THE GREAT ARMIES OF ANTIQUITY

Richard A. Gabriel

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To Uncle John and Aunt Eileen
with love and respect

and for

James and Rosemarie
in gratitude for Suzi

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Foreword

Why did the author write this book? What does it offer the reader? What can one learn from it? These are legitimate questions to ask of any book. In the case of *The Great Armies of Antiquity*, by Richard A. Gabriel, the subject matter raises additional questions. What does one obtain from a study of ancient armies? Has not the world changed so radically since the time of the ancient Assyrians, Greeks, or Romans that their experiences have been overcome by events? Has not the enormous change in technology negated the utility of studying military organizations armed with spears and bows? The implication of this line of reasoning is that ancient history is not an appropriate subject for serious scholarship except, perhaps, in the limited world of archeologists and classicists. History in general and military history in particular labors under the constant burden of perceived irrelevance. Historians often bemoan the fact that the common man does not take his craft seriously, demanding instead demonstrable modern utility. Better to face the issue head-on than to ignore it. What, then, makes the study of ancient armies important, and how is it useful in the modern world?

One might begin by citing Santayana's aphorism about those who do not learn from history being doomed to repeat it. Or, one might offer Richard Neustadt's and Ernest May's not quite so familiar but more compelling thesis from *Thinking in Time* that everything has a history

and knowing that history makes understanding and solving any problem easier. Beginning one's study with the ancients, therefore, provides a deeper understanding of the modern historical context. However, both these responses are inadequate since in most cases one does not have to retreat to the ancient world to discover the roots of modern problems. There is nonetheless a simple and compelling reason for the seeker of modern relevancy to explore ancient history: All history consists of elements of change and continuity—some things are the way they were previously and some things are different. Modern society is no exception and reflects the past—even the ancient past—even as it simultaneously appears new and different. Emphasizing the elements of continuity in human history gives ancient history human relevance and meaning. If one believes that human behavior, especially group behavior, follows predictable patterns that change slowly over time in response to environmental or cultural stimuli, it makes sense to begin any study with the simplest society available. For example, if one is interested in the role of political, social, religious, cultural, or technological innovation or institutions in societal development, it is often useful to begin one's investigations in a period where those phenomena might be observable without the complicating factors introduced by a more complex and integrated world. The frequent scarcity of ancient sources sometimes hampers such investigations, but competent scholars can usually reach reliable conclusions with the material at hand. The comparatively simple nature of the society or institution being examined often makes up for the difficulty. So it is that the fact that much of human behavior has not changed since ancient times makes the study of ancient history important.

This same logic applies to the question of why one studies ancient wars and armies. The most basic features of war have changed little since the time of Sargon the Great or Ramses II. Technological progress, of course, has produced changes in the manner in which war is waged, but the basic nature of warfare has remained remarkably constant. Tanks may have replaced chariots and laser-guided bombs replaced catapults on the battlefield, but the ultimate questions of victory and defeat are still decided not by technology but by the participant who first recognizes that he has been beaten. In this respect the simplicity of ancient technology and the institutions employing it is a bonus to the scholar. It is much easier to analyze warfare when opponents can see one another, maneuver in the single dimension of ground combat, and fight it out face-to-face than it is to analyze a conflict like the one recently conducted in Kosovo where aircraft at high altitude dropped bombs with pinpoint accuracy on unseen targets that were powerless to respond. Nevertheless, these two

types of war are very much alike in their basic nature. It has become fashionable to criticize Clausewitz for developing a philosophy of war based on the post-Westphalian nation-state, particularly as it appeared in Europe during the Napoleonic era. Critics often conclude that Clausewitz's work is inapplicable both to the pre-Treaty of Westphalia period and to the modern world where the nation-state is challenged by other socio-political institutions for supremacy in the area of political decision making. The argument is unconvincing. Clausewitz's basic concepts of war—violence, friction, fog, political context, and so on—remain as useful today and in the ancient world as they were in Clausewitz's time. Although war is characterized by violence, chance, and uncertainty, it remains one of the most important means available to political leaders to address the problems of state and national interests. So, too, in the ancient world. The problems of national defense policy and strategy confronting the pharaohs are not significantly different from those facing modern nation-states, and their solutions equally reflect the goals and interests of the state, the actual or perceived threat to those goals or interests, and the resources available to counter those threats to achieve its interests. In short, exactly the challenge confronting modern leaders.

If one accepts the study of ancient warfare as a useful endeavor, then why examine all the organizational details inevitably involved in the study of ancient armies? Why not concentrate on the battles themselves or, perhaps, the leaders? These would seem to provide the most immediately applicable lessons of strategy, tactics, and effective leadership. From the author's perspective, of course, one should indeed examine these two subjects first, and Gabriel's two previous volumes, *The Great Battles of Antiquity*, and his more recent, *The Great Captains of Antiquity*, certainly provide the opportunity to do so. There are legitimate reasons, however, to examine ancient military institutions in their own right. First, it never fails to amaze a careful student how "modern" the ancient military systems were in many respects. Organizations exist to solve problems and to coordinate activities, and it should surprise no one that ancient soldiers often faced some of the same problems that confront modern soldiers, and that both developed organizations to address them. To go to war one needs to recruit, train, and equip soldiers and leaders; to organize them into efficient and manageable units; to determine where, when, and how they should be employed; to move them to the selected place of employment; to sustain them once deployed; to employ them to the utmost advantage; to re-deploy them if necessary for refitting or reconstitution. The list implies the additional organizational functions (not strictly necessary for war fighting) of keeping records and conduct-

ing other administrative activities. All societies in all ages have faced these problems. Their solutions may be unique and reflect influences peculiar to their times, but both the process and organizational product always offer something to the modern analyst.

For example, skeptics often point to changed technology as a primary reason to ignore ancient warfare and armies. The root issue is how organizations adapt to changes in technology. What causes armies to adopt new technology, especially radically different technology? Closely related is the question of what new weapons or technologies do armies adopt and what do they ignore? The decision to adopt new technology is just the first of the important decisions that arise. How is the new technology integrated with existing technology (now called legacy systems)? How is the new technology used? Does the basic doctrine and, perhaps, even culture of an army change as it adopts new technology? Is there a process to manage all this or is it done by trial and error? Of course, no society will face the problem of integrating the chariot into its military system, although the sight of U.S. special forces soldiers in Afghanistan armed with laser target designators riding into battle on horseback suggests the need for caution in such predictions. Integrating new technology into military organizations still requires the same kind of thinking and problem solving that the ancients had to use. They, too, had to develop or copy the technology, and the warfighting doctrine to support it, construct the organization to fight it, and evolve the tactics for its efficient employment in war. The solutions to each of those problems influenced other aspects of the military equation that often facilitated and/or limited the employment of the new military instrument. A brief examination of a high-tech weapons system of the ancient world, the chariot, illustrates the point.

Why adopt the new technology of the chariot? In the case of the ancient Egyptians, the answer was that the Hyksos had chariots and the Egyptians could not drive the foreigners out of Lower Egypt without them. In other societies the chariot seems to have evolved from a status vehicle for the king to a practical instrument of war based as much on the prestige of riding into battle as any real military advantage it might have offered. Once the chariot came into common use, it became the symbol of a modern army. Thus, there was pressure to field chariots just to retain the prestige and reputation of possessing a first-rate fighting force. It is often believed that most modern nations develop and deploy new technology precisely to counter genuine threats just as the ancient Egyptians did. But modern states also adopt technology as a prestige or status symbol. Consider the Latin American armies that purchase the

latest versions of tanks and jet aircraft when there is no demonstrable threat to justify the expense. When there exist genuine threats, nations naturally seek the most effective military technology. But the element of prestige still plays a role in some technology acquisition. This is precisely the case with regard to the desire of minor states to possess nuclear weapons. Why, for example, did South Africa develop nuclear weapons if not for reasons of national prestige?

