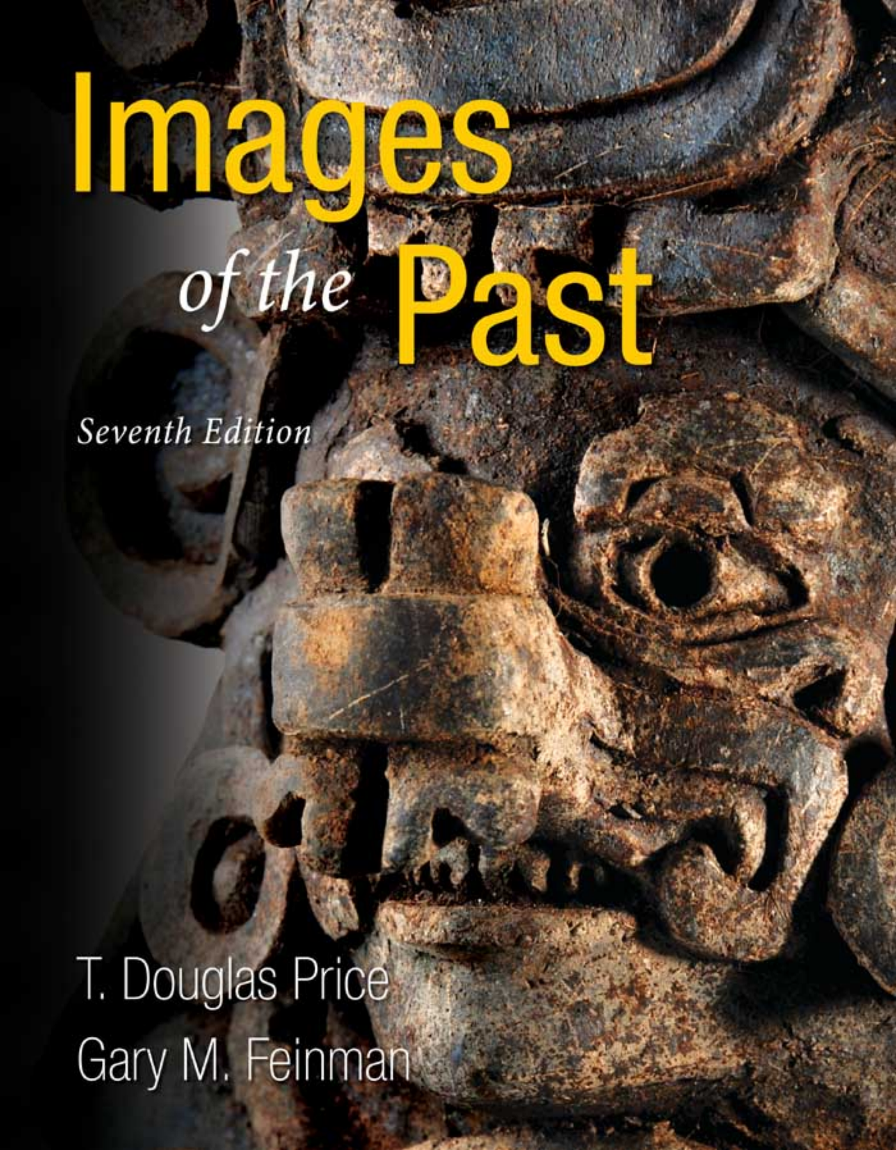

Images of the Past

Seventh Edition

T. Douglas Price
Gary M. Feinman

Images of the Past

SEVENTH EDITION

T. Douglas Price
University of Wisconsin–Madison

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The Field Museum

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For Anne Birgitte Gebauer and Linda Nicholas

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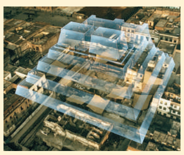

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Preface

Images of the Past is an introduction to prehistoric archaeology that aims to capture the excitement and visual splendor of archaeology while providing insight into current research methods, interpretations, and theories in the field. To introduce our text, we offer some background on why we wrote the book, describe its organization and distinctive features, indicate what is new in this edition, provide some information on the various supplements, and, finally, acknowledge all those individuals and institutions that have contributed to *Images of the Past.*

WHY WE WROTE THIS BOOK

Perhaps a short history of our own teaching experience and the motivation for this volume will help convey our intent. *Images* is the result of a combined total of more than 50 years of teaching archaeology. Some years ago, when our introductory archaeology curriculum was revamped with an advanced section for majors and a beginning course for other students, we decided to make interesting archaeological sites the focus of a survey of world prehistory. We would discuss a series of sites from the Pliocene (now Miocene!) to the present that reflected archaeological knowledge about the past and how that information was obtained. The emphasis on sites allowed us to cover time and space and certain methods and theories, as well as provide a general survey of world prehistory. Students generally enjoyed the course and completed the semester with a broad understanding of archaeology, the major questions in the discipline, and the ways that archaeologists think about the past.

But we were generally dissatisfied with the texts that were available for this introductory archaeology course. A number of introductory books on the subject already existed, of course. Such volumes generally took one of two directions: They provided either a comprehensive survey of world prehistory or a primer on method and theory. Back then, and still today, surveys of world archaeology summarized what archaeologists had learned, but they often tended to be rather dry encyclopedias of information on the many places and times that people lived in, in the past. That vast body of data is formidable to beginning students, and they have trouble discerning what is really important. Primers on method and theory, on the other hand, were compilations of the history, techniques, concepts, and principles of archaeology: how to search for archaeological remains, how excavations are done, how to determine the age of prehistoric materials, who Louis Leakey was, and the like.

Neither of these approaches met our needs, so we decided to write a text that followed the format that had been successful in our introductory class. We wrote a book that combined both survey and primer, but with an emphasis on archaeological sites. We believed then, and still do today, that a combination of what has been discovered and how archaeologists learn about the past is of value in introductory archaeology courses.

We also took a new tack in the book. Rather than try to cover all of archaeology, we chose to emphasize only certain discoveries that had produced major insights into prehistory. Our focus was, and still is, on some 80 archaeological sites from a variety of times and places around the world. These sites are signposts to the past and allow students to focus on what is important.

