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A SHORT HISTORY OF WAR
The Evolution of Warfare and Weapons

Richard A. Gabriel
and
Karen S. Metz

Strategic Studies Institute
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Professional Readings in Military Strategy, No. Five

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Strategic Studies Institute
U.S. Army War College
Carlisle Barracks, Pennsylvania

Memoriam

Olaf Tollefsen
John McGrath
Fr. Anthony Cacciola, O.S.B.

Good men, gone, but alive in
the hearts of their friends

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Comments pertianing to this publication are invited and may be forwarded to: Director, Strategic Studies Institute, U.S. Army War College, Carlisle Barracks, PA 17013-5050. Comments also may be conveyed by calling Dr. Gabriel via commercial (717) 245-3022 or DSN 242-3022.

FOREWORD

The education of an officer goes far beyond the comprehension of tactics and operational skills required to wage war. The warrior must have at his command as complete a knowledge as possible of the larger context in which he acts. He must be ever aware of the consequences of his actions on the battlefield as they influence not only the outcome of the battle, but the larger questions of strategy and politics within whose context wars and battles are fought in the first place. Expanding the context of the officer requires, therefore, an understanding of the history of war.

There was, perhaps, a time when it was possible to provide officers with a list of lessons that served them well for the rest of their careers. Such a time has long past, rendered irrelevant as the process of change in weapons technology, politics, and operational doctrine moves faster with each passing year. Moreover, the larger strategic, political, and social milieu within which these changes occur is in itself caught in the swirl of change. Under these conditions, what a military institution of higher learning can achieve is to expand as widely as possible the informational context within which officers must exercise their intellects while insuring that they also develop the mental capability to deal with larger numbers of variables interacting simultaneously. The study of history holds the promise of conferring such skills.

A Short History of War offers the reader a brief, but relatively comprehensive, overview of the forces that have shaped the development of armies, weapons, and war throughout the ages. Its broad thematic approach conveys that sense of historical context within which solders have had to act over the millennia. The reader will immediately recognize that there is little new in the current debates over force structure, weapons, tactics, and operational skills that has not gone before. The reader will also realize that those nations that did not accurately understand the context in which they carried out their policies paid a terrible price for their ignorance. The risk of similar

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WILLIAM A. STOFFT
Major General, U.S. Army
Commandant

PREFACE

The idea for this volume came originally from Dr. Gary Guertner, Director of Research for the Strategic Studies Institute of the U.S. Army War College. The War College is tasked with the mission of educating some three hundred American and foreign military officers of all services in the discipline of strategic analysis and formulation. As an integral part of this educational experience a great emphasis is placed upon the study of history to provide a context in which these future leaders are able to examine and solve contemporary problems. As military men, quite naturally the study of history occupies a large part of their academic curriculum. The difficulty arises from the fact that many of our students have had insufficient time throughout their careers to study history prior to attending the War College. The press of their command and staff responsibilities has simply been too great to provide the time and leisure that the study of the past necessarily requires.

A Short History of War is a primer of military history that stresses the major developments in weaponry and warfare within an historical framework that is compact and quick to read. It provides a common informational base upon which to build the longer, more substantive, and more detailed study of history that the students are required to master at the War College.

To be sure, no history of warfare and weapons of this length can make any claim to completeness. That is why we have included a bibliographic essay in an effort to guide the student toward readings that can provide the rich detail of historic events that this work cannot. There are, no doubt, any number of multivolume works that will be far more rewarding to the serious student of the subject. However, deeper research into the discipline requires an initial stimulus. By providing the reader of *A Short History of War* with a broad treatment of an immensely complex subject, we hope that the book will lead to greater individual efforts to learn more.

It is impossible to stress too strongly the importance of historical context when, as many of our students will eventually be asked to do, military leaders are required to understand contemporary problems of strategy. In America, history seems to be devalued more than in other countries, perhaps because our own history is so recent. Americans often approach world problems as if they are happening for the first time and, for Americans, this may indeed be the case. But the world is very much older than America, and the rich context of human experience has much to offer and teach. Military and political leaders run great risk if they fail to understand the historical and human context in which their decisions are likely to be played out.