The case of the chariot also illustrates different doctrinal approaches to both the design and the use of new technology. Like the modern tank, the chariot was a carefully balanced compromise between speed, firepower, and armored protection. Small, light, two-horse chariots like the Egyptian model had great speed and maneuverability but possessed less firepower and shock due to its light construction and two-man crew, only one of whom could fire the bow. The alternative design in the armies of the Levant offered a larger and more solid vehicle (in some cases with four wheels) that required up to four horses to pull it. It carried a crew of three or four. These chariots sacrificed speed for better protection, firepower, and shock potential. Obviously, one would not adopt the same warfighting doctrine for these different chariots. The Egyptians used their chariots much like light cavalry of later days. They provided front and flank protection for marching armies and excelled in pursuit. During battle, the Egyptian chariots sought the enemy flanks and rear and engaged them with long-range archery fire. The tactical doctrine of heavier chariot forces was closer to that of modern mechanized infantry mixed with a large dose of medieval heavy cavalry tactics. They were of little utility except in battle where they closed with the enemy using the momentum of vehicle and horses for its shock value.

Once in contact, the crew dismounted to fight as infantry. As the modern U.S. Army transforms itself for the future, it is attempting to develop an armored vehicle that is lethal, survivable, and sufficiently light weight to be strategically transportable. The history of the chariot suggests two considerations for the leaders of that transformation to keep in mind. First is the iron rule of technological trade-offs. Developing a light-weight, lethal, survivable, and agile tank has always been the goal. The problem is that those characteristics are so intertwined that emphasizing one inevitably results in decreased performance in others. Just as the Hittites had to add horses when they increased the crew size of their chariots, an engine powerful enough to propel a well-armored, lethal tank will necessarily increase vehicle weight. Next is the problem of doctrine. How does one fight these light-weight, agile, lethal, survivable tanks? The ancients had different tactics for chariots with different capabilities.

The doctrinal application of future tanks will also reflect their capabilities. The United States is pursuing technology to address a strategic mobility problem rather than to perform essential tactical missions. Consequently, the employment doctrine for the new technology is not yet established. The temptation will surely be to use the new vehicle in much the same way as traditional tanks and will likely result in a less than optimal solution to the evolution of an effective warfighting doctrine. The ultimate doctrine will almost certainly contain some aspects of existing armor doctrine, but, conversely, slavish adherence to existing doctrine will doom the new technology to failure.

How does an army integrate new technology with its existing technology? In the case of chariots, perhaps the best illustration is the example of the integration of existing chariots with the new technology of cavalry. The gradual displacement of chariots occurred as cavalry increased in capability and proved its worth on the battlefield. The chariot did not disappear completely or even quickly, and there was always a period of overlap and at times a resurgence in the popularity of the older technology leading to its occasional re-use. Using the example of today's transformation of the U.S. Army, the plan calls for deployment of interim brigades where new technology can be tested and exercised before the eventual fielding of objective brigades containing the advanced technology. The legacy force will coexist with both the interim and objective brigades until the concept is proven. Over time, both the legacy force and the interim brigades will be phased out. These are modern terms for the process the Assyrians used to transform their force from an infantry-chariot army through an infantry-chariot-cavalry army to an infantry-cavalry army.

Beyond questions of technology as a reason for studying the ancient world is the issue of the relationship between a society and its military. How do societies influence military organizations and how do military organizations reflect the possibilities or limits of their societies? A social, cultural, political, religious, and economic relationship exists in every society that influences the size, composition, and use of its military institutions. For example, the question of drafted versus volunteer service is as much cultural as political or economic, and is often completely divorced from considerations of threats to the national interest. No answer is fixed but changes as the environment changes. The Roman army began as an organization of free citizens exercising their civic duty by serving in times of need. It evolved into an army of professional citizens serving the state, an army of professional citizens and foreigners serving

their commanders, and eventually into an army of non-citizen foreigners that was virtually a mercenary establishment. One can point to some specific causes for that evolution, perhaps the increased frequency and length of wars that made a short-service militia of citizens impractical, but the overall relationship between political, social, cultural, religious, and economic factors that caused all the changes was far too complex for comprehensive analysis. Yet, those relationships are exactly the sort of modern issues we need to understand in order to analyze contemporary society and the great issues of military policy. We may never encounter as clear and uncomplicated a relationship as that between the Mongol culture and its military or as overtly militaristic a society as the Spartans, but each may provide insight into elements of modern cultures, societies, and armies.

A final issue is, Why define the ancient world as broadly as the author does? Conventionally, the ancient world ends with the fall of the western Roman Empire or at least sometime during the late Roman period. Gabriel goes on to talk about cultures and armies a thousand years after that date. Purists may grumble, but actually this is a major strength of his work. The most interesting and important aspect of this book and its predecessors is their broad scope both geographically and temporally. *The Great Armies of Antiquity* discusses armies from east Asia to the British Isles and most of the territory in between. Temporally it spans almost 5,000 years of history from 3500 B.C.E. to 1453 C.E., from the early Bronze Age to European feudalism. It is a brave and rare author who tackles such a broad and diverse range of subjects. The specialist in a particular period may be unsatisfied with some detail of the presentation, but that should not overshadow the commendable and successful effort to synthesize a vast amount of historical material into a comprehensive, integrated, and readable whole. The historical discipline needs more books like this, particularly at a time when we often seem to be falling into the academic pit of excruciating detail about what privates thought about some minor skirmish of the Civil War or the step-by-step advance of a rifle company across Europe in World War II. Both are interesting to our overall understanding of their respective wars. But no matter how well the tales are told or how compelling the heroism depicted, the events themselves remain mere historical trivia. They are insignificant pieces of a much larger and more important whole. Worse, in most cases they represent a return to the drum and trumpet school of military history that the profession has tried to deemphasize since the 1960s. Richard Gabriel is one of the few authors writing about the an-

cient period who synthesizes major trends over sweeping cross-cultural and cross-temporal periods. He deserves credit for his efforts and his book deserves serious attention.

—J. Boone Bartholomees, Jr., Ph.D.

Preface

The Great Armies of Antiquity is the last volume in a project that began more than a decade ago when I was professor of Military History and Politics at the United States Army War College, where I introduced the systematic study of ancient military history to the curriculum. In attempting to select books that provided the student with a comprehensive overview of the field that were, at the same time, sufficiently detailed to permit the student an encounter with the rich literature that renders the study of ancient history so useful and interesting, I discovered that selections were few. Specialization, the curse of academic life in the modern era, had worked against the recent production of general, yet sufficiently detailed, works on the subject. What acceptable texts there were were usually more than fifty years old and tended, like Delbruck's work, to offer detail at the expense of overall comprehension or, like Liddell-Hart's, were often short and incomplete. To deal with this difficulty I wrote *The Great Battles of Antiquity: A Strategic and Tactical Guide to the Great Battles that Shaped the Development of War*, a detailed study of eighteen battles in the ancient period that I deemed to be the most significant for my students to learn about the development of war in the ancient world.

The book worked well enough, but was met with the immediate criticism that it offered too few insights into the personalities of the great captains whose actions in war and politics shaped so much of the de-

velopment of the ancient world. To meet this criticism, I wrote *The Great Captains of Antiquity*. Modeled on Liddell-Hart's work of the 1920s, *Great Captains*, my book offered a study of the personalities and leadership of six "great captains"—Thutmose III of Egypt, Sargon II of Assyria, Philip II of Macedon, Hannibal, Scipio Africanus, and Augustus Caesar—whose actions influenced much of the history of the ancient world. This, too, worked well enough (although by now I was retired from my faculty posting and writing from afar) or so I am told by those using the book in my old class in ancient history which, I am pleased to report, still survives in the War College curriculum.

As I continued my work even in retirement, it came to me that the field also lacked a sufficiently comprehensive treatment of another important aspect of ancient military history, namely the instruments of social violence that had in fact served so much to forge the ancient cultures into what they were, the ancient armies themselves. It was the attempt to fill this need that led me to write the third and last volume in the series, *The Great Armies of Antiquity*. For whatever shortcomings may remain in these three volumes, it is nevertheless of some value that students and teachers of ancient military history (few though they may be!) have available to them a teaching and research tool for approaching the field in a systematic and, one hopes, somewhat complete manner.