To play to our strengths, we divided the writing according to our own areas of knowledge and activity. Doug Price is interested in prehistoric foragers and the transition to agriculture; Gary Feinman is interested in the rise of complex societies and the organization of states. Price works primarily in the Old World with stone tools, bones, and hunter-gatherers; Feinman does fieldwork largely in Mexico and China, where ceramics are a primary source of information. Our diverse interests allowed us to create a text with balanced coverage of the Eastern and Western Hemispheres.

We also took a new approach to the format and layout of the text. We divided the information into pieces, with more than 80 sites and numerous small sections on ideas, methods, people, and things. These short segments, while full of information, can be readily digested by the reader and allow the instructor to organize the readings in the book as best fits the course. The substantial number of illustrations helps convey both the diversity and splendor of archaeology.

Thus *Images* offers a visual, site-oriented look at human prehistory. What is important, we believe, is to convey the excitement, intrigue, and imagery of archaeology.

We think that *Images* does that and that it provides a rich introduction to archaeology. We hope that our interest in and enthusiasm for archaeology carry over to you in this book and that you will enjoy these *Images of the Past.*

ORGANIZATION OF THE BOOK

Our journey begins with the evidence for the first humans, more than 5 million years ago, and concludes with the rise of great empires around the world. This survey of world prehistory is organized in 10 chapters, along chronological and/or geographical lines. Chapters 2 through 4 are in chronological order, from the earliest human remains several million years ago to the beginnings of farming around 10,000 years ago. These chapters follow the expansion of human beings from our original home in Africa to Asia, Europe, and eventually Australia and the Americas. Chapter 4 covers the beginnings of agriculture from a global perspective.

Chapters 5 through 9 are concerned with the rise of large, complex societies and early states and empires. This second half of the text has a geographical organization, with chapters on North America, Middle America, South America, Asia and Africa, and Europe. Within each of these chapters, we have generally followed the sequence of development through time, from earlier to later. Although the earliest state societies arose in the Old World, we have arranged the chapters from the New World to the Old in order to emphasize and compare the rise of states in both areas. This arrangement of the chapters is intended to enhance comprehension of major processes such as the spread of agriculture and the rise of more complex societies.

We have sandwiched these ten chapters of site-oriented survey between two distinctive bookends that introduce the field and convey some sense of the larger context of archaeology. Chapter 1 provides a brief overview of principles and methods. This information gives the reader a basic understanding of the kinds of things that archaeologists want to know and how they find them out. Chapter 10 has been expanded as a conclusion for the book. This chapter considers why archaeology is important and the ethical responsibilities of being an archaeologist.

HALLMARK FEATURES OF THE BOOK

Each of the chapters on world prehistory contains site and concept essays enclosed by an Introduction and by a concluding section called "Images and Ideas." The Introduction provides an overview of the major themes and discoveries in the chapter. The Introduction also contains essential maps and chronological charts for the chapter. The "Images and Ideas" sections provide a recapitulation of the chapter content and place that information in a larger context, often incorporating new concepts, theories, or comparisons. Examples of discussions in the "Images and Ideas" sections are the behavioral correlates of cold climate adaptations, the origins of language, and the nature of cultural complexity. The Introductions and "Images and Ideas" sections should be read with some care; they provide the glue that binds the site descriptions together.

Interspersed among the site descriptions are concept sections that cover some of the how and why of archaeology: essential methods, debates about archaeological interpretation, or certain spectacular finds. In these concept sections, we illustrate some of the more interesting questions archaeologists ask about the past and highlight various new methods that are employed to decipher the archaeological record.

Because prehistory is a very visual subject, we have incorporated more than 500 illustrations in this book—more than any other book on the market. It is essential to see and study the maps, plans, artifacts, and places that help make up the archaeological record. The basic framework of archaeology is the place of prehistoric materials in time and space. For this reason, we have included a series of coordinated maps and timelines to show readers where these sites and materials fit in terms of geography and chronology.

Throughout the text, we have included a number of learning aids to help students better understand the material. Chapter outlines lead off each chapter, giving students a preview of what is to come. Marginal quotes allow students to hear the voices of the field. Technical terms and important concepts in archaeology are indicated in **bold** type; these words can be found both in the adjacent margin of the text and in a glossary at the end of the book. The size and scale of archaeological sites and features is an important aspect. Where appropriate, we have tried to provide some sense of the size of areas and structures with reference to modern features such as city blocks, football fields, and buildings. An appendix offers some English–metric measure conversions and various equivalents to help make sizes more comprehensible.

Supplementary readings are essential for introductory courses for several reasons: to provide interested students with directions for further study, to assist in the preparation of papers, and to elaborate on subjects that can be addressed only briefly in a textbook. In *Images of the Past,* a short list of Suggested Readings appears at the end of each chapter, appropriate to the subject matter. A more complete list of sources used in the preparation of the book can be found in the back pages. Specific citations were not used in the text itself for the sake of readability, but references for the information can be found under the name of the individual associated with the work in the bibliography at the back of the book. In addition, this bibliography appears in searchable format on the book Web site.

An important note on dates in this edition: Because of the long time span covered by archaeology, the age of archaeological materials is given in several ways. Dates older than 10,000 years ago are described in years before the present (B.P.) or in millions of years ago (m.y.a.). Dates less than 10,000 years ago are given in calendar years before Christ (B.C.) or anno Domini, "in the year of the Lord" (A.D.). Dates for the past 10,000 years have been corrected, or calibrated, for a known error in radiocarbon dating. Another term used for more recent periods of time is *millennium,* a period of 1000 years. We live today in the third millennium, the third 1000-year period after Christ. The millennia before Christ run in reverse—for example, the first millennium goes from 1000 B.C. to 1 B.C., and so on.

WHAT'S NEW IN THIS EDITION

The seventh edition of *Images of the Past* contains a number of additions and changes from the previous version. We have retained the basic structure of a site-by-site journey through the past, interspersed with blocks of text about places, methods, and things. We believe that this connected series of short modules serves the reading habits of our students well.

The past does not get old, and new discoveries and interpretations are a constant in archaeology. The pace of discovery and insight in modern archaeology is such that each year there are dramatic changes in our knowledge. We hope to keep *Images of the Past* as up-to-date as a book about the past can be. At the same time, we hope to improve the quality of the book with a new round of revisions.