Nothing has been said here that is not well understood and repeated often by the faculty of the Army War College in their seminars. We are also aware that the students understand that a major purpose of their education here is to expand the frame of reference through which they see the world. In achieving that goal, in our view, there is no substitute for the study of history. If *A Short History of War* has any value, it does so insofar as it contributes to this end.

CHAPTER 1

THE ORIGINS OF WAR

The invention and spread of agriculture coupled with the domestication of animals in the fifth millennium B.C. are acknowledged as the developments that set the stage for the emergence of the first large-scale, complex urban societies. These societies, which appeared almost simultaneously around 4000 B.C. in both Egypt and Mesopotamia, used stone tools, but within 500 years stone tools and weapons gave way to bronze. With bronze manufacture came a revolution in warfare.

This period saw the development of many new weapons–the penetrating axe, armor, helmet, composite bow, the wheel and chariot–and gave birth to a number of tactical innovations–phalanx formations, increased mobility, pursuit, emergent staffs and rank structures. It would be incorrect to conclude, however, that new weapons 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 and means to fight on a heretofore unknown scale. The military revolution of the Bronze Age was rooted more in the development of truly complex societies than in weapons and technology.

What made the birth of warfare possible was the emergence of societies with fully articulated social structures that provided stability and legitimacy to new social roles and behaviors. The scale of these fourth millennium urban societies was, in turn, a result of an efficient agricultural ability to produce adequate resources and 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. The revolution in social structures that rested upon the new economic base was the most important factor responsible for the emergence of warfare.

These early societies produced the first examples of state-governing institutions, initially as centralized chiefdoms and later as monarchies. The new government 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-scale 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. By 3100 B.C., such an administrative structure, complete with writing and formal record keeping, was already evident in Egypt, and by 2700 B.C., it was present throughout the states of Mesopotamia. Although these structures were probably first employed on large scale public works projects–building dikes, irrigation systems, the pyramids, and *ziggurats* of ancient Sumer–it was but a short step to employ these new organizational resources in the service of warfare.

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. in Sumer there was a fully articulated military structure and standing army organized along modern lines. The standing army emerged as a permanent part of the social structure and was endowed with strong claims to social legitimacy. And it has been with us ever since.

As important as these developments were, they could not have worked as they did without a profound change in the psychological basis of the people's social relationship with the larger community. The aggregation of large numbers of people into complex societies required that those living within them refocus their allegiances away from the extended family, clan, and tribe, and 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 were national in scope and definition. Thus, the Egyptian pharaoh became divine, and military achievements of great leaders were perceived as divinely ordained or inspired. In this manner the terribly 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. 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 in the ancient 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 to the point where it could become a powerful psychological engine to drive the spirit of conquest and empire. Even warfare itself had not in any meaningful sense been invented. There were only the embryonic beginnings of a warrior class still 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 and warfare had not yet begun. In any significant sense warfare had not yet been embedded in the social structure of man as a legitimate and permanent function of developed society.

The two thousand 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 characteristic of the social order if people were to survive the predatory behavior of others.

This period saw the emergence of the whole range of social, political, economic, psychological, and military technologies that made the conduct of war a relatively normal part of social existence. In less than two thousand years, man went from a condition in which warfare was relatively rare and mostly ritualistic in which combat death and destruction were suffered at low rates to one in which death and destruction were attained on a modern scale. In this period, warfare assumed modern proportions in terms of size of the armies involved, the administrative mechanisms needed to sustain them, the development of weapons, the frequency of occurrence, and the scope of destruction achievable by military force. And it was in Sumer and Egypt that the world witnessed the emergence of the world's first armies.