The approach that I have taken in *The Great Armies of Antiquity* is the same as that used in the first two volumes and encompasses four elements. First, an analysis of the organizational structure and weapons of each of the nineteen armies studied is offered. Second, since armies are first and foremost societal institutions more than technical devices (this despite the protests of generals through the ages to the contrary!), the societal culture that produced each army is analyzed with a view to revealing the degree to which cultural values and imperatives shaped the form and application of military force. Third, the tactical doctrines and specific operational capabilities of each army are analyzed with a view toward explaining how certain technical limitations (the absence or presence of iron, for example) and societal/cultural imperatives (the social structure of the horse-borne Germanic tribes ensured the dominance of cavalry on the battlefield for a thousand years) affected the operational capabilities of ancient armies. Finally, I have striven throughout the analysis of each army to make cross-cultural and cross-historical connections to ground the analysis in the larger historical context that was the ancient world. Given that my students and colleagues found this approach of some value in the earlier volumes, it is my hope that it offers similar value in the present one.

The last volume ends where the first one began, with the affirmation that there is much to be gained from the study of ancient military history that is directly relevant to those in the modern age whom we entrust with the responsibility of protecting the nation through the design and implementation of national defense policy. One may, of course, quibble with the value of studying this or that battle, field commander, or army, but overall, the value of studying history to expand the context within which the decision maker must act, is surely beyond any reasonable debate. For soldiers, citizens, and policymakers to remain ignorant of what has gone before in the history of warfare is almost to guarantee that the egregious errors of the past will be repeated, if only in analogous form, by the generals and politicians of the present day. *The Great Armies of Antiquity* and the previous companion volumes are one old teacher's attempt to prevent this.

1

War in the Ancient World
2500 B.C.E.–1453 C.E.

The invention and spread of agriculture coupled with the domestication of animals in the fifth millennium set the stage for the emergence of the first large-scale, complex urban societies. These societies appeared almost simultaneously around 4000 B.C.E. in both Egypt and Mesopotamia. Within five hundred years stone tools and weapons gave way to copper and then to bronze, and with bronze manufacture came a revolution in warfare.

While this period saw the development of many new weapons, it is incorrect to conclude that new weapons themselves were responsible for the great increase in the scale of warfare that characterized this period of human history. Improved weaponry, by itself, would have produced only a limited increase in the scale of warfare unless accompanied by new types of social structures capable of sustaining large armies and providing them with the impetus to fight on a heretofore unknown scale. The military revolution of the Bronze Age occurred more in the development of truly complex societies than in weapons technology.

What made the birth of warfare on a modern scale possible was the emergence of social orders characterized by fully articulated social structures that provided stability and legitimacy to new social roles and behaviors. The scale of these fourth-millennium urban societies was a result of an efficient agricultural ability to produce adequate food resources that could sustain large populations. It is no accident that the two earliest

examples of these societies, Egypt and Sumer, were states where large-scale agricultural production was first achieved. But it was the revolution in social structures that rested upon the new economic base that was most important to the emergence of war.

These early societies produced the first examples of state-governing institutions, initially as centralized chiefdoms and later as monarchies. These new governmental structures gave a degree of stability and permanence to the centralized direction of social resources on a large scale. Chiefdoms supported by organized but still small armed forces forged the scattered elements of the protosocieties into true social orders. At the same time centralization demanded the creation of an administrative structure capable of directing social activity and resources toward communal goals. It was these new types of social organizations that permitted Narmer of Egypt, for example, to create a truly national irrigation system for the 700-mile-long Nile in 3200 B.C.E. By 2700 B.C.E. similar administrative structures were present throughout the city-states of Mesopotamia.

The development of central state institutions and a supporting administrative apparatus inevitably gave form and stability to military structures. The result was the expansion and stabilization of the formerly loose and unstable warrior castes that first emerged in the tribal societies of the fifth millennium. By 2700 B.C.E. in Sumer, and earlier in Egypt, there was a fully articulated military structure organized along modern lines. The standing army emerged for the first time as a permanent part of the social structure and was endowed with strong claims to social legitimacy. It has been with us ever since.

As important as these developments were, they could not have worked as they did unless there had been a profound change in the psychological basis of people's social relationships with the larger community. The aggregation of large numbers of people into complex social orders also required that those living within them refocus their allegiances away from the extended family, clan, and tribe toward a larger social entity, the state. This psychological change was facilitated by the rise of religious castes that gave meaning to the individual's life beyond a parochial context. Organized belief systems were integrated into the social order and given institutional expression through public rituals that linked religious worship to political and military objectives that had become national in scope. Thus, the Egyptian pharaoh became divine, and the military achievements of great leaders were perceived as divinely ordained. In this manner the terrible propulsive power of religion was placed at the service of the state and its armies.

It is important to remember that the period from 4000 to 2000 B.C.E. was a truly seminal period in the development of the institution and instrumentalities of war. When this period began, people had not yet invented cities or any of the other social structures required to support communal life on a large scale. Agriculture, which became the basis for the nation state during this period, was still in its infancy and could not yet provide a food supply adequate to sustain populations of even moderate size. Psychologically, people had not yet learned to attach meaning to any social group larger than the extended family, clan, or tribe. The important force of religion had not yet been given specific social focus and institutional expression to the extent where it could become a powerful psychological engine to drive the spirit of conquest and empire. There were only the embryonic beginnings of a warrior caste still only loosely embedded in a tribal social structure, a structure that lacked both the physical and psychological requirements to produce war on any scale. Military technology and organization were primitive, and the professionalization of armies had not yet begun. In any meaningful sense warfare had not yet been embedded in the social structure as a legitimate and permanent function of government.

The 2,000 years following the dawn of the fourth millennium changed all this. As a mechanism of cultural development, the conduct of war became a legitimate social function supported by an extensive institutional infrastructure, and it became an indispensable function of human social order. This period saw the emergence of the whole range of social, political, economic, psychological, and military technologies that made the conduct of war a characteristic element of human social existence. In less than 2,000 years, man went from a condition in which organized social violence was relatively rare and often ritualistic to one in which death and destruction were achieved on a modern scale. In this period warfare assumed truly modern proportions in terms of the size of the armies involved, the administrative mechanisms required to sustain them, the development of weapons, the frequency of occurrence, and the scope of destruction achievable by military force. The ancient world had given birth to a level of warfare that would have been instantly recognizable in all its elements by a soldier of the present day. This book is about the armies that emerged and developed during this period, 2500 B.C.E. to 1453 C.E. As terribly destructive as these armies were, there is no doubting their importance as instruments of history, for it was the armies of the ancient world that often provided the means through which the emperors, tyrants, and demi-gods of the period shaped the history of the world. Without them, that history would have been very different indeed.

To study the armies of the ancient world, then, is to attempt to comprehend human history itself, together with one of mankind's most fascinating social inventions, war.

The historical period addressed by this study is both long and complex. Encompassing as it does the period from 2500 B.C.E. to 1453 C.E., the study of war within it ranges from the end of the Bronze Age, through the Iron Age, to the period of the Dark Ages, and the Age of European Feudalism. While the organization and conduct of war *within* each period manifested a high degree of consistency of application, the conduct and organization of war *between* periods is often diverse. Thus, as the Bronze Age was ending, man had succeeded in inventing and institutionalizing the conduct of war into truly complex societies. By the Iron Age, the increase in social complexity and organization produced an era in which warfare reached levels of application that were virtually modern. Following the collapse of Rome, however, the decline in levels of social organization brought with it a steep decline in the quality of warfare. As the social orders of the Dark Ages plunged to almost Bronze Age levels, so, too, did their ability to produce armies capable of sophisticated operations. The highly organized and sophisticated armies of Rome were replaced with tribal armies whose conduct of military operations can be described as little more than squalid butchery. By the eighth century, however, the West was once again beginning to rediscover the secrets of societal organization and control as feudalism became the dominant form of social organization. While the armies of this period were more sophisticated than the armies of the Dark Ages, they were only marginally so. When the ancient world finally met its demise at the siege of Constantinople in 1453 C.E., armies had still not achieved the level of organization and sophistication evident in the Iron Age.