We have done some reorganization, corrected errors, updated contents, and added some new material. Throughout the volume, we have tried to improve the flow and accuracy of the text and to add to the connectivity of our story. Major changes include the lumping of two pairs of chapters, the addition of several new sites, and a number of new illustrations. More details on these revisions follow.

Chapter 1, Principles of Archaeology, was revised heavily for the last edition and has not undergone substantial changes this time around. The same cannot be said for previous chapters 2 through 5 in the last edition. These chapters have been subject to substantial revision and modification. Chapter 2, The First Humans, and Chapter 3, Out of Africa, have been combined into a single new Chapter 2. We have now placed together in a single chapter all human ancestors prior to the appearance of the Neanderthals and anatomically modern humans, *Homo sapiens.* We think this is more useful for explaining and understanding the early evolution of our early ancestors. There is now more discussion of the genus and species *Ardipithecus ramidus,* which has been recognized in recent years as an important link in the line of human evolution. The site of Swartkrans in South Africa has been deleted to focus more on the human remains from East Africa that provide an almost complete story of the developments from ape to human.

In the second half of the new Chapter 2, more discussion on the role of the brain in our evolution and its growth over time in terms of energy needs and activity has been added. More details on the important site of Dmanisi in the country of Georgia have been included. This site contains the oldest known human evidence outside of Africa. Additional details from Atapuerca, the oldest archaeological site in Europe, have been included, focusing on the new dates from the site and the very early finds from Sima del Elefante. In addition, the age of a number of skeletons of *Homo heidelbergensis* from Simos de los Huesos has been redated to 530,000 years before present. Kalambo Falls and Olorgesailie have been removed in favor of the site of Schöningen in Germany where the evidence for the use of wooden spears is dramatically preserved in deposits of soft coal and peat, some 400,000 years old.

In a similar fashion, Chapter 4, The Hunters, and Chapter 5, Postglacial Foragers, have been combined in a new Chapter 3, The Hunters to document the rise of *Homo sapiens*, anatomically modern humans around the end of the Pleistocene geological epoch. New developments in the study of ancient DNA are outlined as this field of investigation rapidly grows and advances our knowledge of the past. The sites of Pincevent and Lindenmeier have been removed and more attention given to the peopling of the New World and the First Americans. More emphasis is placed on the coastal route between Siberia and North America and more detail is provided on new pre-Clovis sites in the United States. The post-Pleistocene segment of the new Chapter 3 has been condensed, following suggestions from reviewers of the book, and the site of Elands Bay and Sannai Maruyama are no longer included. The discussion of the nature of hunter-gatherers and human society has been expanded.

The Origins of Agriculture are now the subject of new Chapter 4. Two new areas, South Asia and New Guinea, have been added to the list of places where agriculture appears to have been independently invented. A substantial new section has been added on New Evidence from Southwest Asia, which has forced a major rethinking of the nature of human society and activity in this region at the time of the transition to agriculture. The site of Gobekli Tepi in Turkey is the location of monumental construction in the form of large underground structures supported by massive carved columns of stone that completely revises our view of the earliest prepottery Neolithic in that region. The size and scale of construction imply much more organized and sophisticated societies. About the same time, new colonists were leaving mainland Southwest Asia and sailing to Cyprus, a distant and rather barren island in the eastern Mediterranean. They took with them to this largely empty island new species of plants and animals, both wild and potentially domesticated forms and created a new ecosystem on the island. This expansion to Cyprus dramatically documents the spread of agriculture at an early date.

The new Chapter 5, Native North Americans, now includes new information on the introduction of cacao from Mesoamerica to Chaco Canyon. Recent findings from Cahokia also are presented. In the revised Chapter 6, Ancient Mesoamerica, new information on the Preclassic Maya is incorporated into the text as are new ideas regarding prehispanic Mesoamerican craft production. The new Chapter 7, South America; The Inca and their Predecessors, expands consideration of the Wari empire.

New Chapter 8, States and Empires in Asia and Africa, starts with a new introduction on Indian Ocean trade and weaves a discussion of interregional trade and exchange into this section of the book. New findings from northern Mesopotamia and concerning China's first emperor also are added. The coverage on Great Zimbabwe also is updated.

New Chapter 9, Prehistoric Europe, and Chapter 10, The Past as Present and Future, have undergone relatively minor changes with a few new photos, a few corrections, and some expanded discussion of issues in the concluding chapter. A more detailed discussion of the latest interpretation of the Stonehenge region and the significance of these monuments has been added.

We hope that the revised content has resulted in a book that students will continue to want to pick up and read. In addition to the changes in the text, the supplements for the book remain a strong component and are detailed in the next section. We also have expanded our lists of suggested readings, which will allow readers to dig more deeply into many topics raised. The input from students, instructors, and reviewers has been most helpful in revising this edition of *Images.* We benefit greatly from your suggestions and very much appreciate your help and interest. Please do let us know when you would like to see changes in the book.

SUPPLEMENTS

For the Student

The Student's Online Learning Center (by Adam Wetsman, Rio Hondo College). This free, Web-based student supplement features a large number of interactive exercises and activities, helpful study tools, links, and useful information (www.mhhe.com/priceip7e). The Web site is designed specifically to complement the individual chapters of the book. In-text icons guide students to information on a particular topic that is available on the Web site.

Useful Study Tools

- Chapter objectives and outlines—give students signposts for understanding and recognizing key chapter content.
- Multiple-choice and true/false questions—give students the opportunity to quiz themselves on chapter content and visuals.
- Essay questions—allow students to explore key chapter concepts through their own writing.
- Glossary—defines key terms.
- Audio glossary—helps students with words that are difficult to pronounce through audio pronunciation.

Useful Information

- FAQs about archaeology careers—give students answers to questions on available jobs, necessary education and training, and basic texts on the field, as well as picking a college or university, going on a dig, and getting more information.
- Career opportunities—offer students related links to useful information on careers in anthropology.

For the Instructor

The Instructor's Online Learning Center (by T. Douglas Price, Gary M. Feinman, and Adam Wetsman). This indispensable, easy-to-use, password-protected instructor supplement provides a variety of features:

- Image Library—offers professors the opportunity to create custom-made, professional-looking presentations and handouts by providing electronic versions of many maps, tables, illustrations, and photos from the text. All images are ready to be used in any applicable teaching tools.
- PowerPoint lecture slides—give professors ready-made chapter-by-chapter presentation notes.
- Instructor's Manual—offers chapter outlines, chapter summaries, learning objectives, lecture launcher ideas, and suggested films and videos.