CHAPTER 2

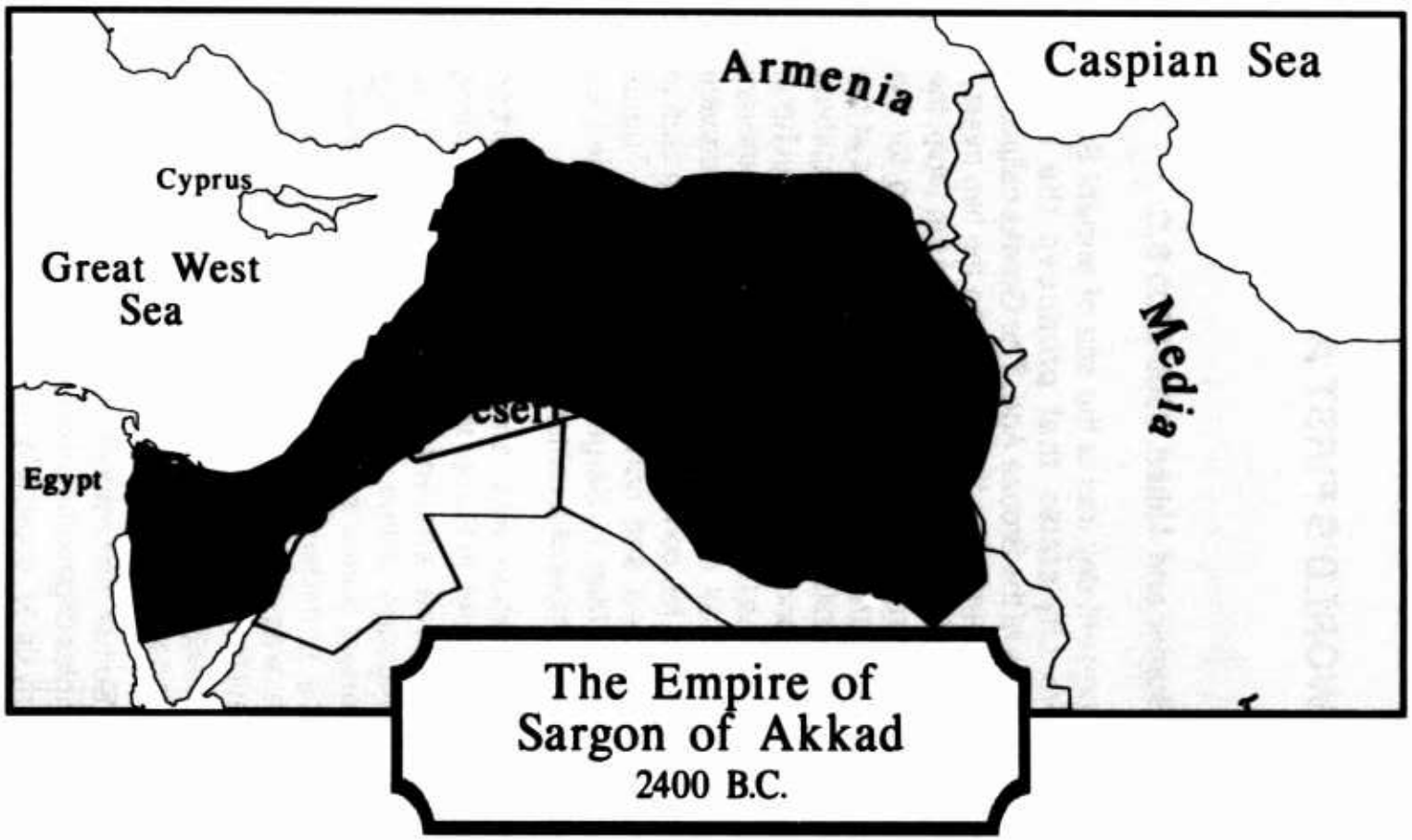
THE WORLD'S FIRST ARMIES

The Armies of Sumer and Akkad, 3500-2200 B.C.

The area of present-day Iraq is the site of ancient Sumer and Akkad, two city-states that produced the most sophisticated armies of the Bronze Age. The Greeks called the area Mesopotamia, literally the "land between the two rivers," a reference to the Tigris and Euphrates basin. In the Bible, the area is called *Shumer*, the original Sumerian word for the southern part of Iraq, the site of Sumer with its capital at the city of Ur. If the river is followed northward from Sumer for about 200 miles, the site of ancient Akkad can be found. From here, in 2300 B.C., Sargon the Great launched a campaign of military conquest that united all of Mesopotamia. Within a decade Sargon had extended his conquests from the Persian Gulf to the Mediterranean Sea and northeastward to the Taurus Mountains of Turkey (Map 1). Sargon the Great provided the world with its first example of a military dictatorship.

