitoba, in a race against the approaching winter. The northern part of the route was unmapped and had been previously travelled mainly by the Chipewyan and Inuit people. It was a time of heroic exploration: Peary had recently claimed to have reached the North Pole, Amundsen had conquered the Northwest Passage, and the world had just learned of the death of Robert Scott on his return from the South Pole. Oberholtzer was inspired by the writings of Canadian surveyor and geologist J.B. Tyrrell, who in his work for the Geological Survey travelled the Dubawnt and Thelon rivers in 1893 and the Kazan and Ferguson rivers in 1894. His report of both surveys, published in 1898, contains descriptions of the region the young American hoped to explore.

David Pelly's book, *The Old Way North*, is not a mere recounting of the Oberholtzer expedition, but instead uses it as a framework for a detailed exploration of the area travelled, particularly the part from Reindeer Lake, on the border between Saskatchewan and Manitoba, north to Nueltin Lake, which straddles the border of Manitoba and the North West Territories (today's Nunavut)—the true Barren Lands.

While the fur trade was firmly established in this area by 1912, represented by both the Hudson's Bay Company and Revillon Frères, Oberholtzer's trip was a forerunner of the kind of adventure travel that would come much later. The area was a no-man's-land where the Inuit and Chipewyan, using different strategies, depended for their livelihood on the caribou: "Whereas the Inuit positioned their camps at likely caribou crossings and waited, the Dene [Chipewyan] were more inclined to simply follow the caribou in their migration, not unlike a pack of wolves" (p. 64). The hostility between them made it difficult for anyone to find a guide to conduct him through the territory.

Pelly does a kind of time-travel through the history of the area, going back to the time of Samuel Hearne in the 18th century and up to the descriptions of Bill Layman, who is still canoeing the area today. The narrative ranges from the mid-19th century, when the Roman Catholic mission was established in the village of Brochet at the head of Reindeer Lake, to the travels of American P.G. Downes, who in 1939 covered some of the same route traveled by Oberholtzer and Magee 27 years earlier. Pelly traces centuries of nomadic movement of the Chipewyan, the Inuit, and the Cree as they followed the caribou across the land, sometimes in co-operation and sometimes in hostility, and then leaps forward to the period between World War I and World War II, when white trappers invaded the area in their quest for the white fur of the arctic fox.

David Pelly's connections to the North are long and deep. His ancestor John Henry Pelly was the governor of the Hudson's Bay Company for 30 years in the early 19th century. In addition to his canoe trips in the North, Pelly has lived in Baker Lake and Cambridge Bay, working closely with the local people, and he obviously relishes his contacts with them. In the preparation of this book, he travelled to Brochet and to Arviat on the Hudson Bay coast: Brochet was the last settlement at which Oberholtzer made his final, unsuccessful attempt to hire a guide for the journey, and Arviat—then known as Eskimo Point—is at the mouth of the Thlewiaza River, where the pair of canoeists miraculously met Inuit who took them south to the Hayes River, thus saving their lives. Pelly had with him some of Oberholtzer's 1912 photographs, and he found current residents of both communities who were able to identify some of their ancestors.

The book is like a medieval tapestry, filled with people and incidents, all connected by different-coloured threads of relationship. Pelly had set out to celebrate the natural and cultural history of one of the least known areas of the North, and he has achieved his aim magnificently. As in a tapestry, the connections are sometimes hard to follow, but with patience and persistence, the whole picture gradually emerges.

There are no reference citations in the book, only a few explanatory footnotes to clarify a point. Occasionally one would like to know the source of the information, particularly on the movement and relationships of the Chipewyan and the Inuit, although one can deduce the answers from the bibliography. There are several oral histories of the people of Brochet, some collected by Pelly himself. The attribution for the others can be found in the Acknowledgement section, which also explains why the Oblate Codex historicus du Lac Caribou, the material for the extensive section on the history of the Catholic Church in Brochet, is not included in the bibliography. One book that might have been included in the bibliography was *No Man's River* (2004), based on