It also provides access to all of the student online materials. Visit our Online Learning Web site at www.mhhe.com/priceip7e to access these robust supplements.

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Any large project like this is the culmination of the efforts and contributions of a multitude of individuals and institutions. We want to thank the many people who have helped with this book in a number of different ways—reviewing the text, providing new data, supplying photographs and art, locating materials and information, checking facts, and giving general support. With more than 500 illustrations, the task of finding artwork, obtaining copies and permissions, and organizing it all is enormous. We have done our very best to contact the copyright holders

of the original work included herein and to secure their permission to reprint their material; if we have overlooked anyone, we offer our sincere apologies.

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To all of these individuals go our deep and sincere thanks. We hope that you find the result worth your efforts and that you will continue to provide input, suggestions, and new discoveries that will improve the next edition.

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by T. Douglas Price

Principles of Archaeology, 2007

CHAPTER ONE

Figure 1.1 Excavations at Boxgrove, a Paleolithic site in England.

Principles of Archaeology

Introduction

Excavation is at the heart of the fascination of archaeology. Digging into the earth to reveal buried lives is an extraordinary undertaking. Excavations at the site of Boxgrove in southern England (Figure 1.1), for example, are uncovering human bones and stone tools from almost half a million years ago. Archaeology tells us about our human past.

This book, *Images of the Past,* is about archaeology and covers more than 7 million years and much of the planet. But it is simply not possible to write about all of human **prehistory** in a single volume such as this; that would be like trying to see all the attractions in Washington, DC, in 10 minutes. Because we can visit only a few of the more interesting places, we have chosen important archaeological sites that have substantially increased our understanding of the past.

We hope the pathway through the past that weaves through the following pages provides you with a sense of what archaeologists know about our global past and how they have come to know it. The trail that runs through this volume and ties the past to the present involves major trends in our development as a technological species—growth, diversification, and specialization. Growth is seen in the increasing number of people on the planet and in the greater complexity of human technology and organization. Diversity is observed in the variable roles and social relationships that exist in society and in the kinds of environments our species inhabits. Increasing specialization is witnessed in the tools and techniques used to obtain food and manufacture objects. The story of our human past, then, is the story of these changes over time as we evolved from small, local groups of people living close to nature to large nation-states involved in global trade, warfare, and politics.

Archaeology is the study of our human past, combining the themes of time and change. Those themes—change in our biology and change in our behavior over time—are also the focus of this book. Archaeology is the closest thing we have to a time machine, taking us backward through the mists of the ages. The fog becomes thicker the farther back we go, and the windows of our time machine become more obscured. In Chapter 2, we go as far back as humans can go, some 7 million years ago, when we took our first steps in Africa. Subsequent chapters trace the achievements of our ancestors as we migrated to new continents, developed innovative technologies for coping with cold climates, crafted more complex tools, imagined art, domesticated plants and animals, moved into cities, and created written languages. But first, in this chapter, we present an introduction for comprehending our human past—those themes of time and change—along with basic methods and principles of archaeology.

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prehistory In general, the human past; specifically, the time before the appearance of written records.

archaeology The study of the human past, combining the themes of time and change.

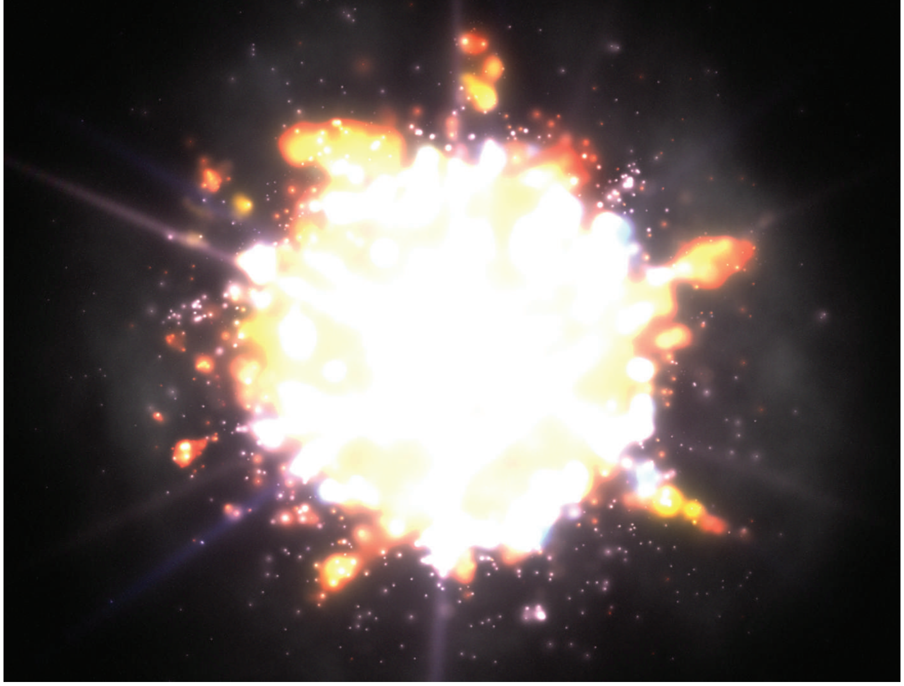

Figure 1.2 The Big Bang began the history of the universe, spewing space and time into the unknown.

TIME

To understand time, it is necessary to imagine the unimaginable. Sometime between 10 and 15 billion years ago, an explosion of cosmic proportions ripped time and space apart and created our universe. Hydrogen and helium hurtled through the emptiness, cast out of that original Big Bang (Figure 1.2). Clouds of these gases began to coagulate, and as they were compacted by gravity, temperatures rose and the energy created in the nuclear furnaces of the first stars lit up the universe.

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More complex reactions in these emerging stars gave rise to heavier atoms of carbon, oxygen, magnesium, silicon, sulfur, and the other elements. Huge eruptions and disintegrations tore these early elements out of the stars and spewed them across space, creating newer and heavier stars. Smaller conglomerations of elements, lacking the mass or the temperature to ignite, condensed and gathered around the edges of the brightly burning stars. Some of these cold outliers became hard, metallic globes; others, frigid balls of gas. The planets were born. Some gases remained on the harder planets and condensed into oceans or enveloped the surface as a primordial atmosphere. Violent electrical storms, driven by energy from the stars and cataclysmic volcanic activity, rifting the surface of the forming planets, tore apart and reconstituted these elements in the early seas and atmospheres.