Sumerian civilization was among the oldest urban civilizations on the planet. In Sumer the first attempts at writing emerged to produce ancient cuneiform, a form of administrative language written as wedged strokes on clay tablets. And in ancient Sumer the first detailed records, written or carved in stone, of military battles appeared. No society of the Bronze Age was more advanced in the design and application of military weaponry and technique than was ancient Sumer, a legacy it sustained for two thousand years before bequeathing it to the rest of the Middle East.

The cities of Sumer, first evident in 4000 B.C., provide the world's first examples of genuine urban centers of considerable size. In these early cities, especially in Eridu and Urak, people first manifested the high degree of cooperative effort necessary to make urban life possible. Both cities reflected the evidence


Armenia
Caspian Sea
Cyprus
Great West Sea
Media
Egypt
The Empire of Sargon of Akkad
2400 B.C.

Map 1.

of this cooperation in the dikes, walls, irrigation canals, and temples which date from the fourth millennium. An efficient agricultural system made it possible to free large numbers of people from the land, and the cities of ancient Sumer produced social structures comprised largely of freemen who met in concert to govern themselves. The early Sumerian cities were characterized by a high degree of social and economic diversity, which gave rise to artisans, merchants, priests, bureaucrats and, for the first time in history, professional soldiers. The ancient Sumerians were a polyglot of ethnic peoples, much like in the United States.

The period of interest for the student of military history is that from 3000 to 2316 B.C., the date that Sargon the Great united all of Sumer into a single state. This period was marked by almost constant wars among the major city-states and against foreign enemies. Among the more common foreign enemies of the southern city-states were the Elamites, the peoples of northern Iran. The conflict between Sumerians and Elamites probably extended back to Neolithic times, but the first recorded instance of war between them appeared in 2700 B.C., when Mebaragesi, the first king on the Sumerian King List, undertook a war against the Elamites, and "carried away as spoil the weapons of Elam." This first "Iran-Iraq war" was fought in the same area around Basra and the salt marshes that have witnessed the modern conflict of the last decade between the same two states.

The almost constant occurrence of war among the city-states of Sumer for two thousand years spurred the development of military technology and technique far beyond that found elsewhere at the time. The first war for which there is any detailed evidence occurred between the states of Lagash and Umma in 2525 B.C. In this war Eannatum of Lagash defeated the king of Umma. The importance of this war to the military historian lies in a commemorative stele that Eannatum erected to celebrate his victory. It is called the Stele of Vultures for its portrayal of birds of prey and lions tearing at the corpses of the defeated dead as they lay on the desert plain. The stele represents the first important pictorial of war in the Sumerian period. The Stele of Vultures portrays the king

of Lagash leading an infantry phalanx of armored, helmeted warriors, armed with spears, trampling their enemies. The king, with a socket axe, rides a chariot drawn by four *onagers* (wild asses.) In a lower panel, Eannatum holds a sickle-sword. The information and implications of this stele are priceless.

The stele demonstrates that the Sumerian troops fought in phalanx formation, organized six files deep, with an eight-man front, somewhat similar to the formation used in Archaic Greece. Fighting in phalanx requires training and discipline, and the stele thus suggests that the men in this battle were professional soldiers. The typical neolithic army of men brought together to meet a temporary crisis found in Egypt throughout the Old Dynasty period had been clearly superseded in Sumer by the professional standing army. We know from the Tablets of Shuruppak (2600 B.C.) that even at this early date the kings of the city-states provided for the maintenance of 600-700 hundred soldiers on a full-time basis. This provision of military equipment for the soldiers was a royal expense. Gone was the practice of each warrior fashioning his own equipment. The stele provides the first evidence in human history of a standing professional army.

The first historical evidence of soldiers wearing helmets is also provided on the stele. From the bodies of soldiers found in the Death Pits of Ur dating from 2500 B.C., we know that these helmets were made of copper and probably had a leather liner or cap underneath. The appearance of the helmet marks the first defensive response to the killing power of an important offensive weapon, the mace, probably the oldest effective weapon of war. It was an extremely effective weapon against a soldier with no protection for the head. But in Sumer, the presence of a well-crafted helmet indicated a major development in military technology that was so effective that it drove the mace from the battlefield.