The period from 1500 B.C.E. to 100 C.E. was one in which there occurred a genuine revolution in most aspects of people's social existence and organization. It was a period also characterized by a revolution in the manner of conducting warfare. The Iron Age was marked by almost constant war, a time in which states of all sizes came into existence only to be extinguished by the rise of still larger empires which, in their turn, were destroyed by military force. During this time humankind refined the social structures that were essential to the functioning of genuinely large and complex social orders and, in doing so, brought into existence a new and more destructive form of warfare. The Iron Age also saw the practice of war firmly rooted in man's societies and experience and, perhaps more importantly, in his psychology. This age produced the prototype of every weapon of war that was developed for the next 3,000

years.[1] Only with the introduction of gunpowder weapons would a new age of weapons and warfare begin. It was during the Iron Age that a military revolution began that eventually produced the age of modern war.

One of the more important stimuli for this military revolution was the discovery and use of iron, first employed as a technology of war by the Hittites.[2] Iron's importance as a technology of war rested in the fact that unlike bronze, which required the use of relatively rare tin to manufacture—a fact that had limited the spread of bronze weapons manufacture—iron was commonly and widely available almost everywhere.[3] The plentiful supply of this new strategic material made it possible for states to produce enormous quantities of reliable weapons cheaply. No longer was it only the major powers that could afford enough weapons to equip a large military force. Now almost any state could do it. The result was a weapons explosion that dramatically increased the frequency, scope, and scale of warfare.

The armies of this period were the first to practice conscription on a regular basis. While the Sumerian and Egyptian armies had used conscription much earlier, the scale and regularity with which conscription was used by Iron Age armies dwarfed this experience. The Iron Age gave birth to the standing national army. The emergence of the standing national army increased the professionalization of military establishments. A constant flow of conscripts required a permanent cadre of professionals to train, lead, and integrate conscript units. While conscripts could be easily used to fill out garrison forces within an empire, only under the tutelage of professionals could their fighting ability and loyalty be achieved. Ultimately, of course, only the fighting ability and political loyalty of the professionals could be relied upon by the national governments. The Assyrians and Persians always retained a large corps of professionals as the centerpiece of their military establishments and ensured that loyal professionals remained in control of key logistics and supply functions of the various national and conscript units under imperial command.[4]

The military revolution made itself felt in a number of key areas of military development, all of which had the cumulative effect of changing the nature, scope, and scale of war. Among the more important military developments of this period were changes in the size of armies, logistics, transport, strategic and tactical mobility, siegecraft, artillery, staff organization, military training, and weaponry. In almost every one of these military capabilities the armies of the Iron Age reached a level of development that was not surpassed until the Age of Napoleon. In still

others, it required the invention of the mechanical weapons and powered machines to surpass the level of ability demonstrated by the ancients.

SIZE OF ARMIES

While the size of the armies in the late Bronze Age were quite large by comparison to those at the beginning of the period, they were minuscule by comparison to armies that fought in the Iron Age. The Persians, for example, routinely deployed field armies that were *ten times larger* than anything seen in the Bronze Age. Some examples of the size of these armies are instructive. The Egyptian army in the time of Ramses II (1300 B.C.E.) is estimated to have had over 100,000 men.[5] This force was largely comprised of conscripts, most of whom garrisoned strong points throughout the empire and carried out public works projects. The actual field army was organized into divisions of 5,000 men and could be deployed individually or as a combined force of several divisions.[6] The Assyrian army of the eighth century B.C. was comprised of between 150,000 and 200,000 men and was the largest standing military force that the Middle East had witnessed to this time.[7] An Assyrian field army numbered approximately 50,000 men with various mixes of infantry, chariots, and cavalry.[8] In modern terms an Assyrian field army was equal in size to five modern heavy American divisions or almost eight Soviet field divisions. When arrayed for battle the army took up an area of 2,500 yards across and 100 yards deep. The Assyrian army was also the first army to be entirely equipped with iron weapons.[9]

Even the Assyrian army, as great as its size, was easily dwarfed by the Persian armies that appeared 300 years later. Darius' army in the Scythian campaign numbered 200,000, and the force deployed by Xerxes against the Greeks numbered 300,000 men and 60,000 horsemen.[10] Even at the end of the empire, the Persians could deploy very large forces. In 331 B.C.E., just before Alexander destroyed the Persian empire at Arbela, Darius III fielded a force of 300,000 men, 40,000 cavalry, 250 chariots, and 50 elephants.[11] Philip of Macedon could field a combat army of 32,000 men, and the army of Alexander sometimes exceeded 60,000 men. The Roman military forces which, at the end of the empire, totaled 350,000 men, could routinely field armies of 40,000. The one exception to the ability of Iron Age armies to deploy large numbers was the armies of classical Greece. Being products of small city-states, classical armies were usually small even by Bronze Age standards.[12] The growth in the size of armies of the Iron Age was almost exponential when compared to earlier armies. Sustained by larger populations, cheap and plentiful

weapons, the need to govern larger land areas of imperial dimension, and the evolving ability to exercise command and control over larger military establishments, the armies of this period were larger than anything the world had seen to this point. After the fall of Rome, tribal forces were often just as large. But the low level of organizational structure of these armies hardly qualifies them as armies as such. By feudal times, with the exception of the Mongols, armies became generally smaller, but still retained the decentralized organizational structure which, more than size, limited their ability to conduct truly sophisticated warfare.

LOGISTICS AND TRANSPORT

As the size of armies and the scale of battles increased, ancient armies had to master the task of logistically supporting these armies in the field. The need to support armies in the field for months, sometimes years, was a function of the rise of the imperium. Armies now had to conduct combat operations over far wider areas for longer periods than ever before. Changes in the composition of military forces also added to the logistics burden. The development of the chariot required repair depots and special mobile repair battalions to ensure that the machines remained functional on the march.[13] The Assyrian invention of cavalry brought into existence a special branch of the logistics train to ensure that the army could secure, breed, train, and deploy large numbers of horses to support these new forces. This special branch, the *musarkisus*, was able to obtain and process 3,000 horses a month.[14] Advances in siegecraft required an army to transport siege towers and engines, and artillery, first introduced by the Greeks but brought to perfection under the Romans, added yet another requirement to transport catapults and shot. The need to manufacture, issue, and repair the new iron weapons in unprecedented numbers required yet more innovations in logistics. Among the more important requirements of the logistics trains of ancient armies was the need to supply large numbers of men and animals with food and water. Of all the achievements of the ancient armies, those in the area of logistics often remain the most unappreciated by modern military planners.

During the Bronze Age the standard mechanism of transport was the donkey (Egypt) or the solid-wheeled cart drawn by the onager (Sumer). Ramses II revolutionized Egyptian logistics by introducing the ox-drawn cart, which quickly became the standard mode of military logistical transport for almost a thousand years.[15] Xenophon recorded that the normal pack load for a single ox-drawn cart in Greek armies was twenty-five

talents, or approximately 1,450 pounds.[16] Studies by the British War Office in World War I noted that a mule could carry upward of 300 pounds, and the camel slightly less.[17] The Persians used teams of oxen to haul their large wooden siege and mobile towers. Xenophon noted that sixteen oxen were required to pull the tower, which weighed approximately 13,920 pounds.[18]

While the ox cart allowed armies to move heavier loads, it slowed their rate of movement to a crawl. It is important to remember that there were few packed roads and none of the paved roads introduced later by the Romans. The animal collar had not been invented yet, so that harnesses pressed on the windpipes of the baggage animals and increased the rate of physical exhaustion. Under the best of conditions an ox cart could travel two miles an hour for five hours before the animals became exhausted.[19]

As the armies grew in size, the logistical burden threatened to reduce drastically their rate of movement and their ability to maneuver at all. The introduction by the Assyrians of the horse allowed a slight increase in logistics capacity, as did their innovation of using the camel as a military beast of burden. Five horses could carry the load of a single ox cart, but could move the load at four miles an hour for eight hours.[20] Equally important, the horse could move easily over all types of terrain, and five horses required only half the forage required to feed a team of two oxen.[21] It was the Persian army that introduced a major innovation in logistics. While the Egyptians sometimes used small coastal vessels to supply their armies, the Persians were the first to introduce a large-scale navy used primarily in support of ground operations.[22] By the time of Alexander the logistics trains of ancient armies had matured to a point where they could regularly supply large armies for longer periods. However, the problem of speed and flexibility of movement over rough terrain remained.