On the planet we call Earth, formed about 4.6 billion years ago, this alchemy of primeval forces churned out new molecules in an atmosphere of methane, ammonia, hydrogen sulfide, water, and hydrogen. Among the multitude of chemistries created in the soup of the early Earth's oceans was a remarkable combination of atoms. This was a strange molecule, able to reproduce itself—to make a copy of its original—to live. Life emerged shortly after 4 billion years ago. Like the broom of the sorcerer's apprentice in the film *Fantasia*, once begun, the copying process filled the seas with duplicates. These reproducing molecules grew, achieved more complex forms, and became the building blocks of more elaborate organisms that developed metabolic and sexual reproductive functions. Systems for eating and internal metabolism enabled organisms to obtain energy from other life-forms. Sexual reproduction allowed for a tremendous diversity in offspring and, thus, a greater capacity for adapting to changing environments and conditions.

If you count one number per second, night and day, starting with 1, it would take 17 minutes to count to a thousand, 12 days to count to a million, and 32 years to count to a billion.

—Carl Sagan (1987)

Plants appeared in the oceans and spread to the land. The atmosphere fed carbon dioxide to the plants, and they in turn replenished the air with oxygen through the process of photosynthesis. Swimming cooperatives of

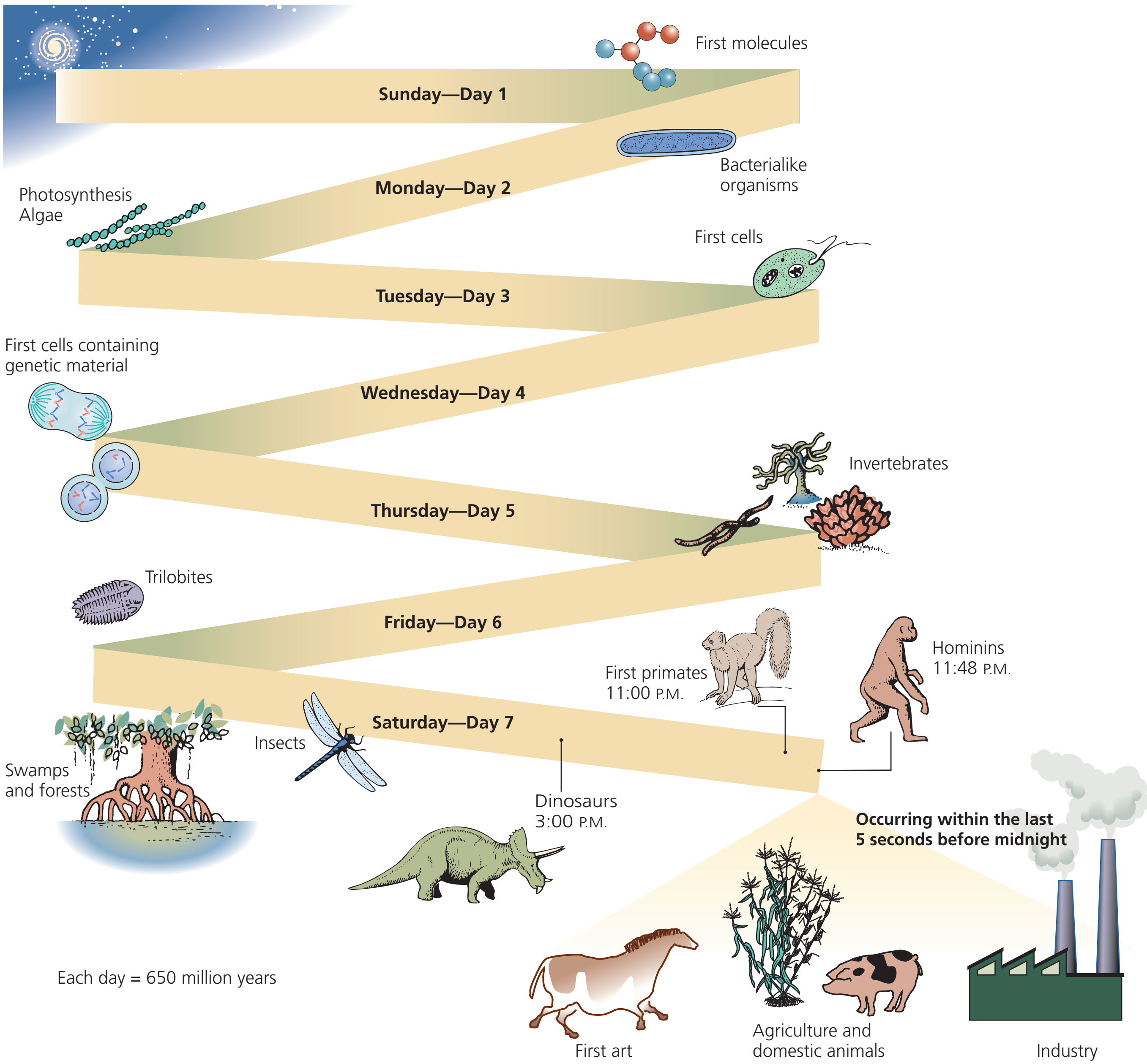

Figure 1.3 The evolution of life on Earth seen as a single week in time. Planet Earth forms at 12:01 on Sunday morning, life shows up for work on Monday morning, fish evolve on Saturday morning, and the first bipedal hominins show up at 11:48 Saturday night.

molecules in the oceans moved onto the land and began to use the oxygen in the air for breathing and other metabolic functions. Fish, amphibians, reptiles, insects, mammals, and birds spread across the face of the earth. And then, only a moment ago in geological time, a human creature evolved as part of this great chain of living beings.

Geological Time

Time is a very difficult concept. The universe is perhaps 10 billion years old. Earth is roughly 4.6 billion years old. The idea of 10 billion years, 4.6 billion years, or even 1 million years is impossible for us to comprehend. But to understand our past and our place in the cosmos, we need some way to appreciate such a vast span of time. If we could compact the eons that have passed into meaningful units of time, the events of our evolutionary history might make more sense.