The first military application of the wheel is depicted on the stele which shows Eannatum riding in a chariot. Interestingly, the Sumerians also invented the wheeled cart, which became the standard vehicle for logistical transport in the Middle East until the time of Alexander the Great. The Sumerian invention of the chariot ranks among the major military innovations in

history. The Sumerian chariot was usually a four-wheeled vehicle (although there are examples of the two-wheeled variety in other records) and required four *onagers* to pull it. The Sumerians are also credited with inventing the rein ring for use with the chariot in order to give the driver some control over the *onagers*. At this early stage of development the chariot probably was not a major offensive weapon because of its size, weight, and instability. In all probability it was not produced in quantity. Later, however, in the hands of the Hyksos, Hittites, Cannanites, Egyptians, and Assyrians, the chariot became the primary striking vehicle of the later Bronze and early Iron Age armies. Chariot drivers, archers, and spearmen became the elite fighting corps of the ancient world. In some countries of the area, the tradition continues to this day. It is not accidental that the Israeli army named its first tank the *Merkava*. In Hebrew, *Merkava* means chariot.

The lower palette of the Stele of Vultures shows the king holding a sickle-sword. The sickle-sword became the primary infantry weapon of the Egyptian and Biblical armies at a much later date. When the Bible speaks of peoples being "smoted," the reference is precisely to the sickle-sword. The fact that the sickle-sword appears on two independent renderings of the same period suggests strongly that the Sumerians invented this important weapon sometime around 2500 B.C.

The stele shows Eannatum's soldiers wearing what appears to be armored cloaks. Each cloak was secured around the neck and was made either of cloth or, more probably, thin leather. Metal disks with raised centers or spines like the boss on a shield were sown on the cloak. Although somewhat primitive in application, the cloak was the first representation of body armor, and would have afforded relatively good protection against the weapons of the day. Later, of course, the Sumerians introduced the use of overlapping plate body armor.

Other ancient Sumerian archaeological sources portray additional examples of important military innovations. A carved conch plate shows the king of Ur armed with a socket axe. The development of the bronze socket axe remains one of Sumer's major military innovations, one that conferred a significant

military advantage. Ancient axe makers had difficulty in affixing the axeblade to the shaft with sufficient strength so as to allow it to remain attached when striking a heavy blow. The use of the cast bronze socket, which slipped over the head of the shaft and could be secured with rivets, allowed a much stronger attachment of the blade to the shaft. It is likely that the need for a stronger axe arose in response to the development of some type of body armor that made the cutting axe less effective as a killing instrument. Further, Sumerian axes by 2500 B.C. clearly show a change in design. The most significant change was a narrowing of the blade so as to reduce the impact area and bring the blade to more of a point. The development marks the beginning of the penetrating axe, whose narrow blade and strong socket made it capable of piercing bronze plate armor. The result was the introduction of one of the most devastating weapons of the ancient world, a weapon that remained in use for two thousand years.

The military technology of the ancient world did not, as in modern times, develop independent of need. There were, after all, no research and development establishments to invent new weapons. In the ancient world military technology arose in response to perceived practical needs arising from battlefield experience. And in Sumer, two thousand years of war among the city-states provided the opportunity for constant military innovation. In other countries, such as Egypt, that were sealed off from major enemies by geography and culture, there was little need to change military technologies. The weapons of Egypt, as a result, remained far behind developments in Sumer because they were adequate to the task at hand. There was no need to develop body armor, the helmet, or the penetrating axe when one's enemies did not possess this technology. But sophisticated weaponry and tactics required some form of larger social organization to give them impetus and direction.

We know very little about the military organization of Sumer in the third millennium. We can judge from the Tablets of Shuruppak (2600 B.C.) that the typical city-state comprised about 1800 square miles, including all its fields and lands. This area could sustain a population of between 30 and 35 thousand people. The tablets record a force of between 600-700 hundred

soldiers serving as the king's bodyguard, the corps of the professional army. But a population of this size could easily support an army of regular and reserve forces numbering between four and five thousand men at full mobilization. Surely some form of conscription must have existed since theirs was a common tradition of corvée labor to maintain the dikes and temples. Yet the military confrontations of the time may not have required very large armies. Conscript troops would not usually be capable of the training and discipline required of an infantry phalanx. If they were used, they were likely armed with some other weapons, like the sickle-sword or the bow, whose application could be taught to an average conscript or reservist in a few days.