Philip of Macedon increased the rate of movement of his armies by forbidding the practice of taking wives and camp followers along with the army.[23] He eliminated the ox cart from the logistics train and replaced it with a mix of horses and mules. By requiring the soldier to carry his own equipment, Alexander created the lightest, most mobile, and fastest army the world had ever seen. Alexander's army could routinely move at thirteen miles a day, and separate cavalry units covered twice that distance.[24] These same reforms introduced in the Roman army by Marius in 99 B.C.E. produced the same results.

STRATEGIC MOBILITY

A tremendous increase in strategic mobility resulted from the ability of Iron Age armies to deploy larger and larger armies and to sustain them logistically in the field. Strategic mobility can be defined as the ability of a military force to project power over a given area. After the fall of Rome, only the armies of the Mongols and Islam could match the strategic mobility of these earlier armies. The typical range of a Bronze Age army was approximately 350 miles by 150 miles. The earliest armies of Sumer conducted military operations over a range of 250 by 125 miles.[25] Egyptian armies of the same period projected force over a 600 by 200 mile area.[26] By the Iron Age, strategic range had increased enormously.

The Egyptian army of 1400 to 1250 B.C.E. had a strategic range of 1,250 by 200 miles or more than twice the range of the earlier period. Assyria conducted military operations over 1,250 miles by 300 miles, five times the range of the Sumerian armies. The armies of Persia, Alexander, and Rome (and later the Mongol and Islamic armies) attained strategic ranges typical of present-day armies. The Persian army, for example, conducted operations from the Iaxartes and Indus Rivers to Thrace, Cyrene, and Thebes, a strategic range of 2,500 by 1,000 miles. Alexander's armies ranged from the Hellespont to the Caspian Sea to the Persian Gulf, a range of 2,600 by 1,000 miles.[27] The range of Roman armies was 3,800 miles by 1,500 miles. On average, the armies of the late Iron Age had a strategic range that was nine times greater than the range of the armies in the Bronze Age.

The increased mobility of some of these armies was also a function of the military road. Early imperial states had the advantage of interior lines and regular travel over regular routes, a practice that packed down and widened dirt trails into usable, good-weather roads. Regular routes of travel made the use of military maps a regular practice for the first time. The Persian empire was tied together by a system of royal roads that facilitated military control and communication with the provinces at the empire's rim. A system of regular bridges over streams and other terrain obstacles, more than the surface of the road itself, greatly increased rates of movement. The most amazing system of military roads was the Roman road network, which crisscrossed the entire empire. As Rome established her hegemony over the Western world, she connected the entire empire with a network of military roads. The Romans constructed over 250,000 miles of roads, including 50,000 miles of paved, permanent roadways, most of which still exist.[28] The effect on the mo-

bility of Roman armies was amazing. On dry, unpaved roads a Roman legion (6,000 men) could move no more than eight miles a day.[29] In wet weather, movement was almost impossible at any speed. On paved roads, however, a legion could move twenty to thirty miles a day in all kinds of weather. The Roman military road network not only increased strategic range and mobility, but revolutionized logistics and transport as well.

TACTICAL FLEXIBILITY

The armies of this period also made revolutionary advances in tactical mobility and proficiency, which had important effects on the conduct of war. Tactical mobility can be defined as the ability of small combat units to perform sophisticated tactical maneuvers to increase the combat power of these units, thereby increasing the overall combat power of the army as a whole. Even seemingly small innovations had considerable impact. The Assyrian invention of the leather jackboot is an excellent example. The lack of adequate footgear was a major factor in limiting the tactical mobility of early ancient combat units. The Assyrians were the first to improve the military footgear of the ancient soldier. The Assyrian soldier wore a knee-high, leather jackboot with thick leather soles complete with hobbed nails to improve traction. The boot had thin plates of iron sewn into the front to provide shin protection.[30] The high boot provided excellent ankle support for troops who fought regularly in rough terrain, and served as excellent protection in cold weather, rain, and snow. The boot kept foot injuries to a minimum, especially in an army with large contingents of horses and other pack animals. The Assyrian boot was a major factor in the ability to develop an all-weather combat capability for the Assyrian army. Within a short time of the Assyrian innovation, military boots of various designs became standard equipment for all the later armies of the period.

The growth in small-unit tactical ability was also evident in the ability of armies to develop an all-weather capability for ground combat. The Assyrians regularly fought in the summer and winter months and even carried out siege operations during the winter.[31] They also fought well in marshlands. Placed aboard light reed boats, tactical units became waterborne marines who used fire arrows and torches to burn out the enemy hiding among the bushes and reeds.[32] The ability to mount military operations in all kinds of weather and terrain quickly became a major characteristic of all later Iron Age armies.

The regular use of tactical combat engineering units provided yet an-

other increase in the combat power of field units. Assyrian engineers built the first portable military pontoon bridges from palm wood planks and reeds.[33] At times they used inflated animal skin bags to float men and equipment over rivers.[34] The large cavalry contingents of the Persian armies required that their combat engineers become skilled at the construction of bridges with vertical sides so that horses could cross steep ravines without fear driving them to bolt. Military engineering skills reached their height in the ancient world under the Romans, including the ability to construct a fortified camp every night while on the march. The regular presence of combat engineering crews within field armies, itself a major military innovation, greatly increased the capabilities of tactical combat units.

Among the most difficult tasks of any commander, ancient or modern, is the ability to control his tactical combat units once committed to battle. For the most part, armies tried to control units by introducing semaphore flag signals and sounds from drums and trumpets. Alexander made good use of a corps of staff riders who could ride to combat units and pass instructions, an innovation copied by Napoleon. The Romans used a combination of these techniques, as the Mongols did later, but improved on them by having a special signaler within each cohort. The Greeks seem to have been the first to introduce the use of the signalling mirror to pass orders.[35] A Roman innovation was to stress small unit tactical proficiency in training, making the soldier able to respond instantly to formation and other commands given by his unit leader. The earliest armies were essentially infantry forces, with little in the way of tactical capability. While the early Egyptian armies organized their infantry by the types of weapon it carried, this did little to increase tactical flexibility. The result was packed infantry formations that could hardly move once arrayed for battle. When rival infantry formations clashed and one side broke, the victor had no opportunity to pursue and increase the kill rate. This situation changed completely with the Egyptian adoption of the chariot.

The Egyptian chariot, a much improved version over the old Sumerian, Hyksos, and Cananite machines, introduced a radically new tactical capability to the battlefield: mobility. The chariot added a new dimension to the traditional use of shock tactics and, when equipped with archers armed with the composite bow, provided the world's first mobile firing platform. It was the only weapon that could participate in all phases of the battle with equal effectiveness.[36] Its archer crews could engage the enemy at long range. Upon closing, the crews switched to the javelin and the axe and attacked as infantry. Once the enemy was scattered, the

chariot could be used to mount a truly lethal pursuit. In addition, the chariot could be used to inflict surprise, a tactic that had never been possible with densely packed infantry formations. The chariot also permitted another major tactical innovation, the use of mobile reserves that could be committed at a propitious moment to turn a flank or exploit a breakthrough. It was the high-tech fighting machine of its day.

The tactical flexibility of the Assyrian army relied on providing a mix of units acting in concert. The firepower of their archer companies was increased by as much as forty percent by introducing an innovation in the shoulder quiver that allowed the arrows to be brought within easy reach of the bowman.[37] The Assyrian chariot was a larger and heavy vehicle pulled by three horses, and carried a crew of four. The Assyrian chariot's tactical role was to maximize the use of shock. The idea was to attack enemy infantry from as many directions as possible and deliver maximum shock. Once engaged, the crews dismounted and fought as infantry. The Assyrians were the first to introduce the use of mounted infantry, and their use of the chariot strongly parallels the use of armored personnel carriers in modern armies.