Consider a single week, from Sunday morning to Saturday night, as a substitute for our countdown to today (Figure 1.3). One day in this 4.6-billion-year week would represent over 650 million years, a single hour would be 25 million years, a minute would be 400,000 years, and the passage of a single second would take more than 6000 years.

Roughly 4.6 billion years ago—the 7 days of our symbolic week—the earth formed in our solar system. The time was the first thing Sunday, 12:01 A.M. By Sunday evening, a primitive atmosphere and oceans had appeared, and the first molecules began to coalesce. By Monday morning, the first traces of life emerged in the shape of bacteria that evolved and multiplied. More complex bacteria and algae, using photosynthesis, began the task of converting the poisonous, primordial atmosphere to an oxygen base on Tuesday. Not until Thursday were the first cells carrying genetic material created. Late Friday morning, the first invertebrate animals—resembling jellyfish, sponges, and worms—evolved. Before dawn on Saturday morning, the seas were teeming with shell-bearing animals, such as the trilobites. Around breakfast time on Saturday, fish and small land plants appeared. By 11:00 A.M., amphibians began to move onto the land, and insects appeared in a warm landscape of swamps and forests. Late that same afternoon, the first dinosaurs crawled about. Smaller, warm-blooded dinosaurs began to produce live young and nurse them. The ancestors of modern mammals appeared shortly after 9:30 P.M. At 10:53 P.M., the common ancestor of apes and man made its home in the dense forests of Africa. The first recognizable human, walking on two legs, made an appearance at 11:48 P.M. The first art was created less than 5 seconds before midnight. Agriculture and animal domestication originated only 2 seconds before the end of the week, and the industrial revolution began just as the echoes of the last bell at midnight disappeared.

To help make this huge time span comprehensible, archaeologists and geologists have developed systems for breaking the vastness of time into smaller segments. Archaeologists deal with the period of humans on the planet, roughly the past 6 or 7 million years. Archaeologists use geological time, but they also have created a means of reckoning time that reflects changes in human behavior and artifacts. This archaeological system of chronology involves divisions such as Paleolithic, Neolithic, Bronze Age, and Iron Age and is discussed in more detail in a subsequent chapter. (See Chapter 3, p. 70.)

Geologists deal with the entire history of the earth and distinguish a series of **eras** representing major episodes, usually separated by significant changes in the plant and animal kingdoms (Figure 1.4). The Precambrian was the first major era of geological time, extending from the origin of the earth to about 600 million years ago (**m.y.a.**). The succeeding Paleozoic era witnessed the appearance of the first vertebrate species: fish and the first amphibians. Plants spread onto the land, and reptiles began to appear. Around 245 m.y.a., the Mesozoic era, the Age of Dinosaurs, began following a period of extinction. The Cenozoic, our current era, began about 65 m.y.a. with the expansion of modern mammals, birds, and flowering plants, following the extinction of the dinosaurs. This episode of extinction is now thought to have resulted from the catastrophic impact of a meteor, causing major climatic and environmental disruption.

The Cenozoic is further divided by geologists into a series of seven **epochs,** only the last four of which are relevant to the evolution of the human species. The Miocene, which dates from 25 to 5.5 m.y.a., witnessed the emergence of our first humanlike ancestor near the end of the epoch. The Pliocene, beginning about 5.5 m.y.a., is the geological epoch in which a variety of hominins, or humanlike creatures, appeared. The Pleistocene, beginning about 2 m.y.a., was marked by a series of major climatic fluctuations. Completely modern forms of the human species appeared toward the end of this epoch. The Recent epoch—also called the Holocene (or the Postglacial or Present Interglacial)—began only

era A major division of geological time, tens or hundreds of millions of years long, usually distinguished by significant changes in the plant and animal kingdoms. Also used to denote later archaeological periods, such as the prehistoric era.

m.y.a. Abbreviation for *millions of years ago.*

epoch A subdivision of geological time, millions of years long, representing units of eras.

Era	Period	Epoch	Millions of years ago (m.y.a.)	Important Events
CENOZOIC	Quaternary	Recent (Holocene)	0.01	Modern genera of animals.
		Pleistocene	2.0	Early humans and giant mammals now extinct; glaciation.
	Tertiary	Pliocene	5.5	Anthropoid radiation and culmination of mammalian speciation; earliest apes.
		Miocene	25	
		Oligocene	38	Expansion and modernization of mammals.
		Eocene	54	
		Paleocene	65	
MESOZOIC	Cretaceous		135	Dinosaurs dominant; marsupial and placental mammals appear; first flowering plants spread rapidly.
	Jurassic		180	Dominance of dinosaurs; first mammals and birds; insects abundant, including social forms.
	Triassic		245	First dinosaurs and mammal-like reptiles, with culmination of large amphibians.
PALEOZOIC	Permian		270	Primitive reptiles replace amphibians as dominant class; glaciation.
	Carboniferous		350	Amphibians dominant in luxuriant coal forests; first reptiles and trees.
	Devonian		400	Dominance of fishes; first amphibians.
	Silurian		440	Primitive fishes; invasion of land by plants and arthropods.
	Ordovician		500	First vertebrates, the jawless fish; invertebrates dominate the seas.
	Cambrian		540	All invertebrate phyla appear and algae diversify.
PRE-CAMBRIAN			4600	Oldest rocks; a few multicellular invertebrates; earliest fossils at 3.6 b.y.a. Single-cell organisms appear.

Figure 1.4 The major periods of geological time and their principal characteristics.

11,000 years ago and witnessed the origins of agriculture, the first cities, and the industrial age, including our present time.

CHANGE

Change, modification, variation—these themes describe the path of evolution from the first self-replicating molecules to the fully modern humans of today. Most of the evolution of life on Earth is marked by biological evolution from one species to another in order to adapt to change. As humans, we have a second, unique system for adaptation that involves learned behaviors. **Culture** is a means of human adaptation based on experience, learning, and the use of tools. Cultural and biological responses to cold conditions provide an example. Humans built fires to stay warm, whereas body hair increased on other animals, such as the woolly mammoth. Within limits, culture enables us to modify and enhance our behavior without a corresponding change in our genetic makeup. As a consequence, biological evolution and natural selection alone cannot explain the culturally acquired traits of the human species.