One fact contributing strongly to the possibility of some sort of military organization was that by 2400 B.C. the Sumerian kings had largely abandoned their religious functions to the priesthoods while increasing their civil functions and control. The kings became the undisputed controllers of civic resources. Moreover, it is simply not reasonable to expect that a people who could organize themselves to tame the Tigris and Euphrates with an elaborate system of dikes, canals, and bridges and who could sustain a sophisticated system of irrigation would, at the same time, have simply left to chance the organization of their military arm, among the most important roles of the king.

The period following Eannatum's death was characterized by more war, a situation that led to a relatively even development of weapons technology throughout the city-states of Sumer. Two hundred years after Eannatum, King Lugalzagesi of Umma succeeded in establishing his influence over all of Sumer, although there is no evidence that he introduced any significant changes. Twenty-four years later, the empire of Lugalzagesi was destroyed by the forces of a Semitic prince from the northern city of Akkad, Sargon the Great. By force of arms he conquered all the Sumerian states, the entire Tigris-Euphrates basin, and brought into being an empire that stretched from the Taurus Mountains to the Persian Gulf. Sargon united both halves of Mesopotamia for the first time since 4000 B.C.

As with most early Sumerian kings, we know little about Sargon the Great. Cuneiform records indicate that in his 50-year reign he fought no fewer than 34 wars. One account suggests that his core military force numbered 5,400 men; if that account is accurate, then Sargon's standing army at full mobilization would have constituted the largest army of the time by far. Even for this time a standing army of this size is not as outrageous as it may seem. Unlike leaders of the previous wars between the rival city-states, Sargon created a national empire and would have required a much larger force than usual to sustain it, as he and his heirs did for 300 years. In this sense, Sargon faced the same problem as Alexander. Like Alexander, once the city-states were brought to heel, Sargon would have required them to place at his disposal some of their military forces. As we have noted, each of the 14 major city-states could have sustained an army of between four and five thousand men, not counting the small states that would also have been forced to contribute. Yet another source of military manpower would have been available from the conquered non-Sumerian provinces. It was common practice through Greek and Roman times to enlist soldiers of the conquered into the imperial armies of the time. The armies of imperial Egypt, Assyria, Persia, and Rome all had large contingents of former enemies within their ranks.

That Sargon's army would have been comprised of professionals seems obvious in light of the constant state of war that characterized his reign. Even if they had begun as conscripts, within a short time Sargon's soldiers would have become battle-hardened veterans. Equipping an army of this size would have necessitated a high degree of military organization to run the weapons and logistics functions, to say nothing of routine administration likely attendant to a people who, by Sargon's time, had been keeping written records for more than a millennium.

During the Sargonid period, the Summerians/Akkadians contributed yet another major innovation in weaponry, the composite bow. The innovation may have come during the reign of Naram Sin (2254-2218), Sargon's grandson. Like his grandfather, Naram Sin fought continuous wars of suppression

and conquest. His victory over the Lullubi is commemorated in a rock sculpture that shows Naram Sin armed with a composite bow. This rendering marks the first appearance of the composite bow in history and strongly suggests it was of Sumerian/Akkadian origin.

This bow was a major military innovation. While the simple bow could kill at ranges from 50-100 yards, it would not penetrate even simple armor at these ranges. The composite bow, with a pull of 2-3 times that of the simple bow, would easily have penetrated leather armor, and perhaps even the early prototypes of bronze armor that were emerging at this time. Even in the hands of untrained conscript archers, the composite bow could bring the enemy under a hail of arrows from twice the distance as the simple bow. So important was this new weapon that it became a basic implement of war in all armies of the region for the next fifteen hundred years.

The armies of Sumer and Akkad represented the pinnacle of military development in the Bronze Age. No army of the same period could match the Sumerians in military effectiveness and weaponry. The Sumerian civilization produced no fewer than six major new weapons and defensive systems, all of which set the standard for other armies of the Bronze Age and Iron Ages. Few armies in history have been so innovative.