The scope of Assyrian military action required it to fight in all types of terrain, a condition to which the heavy chariot was not suited. A major Assyrian revolution in battlefield capability was the invention of cavalry. Assyrian cavalrymen used the saddle girth, crupper, and breast strap to stabilize the rider, and the horse was controlled by leg and heel pressure of the boot. (The spur and stirrup had not been invented yet.) These innovations made possible the first use of mounted archers, the famed "hurricanes on horseback" mentioned in the Old Testament. The ability of the horse to traverse uneven terrain made the cavalry especially lethal in the pursuit. This same capability made cavalry forces highly flexible and valuable for reconnaissance in force, providing flank security, and inflicting tactical surprise. The Persians expanded the role of cavalry in their fighting formations. By the time of Cyrus, the Persian army's ratio of cavalry to infantry was 20 percent cavalry to 80 percent infantry.[38] It was the largest cavalry force in the world.

Throughout the classical period, the primary killing arm of Greek armies had been heavy infantry. Philip's reforms had created the Macedonian phalanx, which, if anything, was even heavier and less capable of complex battlefield maneuver than the old phalanx. Alexander's tactical contribution was to use his heavy infantry in an entirely new manner while reducing its role as the primary killing arm. Alexander used his heavy infantry to anchor the center of the line and to act as a platform for the maneuver of his primary striking arm, the heavy cavalry armed

with the javelin. He coupled this new tactical idea with another, the oblique formation. The infantry was not deployed as the foremost frontal point of the line but held back obliquely in the center while the heavy cavalry deployed in the strength on the right, connected to the infantry by a hinge of elite cavalry. The idea was to engage the enemy on the flank and force him to turn toward the attack. Alexander was the first of the ancient commanders to use cavalry as the primary combat arm of an army and bequeathed the lesson to future armies that cavalry is always to be used in concert with infantry. When both Wellington and Ney forgot this lesson at Waterloo, the result was a disaster for both British and French cavalry forces.

The tactical proficiency of ancient armies went through several phases. First was the primacy of infantry; then the Egyptian use of the chariot introduced the new element of mobility to the battlefield. The Assyrians found a new role for the chariot, mounted infantry, but relied more heavily upon cavalry to provide mobility and flexibility. The great reliance upon cavalry by the Persians led to the neglect of heavy infantry, and Alexander's use of ponderous infantry formations as a platform of maneuver signaled the emergence of cavalry as the primary striking force of ancient armies. In each phase of tactical development, the role of infantry as the main maneuver and killing force on the battlefield declined. How surprising, then, that the next major army to appear on the ancient battlefield found its primary strength in the role of its heavy infantry formations.

The spine of the Roman army was its heavy infantry formations. Unlike infantry of the past, the Roman maniples and, later, cohorts were more maneuverable than any infantry formations the world had seen to that point. They also far surpassed the killing power of earlier infantry formations to an almost exponential degree. The secret of the Roman killing machine was that the Roman soldier was the first soldier to fight within a combat formation while at the same time remaining somewhat independent of its movement as a unit. He was also the first soldier to rely primarily upon the sword, the *gladius*, instead of the spear.[39] The Roman gladius was responsible for more death on the battlefield than any other weapon until the invention of the firearm.[40]

The old phalanxes of the past were virtually immobile as a result of their density. The Roman innovation was to build in spaces between soldiers and units, thereby greatly increasing tactical flexibility and mobility. Each soldier could move freely over five square yards of ground *within the unit*, seeking and destroying individual targets. Each line of infantry was separated from the next by an interval of approximately 100

yards. This *quincunx* or checkerboard arrangement provided maximum flexibility for each maniple and allowed it to deliver or meet an attack from any direction while delivering maximum killing power.

Tactical flexibility was increased by the relationship between the lines of infantry. If, after the first line engaged, it was unable to break the enemy formation or grew tired, it could retire upon command in good order through the gaps left in the second line. The second line then moved to the front and continued the attack. This maneuver could be repeated several times, with the effect that the Roman front line was always comprised of rested fighting men. The ability to maneuver tactically through one's own lines offered yet another tactical innovation. The inability of earlier infantry formations to replace men in the front ranks often turned the defeat of the front rank into a rout of the whole unit. No army until the time of Rome had learned how to break contact and conduct a tactical retreat in good order. The ability of individual lines to pass to the rear, withdrawing through the gaps, allowed the Romans to master the art of disengagement and tactical withdrawal.

The resurgence of infantry as the primary tactical killing arm inevitably reduced the role of cavalry to a secondary one. Roman infantry ruled supreme in the ancient world until its fatal defeat at the battle of Adrianople (378 C.E.). The defeat of Roman infantry at the hands of barbarian cavalry shook the tactical thinking of the ancient world. Followed as it was by years of invasion by tribal armies that generally used loose, tribal cavalry armies, the empire in the West eventually collapsed and with it went the primacy of infantry. The death of disciplined infantry forces was a natural consequence of the social organization of the new tribal states of Europe. Infantry decayed and the primacy of cavalry became complete. The battle of Hastings in 1066 C.E. settled the question for hundreds of years.

During the Middle Ages the armored knight became the prototype of the successful warrior, and infantry all but disappeared. The Islamic and the Mongol threats to Europe reinforced that idea that infantry was no longer an effective fighting arm. Tactics of any sort declined greatly, so much so that most battles of this period could be described as little more than semiorganized brawls. Although the Swiss had shown at Paupen (1339 C.E.) that disciplined infantry could deal effectively with cavalry, and Crecy (1346 C.E.) demonstrated their vulnerability to the new long-range weapon—the long bow—cavalry remained supreme.[41] The supremacy of infantry and tactical flexibility did not begin to appear again until the invention of the musket. By that time, the armies of the ancient world were long dead.

SIEGECRAFT

Siegecraft came into existence in an attempt to deal with one of the most powerful defensive systems produced by the Iron Age, the fortified city. The first fortified city to appear in the Middle East was at Jericho, although it is by no means clear that the walls of this city were originally built for military reasons.[42] By the Bronze Age, however, there was unambiguous evidence of fortifications built exclusively for military purposes. Within two hundred years, fortification of urban areas had become commonplace.

Fortified cities placed field armies at great risk. Safe behind the city's walls, defending armies could provision themselves for long periods, while attacking armies were forced to live off the land until hunger, thirst, or disease ravaged them. Worse, no army bent on conquest could force a strategic decision as long as the defender refused to give battle. A conquering army that tried to bypass fortified strong points placed itself at risk of surprise attack from the rear at a time of the enemy's choosing. Even in ancient times, then, the success of a conquering army depended upon its ability to overcome fortified strong points and cities if it was to achieve its strategic and tactical objectives.

Not surprisingly, the military engineers of ancient armies invented the techniques of siegecraft, one of the most sophisticated expressions of the military art. One of the earliest inventions to overcome fortifications was the battering ram, which dates from at least 2500 B.C.E.[43] The ability to secure large spear blades to long beams allowed engineers to pry stones loose from the walls until a breach was achieved. The Hittites used the technique of building an earthen ramp at a low spot in the wall and then rolling larger, covered battering rams into place. The Assyrians built wooden siege towers taller than the defensive walls and used archers to provide cover fire for the battering ram crews working below. The Assyrians also perfected the use of the scaling ladder to mount soldiers with axes and levers who dislodged the stones in the wall at midpoint. Longer ladders were used to insert combat forces over the walls. To an army on the march, fortifications had to be overcome quickly to preserve the offensive.

The development of siegecraft continued during the reigns of Philip and Alexander. Philip realized that the new Macedonian army would remain a force fit for obtaining only limited objectives if it were not provided with the capability to rapidly reduce cities. Alexander's far-flung victories would have been impossible without this capability. Philip introduced the use of siegecraft into his army, copying many of the

techniques first used by the Assyrians and passed to him by the Persians. Both Philip's and Alexander's armies made regular use of siege towers, battering rams, fire arrows, and the *testudo*.[44]

The Roman ability to reduce fortifications was probably the best in the ancient world, but it relied primarily upon organization and application rather than on engineering innovation. For the most part Roman siege engines were significantly improved versions of the old Greek and Persian machines. The Romans raised the art of circumvallation and countervallation to new heights. Mostly, it was Roman determination and discipline, Roman *gravitas*, that proved more effective than machinery. Once the Romans were committed to a siege, the results were almost inevitable no matter how long it took.

