

## *Preface*

The Hell Creek Formation of the northern Great Plains is the most thoroughly sampled source of paleontological and geological data used to evaluate changes in nonmarine faunas and floras across the Cretaceous-Tertiary (K-T) boundary. Much of the data have come from exposures near Fort Peck Reservoir in east-central Montana. This volume provides new and well-integrated studies from Hell Creek exposures in western North Dakota and South Dakota and surrounding areas and presents new analyses of the Fort Peck record. In contrast to other studies conducted in the northern Great Plains, the patterns of biotic change throughout the Hell Creek Formation presented here are stratigraphically well documented, and numerous lithic, biotic, and paleomagnetic observations control the placement of the K-T boundary in the sections studied. The breadth of coverage is broad and includes the records of plant macrofossils, palynomorphs, mollusks, insects, and vertebrates, as well as the supporting stratigraphic framework. Much of the debate that has ensued over the K-T boundary record in the Fort Peck area has been based on an incomplete knowledge of the patterns of faunal and floral changes throughout the Hell Creek Formation. In addition, the Fort Peck sections have been plagued with difficulties associated with the reworking of Cretaceous fossil material into Paleocene rocks and the near absence of plant macrofossil and insect fossil studies. This contribution resolves these problems with new data that will place the answers to many end-Cretaceous questions on a more substantive foundation.

This volume had its conception in 1997 when Dean Pearson of the Pioneer Trails Regional Museum, Bowman, North Dakota, suggested to Kirk Johnson and Joseph Hartman that a compilation of papers based on the long-term North Dakota field studies of many of the contributors would provide a new and timely synthesis to resolve questions concerning the paleontological record of the end of the Cretaceous and the faunal and floral transition into the Paleocene in central North America. The concept of a comprehensive volume seemed particularly appropriate because many of the results were new and few of the basic data for this part of the northern Great Plains had been published. Preliminary results of this research were pre-

sented as a topical session at the 1999 annual meeting of the Geological Society of America. We hope that this volume will provide a data-rigorous foundation upon which others will ultimately build a more comprehensive picture of nonmarine and marine conditions at the end of the Cretaceous and earliest Paleocene in North America. Having put the volume together, we now realize that we have just begun to mine the information lode available on biotic patterns preserved in this part of the northern Great Plains.

### STRATIGRAPHIC CONVENTIONS

The North Dakota, South Dakota, and Montana state geological surveys recognize the Hell Creek Formation as a lithostratigraphic unit, delimited below by the Fox Hills Formation and above by the Fort Union Formation or Fort Union Group. The U.S. Geological Survey (USGS) recognizes the Fort Union as a formation with member subdivisions, whereas the North Dakota Geological Survey recognizes the Fort Union Group with formally defined subdivisions as formations. In this volume, we use the nomenclature applied by the USGS to the stratigraphic units of the Williston Basin. This step was taken to provide the reader with a uniformity of usage from one chapter to the next, but does not imply that one approach is more or less valid than the other. All beds and lithofacies discussed in this volume are treated informally.

For the geologic period, the name Tertiary is considered antiquated, but will undoubtedly continue to remain in use. The use of the symbol K-T to label the Cretaceous-Tertiary boundary has extended the use of Tertiary; however, K-P for Cretaceous-Paleogene would be more meaningful and consistent with suggested chronostratigraphic standardization, although not sounding quite right. In this volume, the word contact is used in reference to lithostratigraphic units, and the word boundary is used in reference to chronostratigraphic or geochronologic unit nomenclature. Thus the K-T boundary is distinguished chronostratigraphically, whereas the Hell Creek-Fort Union formational contact is distinguished lithostratigraphically. Although this use may be well understood today,

many previous arguments concerning the placement of the K-T boundary resulted from the lack of differentiation of these horizons.

#### **ACKNOWLEDGMENTS**

The volume editors thank their respective institutions for support to complete this project. Hartman gratefully acknowledges

the financial support of Gerald Groenewold and Edward Steadman of the Energy & Environmental Research Center for this endeavor.

Joseph H. Hartman  
Kirk R. Johnson  
Douglas J. Nichols