The armies of Egypt, on the other hand, although already a thousand years old by the time of Sargon, were technologically inferior to the Sumerians and would remain so until, in a remarkable example of technological transfer, the Egyptians themselves obtained the weapons of the Sumerians and used them to forge the world's next great military empire.

The Armies of the Pharaohs, 3200-1300 B.C.

Human settlement in Egypt may have begun as long as two hundred and fifty thousand years ago. Climatic and geographic conditions were highly favorable to the rapid development of a large-scale agricultural society. Egyptian society of 4000 B.C. was formed around provincelike entities called *nomos* ruled by individual chiefs or *nomarchs*. Over time, these nomarchs

assembled in loose feudal arrangements into two clusters of kingdoms, Upper and Lower Egypt. In 3200 B.C., the king of Upper Egypt, known variously to history as Narmer, Menses, or, probably most correctly, Hor-Aha (Fighting Hawk), unified the two kingdoms by force into a single Egyptian state. Hor-Aha diverted the rivers of the Nile and founded the first Egyptian capital at Memphis. Thus began the reign of pharaohs of the predynastic period, which lasted for 700 years.

The kings that followed from 3100 to 2686 B.C. expanded the Egyptian state. Successful campaigns were launched against the Nubians to the south and the Libyans to the west. Expeditions were undertaken in the Sinai, and trade was established with the states north of Lebanon and Jordan. During this period a state bureaucracy was brought into existence, writing was introduced as a tool of centralized administration, and political institutions were transformed from a chiefdom into a theocratic state led by a divine pharaoh supported by administrative, religious, and military institutions.

The period from 2686 to 2160 B.C. was the period of the Old Kingdom, and it was during this time that we see the emergence of a definable military organization which was shaped by two factors. First, Egypt was protected by formidable natural barriers to her east and west in the form of great deserts. The peoples of these areas, the Sand Peoples of Palestine and the Libyans to the west, were largely nomadic and represented more of a nuisance than a military threat. Nubia to the south presented a real threat of invasion, but the fortresses and strong points built in 2200 B.C. seemed to have contained the threat relatively well. For a period of almost a thousand years Egypt was under no significant military threat from outside her borders. Second, Egypt's political order was somewhat fragmented. Although united in a single kingdom, the local chiefs maintained their own military forces and often exercised control over strategic trade routes. The situation was not unlike that of feudal Europe where the high king depended greatly upon the local barons for military and political power.

The impetus for the army came from the need of the central rulers to defend the state and deal with periodic revolts by the local chiefs. The pharaoh's army consisted of small but regular

standing forces of several thousand organized like household guards. Egypt introduced conscription during this time, levying one man in a hundred to be called to service each year. The pick of the conscripts went to the regular army. During this period the first military titles and ranks also appear. Yet, the majority of the army was still organized into militia units under the command of local barons. In normal times, these forces were stationed and trained at the local level. In times of crisis, the political relationship between the barons and the pharaoh determined in practice how many troops were made available for national aims. Such a form of military organization produced an army that was unfit for forging a large national empire.

The exact structure of the Egyptian army of this period is unclear. Some distinctions were made between regular officers and others, and it is evident from titles that the army was broken into a number of military specialties and ranks. The size of the army is also a matter of some conjecture. Weni, a commander of the army in the Sixth Dynasty (2345 B.C.), recorded that his force was "many tens of thousands strong." A string of 20 mud-brick fortresses was built around 2200 B.C. to guard the southern approaches to Egypt; each required at least 3,000 men per garrison. This would suggest an army of 60,000 men in the frontier force alone. With a population approaching two million at this time, these and even larger force levels could easily have been achieved.

The Egyptian armies of the Middle Kingdom (2040-1786 B.C.) became more structurally sophisticated as Egypt struggled through periods of anarchy and the weakening of centralized power, leading eventually to its invasion and conquest by the Hyksos in 1720 B.C. Still, a clearer command structure did emerge with the pharaohs acting as field commanders on the major campaigns and with general officers in charge of safeguarding the frontiers and managing logistics. Titles emerged for such positions as commanders of shock-troops, recruits, instructors, and commanders of retainers. There was also the title for troop commander, and progression in rank seems to have moved from command of 7 men to a company of 60 to a command of 100 men.