ARTILLERY

It was Philip of Macedon who first organized a special group of artillery engineers within his army to design and build catapults. Philip gave Greek science and engineering an opportunity to contribute to the art of war, and by the time of Demetrios I (305 B.C.E.), known more commonly by his nickname "Poliocetes" (the Besieger), Greek inventiveness in military engineering was probably the best in the world.[45]

The most important contribution of Greek military engineering of this period was the invention of artillery, the earliest of which took the form of catapults and torsion-fired missiles. The earliest example dates from the fourth century B.C.E., and was called a *gastraphetes*, literally, "belly shooter."[46] Later, weapons fired by torsion bars powered by horsehair and ox tendon (the Greeks called this material *neuron*,) springs could fire arrows, stones, and pots of burning pitch along a parabolic arc. Some of these machines were quite large and mounted on wheels to improve mobility. One of these machines, the *palintonon*, could fire an eight-pound stone over 300 yards, a range greater than that of some Napoleonic cannon.[47] All these weapons were designed for use by Philip in siege warfare. But it was Alexander who used them in a completely new way—as covering artillery—and gave birth to a new branch of the combat arms.

Roman advances in design, mobility, and firepower of artillery produced the largest, longest-ranged, and most rapid-firing artillery pieces of the ancient world. Roman catapults were much larger than the old Greek models and were powered by torsion devices and springs made of sinew kept supple when stored in special canisters of oil. Josephus recorded in his account of the siege of Jerusalem that the largest of these

artillery pieces, the onager, could hurl a 100-pound stone over 400 yards.[48] Vegetius later noted that each legion had ten of these machines, one for each cohort.[49] Caesar required that each legion carry thirty smaller versions of these artillery pieces, giving the legion a mobile, organic artillery capability. Smaller machines fired iron-tipped bolts. Designed much like the later crossbow but mounted on small platforms or legs, these machines required a two-man crew and could be used as rapid-fire field guns against enemy formations. They fired twenty-six inch bolts over a range of almost 300 yards. These machines could fire three to four bolts a minute and were used to lay down a barrage of fire against enemy troop concentrations.[50] They were the world's first rapid-fire field artillery guns.

The emergence of siegecraft and artillery as basic implements of ancient armies represented a major innovation in warfare. Without the ability to reduce cities and strongpoints in hostile territory, no army could hope to force a strategic decision with any rapidity. The very idea of empire would have been unthinkable. After the collapse of Rome, artillery and siegecraft generally fell into decline as much of the required technical knowledge was lost. The art remained in practice in Byzantium which, through military contact, passed it to the armies of Islam. In Asia, the Mongols became adept at using Chinese techniques of siegecraft and artillery. Although siegecraft and artillery represented the birth of a major new idea in the technology of war, it was an idea that came to full fruition only with the introduction of gunpowder.

STAFF ORGANIZATION

The emergence of large, complex armies brought into existence the specialized staffs required to make them work. The invention of the military staff may be compared in importance with the rise of the administrative mechanisms of the state that appeared at the same time. In the modern age we are so accustomed to various forms of social organization and bureaucracy that we are prone to forget how important a social invention administrative mechanisms were. Without them it would have been impossible for the states of the period to generate the high levels of social and economic complexity that they did, and it would have been impossible to produce large and sophisticated armies.

The first military staffs emerged in Egypt during the period of the Old Kingdom (2686–2160 B.C.E.). While the complete structure is unknown, through an analysis of titles there is ample evidence of sophisticated staff organization. The organizational principle, then as now, was probably

based on function. A clearer command and staff structure emerged during the Middle Kingdom (2040–1786 B.C.E.), when titles for general officers in charge of logistics, recruits, frontier fortresses, and shock troops were found.[51] For the first time there was evidence of a military intelligence service.[52] Surprisingly, there is clear evidence of the first use of the commander's conference for staff planning on the battlefield.[53]

The citizen armies of classical Greece were essentially part-time affairs, and there does not appear to have been any permanent staff organization except for Sparta, itself a military society. Yet, this period may have produced the first written treatises on tactics and strategy.[54] Earlier evidence reveals the existence of cuneiform manuals for military physicians in Assyria, a datum that could imply that the Assyrians may also have written and used military textbooks to train their officers. The armies of Philip and Alexander, while more structurally articulated in staff organization than the armies of classical Greece, do not appear to have reached the level of sophistication of earlier armies. The structures of these armies were essentially extensions of the personalities of their respective commanders, and did not survive long enough to acquire institutional foundations of their own.

The height of military staff development was achieved by the Romans. So effective was the Roman staff organization that more than any other army, it still serves as a model for modern armies. Each senior officer had a small administrative staff responsible for paperwork, and the Roman army generated considerable numbers of files. Each soldier had an administrative file that contained his full history, awards, physical examinations, training records, leave status, retirement bank accounts, and pay records. Legion and army staff records included sections dealing with intelligence, supply, medical care, pay, engineers, artillery, siegers, training, and veterinary affairs.[55] The degree of sophistication and organization evident in the army of Rome was not achieved again until, at least, the armies of the American Civil War.

COMBAT TRAINING

As armies became more complex, the need to train the soldier in more skills increased. The first evidence of military training is found in ancient Egypt. A surviving scrap of papyrus warns the soldier against military life because of its rigors and the propensity of commanders to use beatings and other physical punishments.[56] A description of military training among the Persians was produced by Strabo, who noted that Cyrus introduced universal military training among the Persians. Training was

vigorous and included physical conditioning, instruction in the bow and javelin, and horsemanship. Recruits were also trained to forage for their food, prepare meals in the field, and make and repair weapons.[57] The first code of military ethics, the code of the Persian army, taught the recruit to "ride well, shoot straight, and tell the truth."

The training regimen of the classical Greeks was directed more at physical conditioning than at the development of specific military skills. This focus was logical in light of the fact that the phalanx tactics of the day required more stamina and bravery than skill to implement. The Roman mix of equipment and special military skills required special training, which, in turn, required an intelligent soldier. The legions screened applicants for military service and selected only the best physical specimens. Equally important was the selection of men who could read, write, and perform some mathematical calculations.[58] The most intelligent soldiers were trained in the special skills needed by the army. The Roman army trained its own medical personnel and surgeons, and operated its own hospitals. As a professional army, the legions ran their own specialized training programs in everything from military engineering to artillery gun repair. The complexity of war, as in modern times, made the mental skills of the soldier at least as important as his physical skills. In 105 B.C.E., the Roman army adopted the training methods heretofore used by professional athletes in the gladiatorial school.[59] It was also common practice to ship units to special exercise areas to build up skill proficiency prior to embarking upon campaign.[60]

When taken together, all the elements discussed above made possible a military revolution that increased the capabilities of armies to levels that gave birth to war on a modern scale. The increased size and complexity of these armies resulted in an increase in the size of battles and the accompanying destruction. These battles often involved numbers of men that were not usually exceeded in battles of the modern period until Waterloo and Gettysburg. The increased destructive power of these armies permitted the destruction of whole cities on almost a routine basis. The destruction of some cities of the period was as complete as if they had been struck by a nuclear attack. In some instances whole cultures were destroyed and disappeared, never to emerge again.[61]

But what distinguishes modern warfare from primitive warfare is more than the level of military capability and destructive power. The key defining quality of modern war is strategic endurance, and this quality is a function of the total integration of social, economic, and political resources of the state in support of military operations. For much of the early ancient period, armies could often force a strategic decision with

a single battle. As the states of the period grew in complexity, their ability to remain at war increased exponentially. Because armies could now draw upon the total mobilized resources of their states to support military operations, a single battle no longer decided their fate. The staying power or strategic endurance of some of the ancient armies increased to a level at least equal to that of the armies of World War I.

WEAPONS TECHNOLOGY

The advent of metals technology did not greatly affect the weaponry of warfare. The most significant impact was its contribution not to offensive weapons, but to defensive systems. The development of protective body and head armor had a tremendous impact on warfare and tactics, and the development of new metal weapons represented an attempt to thwart the effectiveness of defensive armor. Metals technology, early on, did permit the introduction of two important new weapons, the penetrating socket axe and the sickle sword, whose effectiveness depended directly upon the ability to cast metal into required shapes. Neither weapon revolutionized warfare on any significant scale. Indeed, the most important and revolutionary weapons of the metals age, the composite bow and the chariot, did not depend upon metals technology at all.