The prehistoric record of our ancestors is characterized by both biological evolution and cultural developments (Figure 1.5). Biological, rather than cultural, changes dominated our first several million years of existence. The evolution of our earliest forebears was highlighted by key changes in movement, body

culture A uniquely human means of nonbiological adaptation; a repertoire of learned behaviors for coping with the physical and social environments.

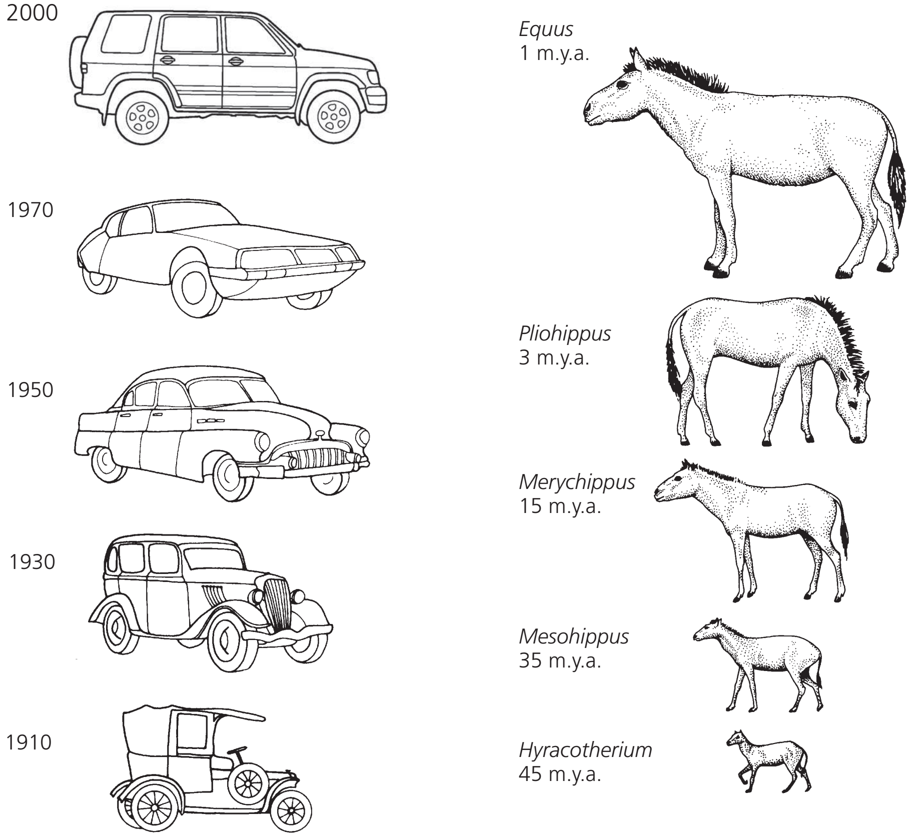

Figure 1.5 Biological organisms and cultural artifacts change over time. The history of the automobile from A.D. 1910 to 2000. The evolution of the horse from *Hyracotherium,* 45 m.y.a., to *Equus,* 1 m.y.a.

size, teeth, and the size and organization of the brain. The transmission of cultural traits through learning occurs much more rapidly than Darwinian evolution. The past hundred thousand years or so of our presence on the planet are marked primarily by cultural changes rather than biological ones. The story of archaeology—the search for evidence of our cultural development over time—is the subject of this book. The nature of biological evolution is briefly discussed in more detail before we return to the subject of archaeology.

Biological Evolution

What are the differences between cultural development and biological development?

The theory of natural selection, formulated by Charles Darwin and Alfred Russel Wallace in the middle of the nineteenth century, describes this process of change. Wallace and Darwin were strongly influenced by the ideas of Thomas Malthus, an English clergyman and philosopher. In his *Essay on the Principle of Population* (1798), Malthus observed that the growth rate of the human population potentially exceeded the amount of food available. Malthus argued that famine, war, and disease limited the size of human populations, and for those reasons the number of people did not overwhelm the resources available to feed them. In essence, Malthus noted that not everyone who was born survived to reproduce.

Darwin coined the term *natural selection* to account for the increase in offspring of those individuals who did survive. He introduced the concept in his 1859 publication *On the Origin of Species by Means of Natural Selection.* During a global voyage of exploration aboard the HMS *Beagle,* Darwin had observed that most species of plants and animals showed a great deal of variation—that individuals were distinct and exhibited different characteristics. Following Malthus, Darwin pointed out that all organisms produce more offspring than can survive and that the individuals that survive do so because of certain advantageous characteristics they possess.

In other words, the surviving organisms are better adapted to the world that confronts them. For example, offspring with better hearing or eyesight can more effectively avoid predators. Nature's choice of better-adapted individuals—the "survival of the fittest," according to Darwin—leads to continual change in the species, as their more advantageous characteristics are passed genetically from one generation to the next. This basic process gave rise to the myriad creatures that occupy the world today. Evolutionary change is often described as differential reproductive success, and natural selection is the principal, though not the exclusive, mechanism responsible for it. Of course, as environmental conditions change, those physical characteristics that enhance survival and successful parenting also may vary.

Views on this process of **evolution** change over time, too. New mechanisms for evolution have been proposed, and there is ongoing discussion about the level in populations at which selection operates, whether on groups or on individuals. There is also debate about the pace of change—whether major evolutionary modifications occurred gradually, as Darwin emphasized, or rather abruptly and suddenly. Stephen Jay Gould and Niles Eldredge of Harvard University describe the uneven pace of evolution as "punctuated equilibrium." It now seems that some biological shifts occur gradually, as Darwin described, whereas others may occur in rapid spurts following long periods of stasis, or little change. A major theory such as evolution is modified over time, but the basic tenets of this view have withstood many tests and offer the best way to understand the emergence of life and early humans.

Does evolution happen slowly or quickly?

FUNDAMENTALS OF ARCHAEOLOGY

As noted previously, archaeology is the study of our human past, combining the themes of time and change, using the material remains that have survived. Archaeology focuses on past human behavior and change in society over time. Archaeologists study past human culture across an enormous amount of time and space—essentially, the last several million years and all of the continents except Antarctica. In one sense, archaeology is the investigation of the choices that our ancestors made as they evolved from the first humans to the historical present.