The Bronze Age is normally dated as encompassing 4000 to 1200 B.C.E., at which date the Iron Age is generally held to have begun. Even when metals technology had found its way into most states of the Middle East, say by 2600 B.C.E., its military use was dictated by factors other than the technology itself. In Mesopotamia, where warfare among rival city-states was constant, metal weapons assumed an immediate importance. Frequent war accelerated the rate of weapons development and accounted for the large number of weapons innovations introduced by the Mesopotamian states of this period. In other states, most notably Egypt, metals technology had far less impact on weapons technology, and the rate of innovation was slow. Technological progress in bronze weapons was slowed further by the rarity and expense of tin needed to fashion bronze. The supply was never adequate for large-scale weapons manufacture, and the cost of production remained high. The wide availability of iron, first used as a technology of war by the Hittites around 1200 B.C.E., and its ease of extraction marked the first true revolution in metal weapons by bringing them within easy reach of even small states. Metals technology from the beginning did provide the ability to fashion an effective body armor. Once body armor was introduced, weapons

development is most properly seen as an attempt to overcome the effectiveness of armor, a task that was never truly mastered. Thus, the basic weapons revolution of the age of metals was in defensive systems.

ARMOR AND HELMETS

The first recorded instance of body armor is found on the Stele of Vultures in ancient Sumer, which shows Eannatum's soldiers wearing leather cloaks on which are sewn spined metal disks.[62] The disks do not appear to be arranged in any order, and we do not know if the disks were made of copper or bronze. By 2100 B.C.E. the victory stele of Naram Sin appears to show plate armor, and it is likely that plate armor had been in wide use for a few hundred years. Plate armor was constructed of thin bronze plates sewn to a leather shirt or jerkin. The plates themselves were two millimeters thick and had slightly raised spines to allow them to hang correctly.[63] This type of armor became standard protection for the Egyptian soldier of the New Kingdom (1600–1000 B.C.E.). The rise of the iron army of Assyria saw the introduction of a new and more effective form of body armor called lamellar armor. Assyrian armor was comprised of a shirt constructed of laminated layers of leather sewn or glued together. To the outer surface of this coat were attached fitted iron plates, each plate joined to the next at the edge with no overlap and held in place by stitching or gluing. A conservative estimate of the weight of this armor is thirty pounds.[64]

By the time of classical Greece and ancient Rome (600 B.C.E.), armor had changed considerably. Instead of laminated leather and iron plates, the Greeks and early Romans introduced the cast bell muscular cuirass made of bronze. This form of armor bears no connection to earlier developments in Assyria, Sumer, or Egypt and represents a totally new type of armor. The cuirass weighed about twenty-five pounds, was hot and uncomfortable, and slowed movement.[65] By the third century B.C.E., the bell cuirass had given way in Greece to the linen cuirass. Constructed of strips of linen glued and sewn together in lamellar fashion, it was cheaper, more flexible, and lighter than the bronze cuirass.[66]

The third century B.C.E. saw the introduction of iron chain mail, probably invented by the Celts.[67] A shirt of mail weighed about thirty pounds, but was much easier to make in quantity than cast bronze armor. The Romans adopted the chain mail armor for their own troops, and the mail shirt remained the basic armor of the Roman infantryman until the first half of the first century B.C.E. By the first century C.E. the Roman army was equipped with laminated leather armor that provided sufficient pro-

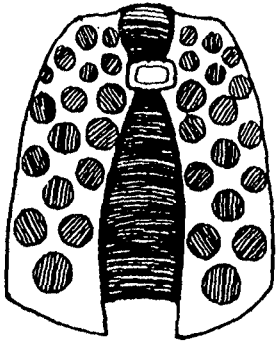
tection against the tribal armies that they encountered most. Perhaps the ultimate body armor appeared at the same time, the *lorica segmentata.* It was constructed of plates of thin sheet steel riveted to leather plates held together by straps and a series of buckles and locks. At twenty pounds it was considerably lighter than the traditional chain mail.[68] Figure 1.1 provides examples of each of the different types of armor discussed above.

The earliest evidence for the helmet is found in Sumer at the Death Pits of Ur dating from 2500 B.C.E. Similar helmets appear on the Stele of Vultures. The Sumerian helmet was made of a cap of hammered copper approximately two to three millimeters thick fitted over a leather cap. It remains unclear why the Sumerians did not use bronze for their helmets. Once the helmet made its appearance, it became standard military equipment, at least until the seventeenth century C.E. In Assyria the helmet was constructed of iron and shaped to an acute point so as to reduce its area and increase its ability to deflect arrows and blows. The Assyrian helmet, like all helmets of the period, required an inner cap of leather or wool, which helped absorb impact and dissipate heat. The helmet chin strap was introduced by the Sea Peoples to Egypt early in the New Dynasty. Greek helmets were constructed of bronze and had cheek and face plates. Roman helmets also came to have face plates. Face plates were never a major feature of helmets in the Middle East, probably because they made the head too hot. The Romans were the first to mass-produce bronze helmets, casting them in state arms factories.

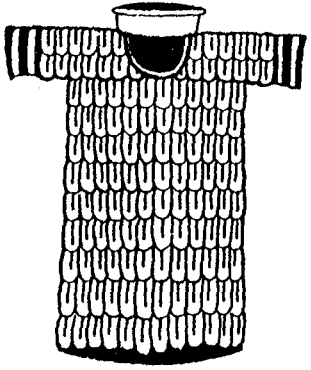
The body armor and helmet of the ancient soldier afforded him good protection against the weapons of the day. Table 1.1 provides data on empirical tests with replicas of ancient weapons and data on the amount of impact energy that can be produced through muscle power for a range of weapons. Also provided is the amount of impact energy relevant to the size of the striking surface required to penetrate standard bronze and iron armor of the period. The data suggest that the helmet and body armor of the ancient soldier provided excellent protection except against the penetrating axe.

The advent of gunpowder is commonly thought to have made body armor obsolete. Yet, it was two hundred years after the introduction of gunpowder that the musket was sufficiently powerful to pierce the plate armor of the Renaissance knight. The result was that armies completely abandoned the search for personal protection for the soldier, and body armor and the helmet disappeared from the battlefield. This was a tragic mistake. The fact is that the body armor and shield of the ancient armies would have provided excellent protection against firearms well past the

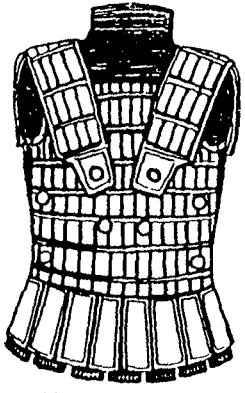
Figure 1.1
The Development of Body Armor



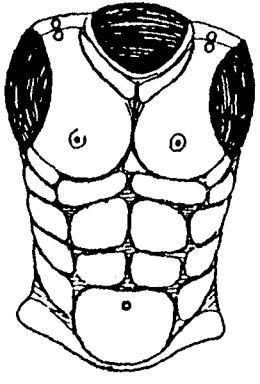
SUMER (2500 B.C.)



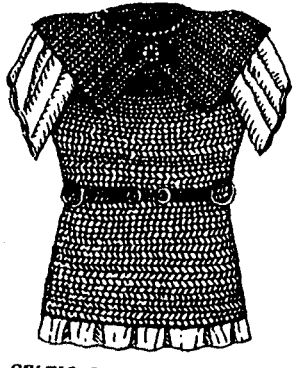
EGYPT (1700 B.C.)



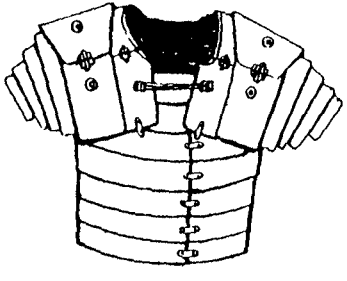
ASSYRIA (900 B.C.)



GREECE (400 B.C.)



CELTIC CHAIN MAIL (200 B.C.)



ROME (100 A.D.)