Archaeology is also a detective story, a mystery far more complex and harder to solve than most crimes. The clues to past human behavior are enigmatic—broken, decomposed, and often missing. Piecing together these bits of information to make sense of the activities of our ancestors is a challenge. This challenge—and the ingenuity, technology, and hard work necessary to solve it—creates both the excitement and the frustration of archaeology.

Archaeology is a fascinating field, in part because the subject matter is highly diverse and highly human. There are so many times and places involved, and so many questions to be asked. Archaeology accommodates an extraordinarily wide range of interests: chemistry, zoology, human biology, ceramics, classics, computers, experiments, geology, history, stone tools, museums, human fossils, theory, genetics, scuba diving, and much, much more. Many of these subjects are discussed in the following chapters.

Another way to regard the nature of archaeology is to consider how it fits in among academic fields of study. There are different kinds of archaeology, and disciplinary homes vary. Archaeology is usually situated in the social sciences or humanities in a university setting. In the United States, archaeology is usually part of a Department of Anthropology, which combines archaeology with **biological anthropology** and **cultural anthropology,** all focused on humans and culture. Biological anthropology is the study of the biological nature of our nearest relatives and ourselves. Biological anthropologists study bones, blood,

evolution The process of change over time resulting from shifting conditions of the physical and cultural environments, involving mechanisms of mutation and natural selection.

biological anthropology The study of the biological nature of our nearest relatives and ourselves.

cultural anthropology The study of living peoples and the shared aspects of the human experience.

genetics, growth, demography, and other aspects of living and fossil humans and primates like the monkeys and apes. Cultural, or social, anthropologists study living peoples and focus on the shared aspects of the human experience, describing both the differences and the common characteristics that exist.

Archaeology in anthropology departments is sometimes designated as **anthropological archaeology,** or **prehistory.** Anthropological archaeology refers specifically to archaeological investigations that seek to answer the larger, fundamental questions about humans and human behavior that are part of anthropological enquiry. Prehistory refers to the time of humans before the written record placed us in history. Many archaeologists do study prehistory, but many also study literate societies such as the Maya and Aztec, and the urban civilizations of ancient Mesopotamia and China, where writing began. The term *prehistory* is often misused and applied to these early literate civilizations as well. **Historical archaeology**—archaeology in combination with the written record—borders on the field of history and usually refers specifically to the archaeology of civilizations of the Renaissance and Industrial era.

The Discovery of Archaeological Sites

Archaeologists study change in human culture, from the time of our early ancestors to the historical present. Much of the information about the past comes from artifacts and sites. **Artifacts** are the objects and materials that people in the past made and used. **Sites** are accumulations of such artifacts, representing the places where people lived or carried out certain activities. The process of discovery, analysis, and interpretation of artifacts and sites is the basic means through which archaeologists learn about the past.

Archaeological materials are most often discovered by accident. Digging and construction activities often uncover prehistoric objects; farmers and individuals in the outdoors come upon artifacts. Amateur archaeologists often know a great deal about the prehistory of their local areas and frequently find sites while walking fields. It is essential that these finds be reported to a local historical society, museum, or university. The past is too important not to share.

In addition to the chance discoveries, much of the information gathering for archaeological studies requires **fieldwork** that is intended to locate artifacts and sites. Artifacts and sites are found either on the surface or beneath the ground. **Surveys** (undertaken by archaeologists to discover artifacts on the ground) and **excavations** (used to expose buried materials) are the primary discovery techniques of professional field archaeology.

The discovery of archaeological sites depends in part on what is already known about the landscape, environment, and history of an area. Before beginning fieldwork, archaeologists check the relevant written material on the time period and place of interest. That research reveals the present state of knowledge, indicates what is not known, as well as what is, and helps establish directions for further research. Such library research is also essential to ensure that investigations similar to those planned have not already been completed.

The next step is to visit the local historical society or other archaeological institutions, such as museums or university departments, where records of the area are maintained. Such institutions generally keep archives of information on the location and contents of known archaeological and historical sites. Study of those archives indicates what types of sites are already known and perhaps their size and the general content of artifacts. Conversations with local amateur archaeologists and other interested individuals can provide additional useful information.

Maps are one of the most important tools for fieldwork. Topographic maps (showing the shape of the land surface with contour or elevation lines) are available for most areas and contain a great deal of information about longitude and latitude, elevation, slope, and the location of water, roads, towns, and other

anthropological archaeology (prehistory) Archaeological investigations that seek to answer fundamental questions about humans and human behavior.

historical archaeology Archaeology in combination with the written record.

artifact Any object or item created or modified by human action.

site The accumulation of artifacts and/or ecofacts, representing a place where people lived or carried out certain activities.

fieldwork The search for archaeological sites in the landscape through surveys and excavations.

survey A systematic search of the landscape for artifacts and sites on the ground through aerial photography, field walking, soil analysis, and geophysical prospecting.

excavation The exposure and recording of buried materials from the past.

Figure 1.6 An aerial photograph of an effigy mound in southern Wisconsin, approximately 800 years old. The mound has been outlined in white. See also the aerial photograph of Poverty Point, Louisiana, in Figure 5.5.

features. In the United States, the U.S. Geological Survey compiles and distributes these maps.

Aerial photographs also can provide information on the location of archaeological sites (Figure 1.6). Old foundations or prehistoric agricultural fields, overgrown with vegetation and almost hidden on the surface, may appear in aerial photographs. When prehistoric structures were originally abandoned, the depressions often filled with rich topsoil, which provides better growth conditions for vegetation. In fields of wheat, for example, such different soil conditions might result in a distinctive pattern showing the outlines of houses or whole villages. In many parts of the world, such patterns are best observed from low-flying planes during a dry period in the early summer.

The next step in discovering the past involves fieldwork. An archaeological survey is a systematic search of the landscape for artifacts and sites (Figure 1.7). It is not always possible to make a complete survey of the entire area under investigation, because roads, forests, other vegetation, or construction often covers substantial parts of the landscape. It may be possible to thoroughly survey only a portion of the entire area, but that portion should be representative of the larger region under investigation. The larger the proportion of the research area that can be surveyed, the better.

The basic type of archaeological field survey involves systematic field walking. Field crews walk up and down cultivated fields and exposed surfaces.

Figure 1.7 Field survey in Denmark. The small red flags mark the location of finds on the surface of the plowed field. This site was from the Neolithic period.