By 1790 B.C. the centralized government of Egypt began to lose ground to the rebellious local barons, and the national army proved insufficient to bring them to heel. Taking advantage of the disarray, the Hyksos invaded Egypt and established themselves for almost 200 years as its rulers. The name *Hyksos* is probably a Greek rendering of the Egyptian term *hik-khase*, meaning "chiefdom of a foreign hill country." In the Egyptian lexicon of the day, these people were referred to derisively as asiatics. While the origins of the *Hyksos* remain obscure, it is likely that they were the nomadic tribes of the Palestinian land bridge.

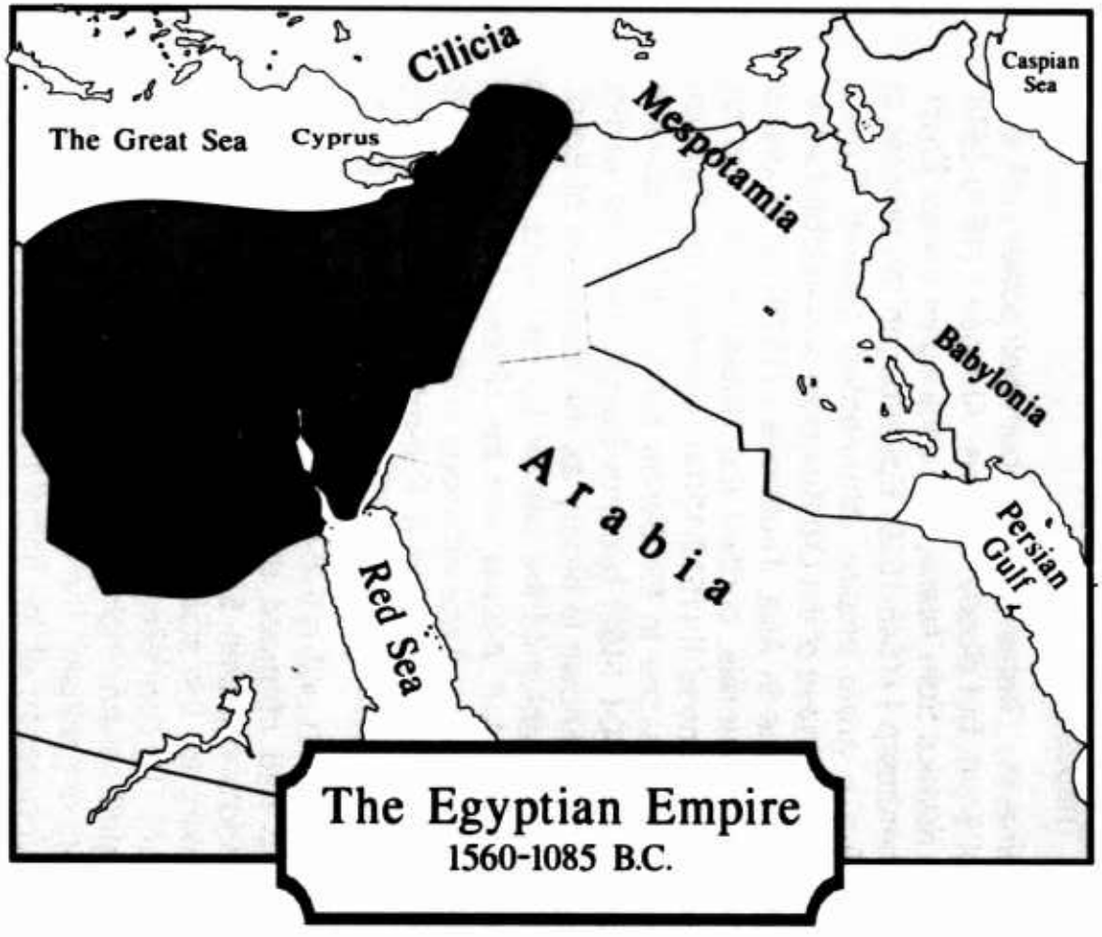
It remains an interesting question how a people who were culturally and economically so far beneath the Egyptians could have conquered such an advanced culture as Egypt's. The answer lies in the use of very sophisticated military technology. The Egyptian army of this period was an infantry force organized by function in units of bowmen, spearmen, and archers. The primary killing weapon was the mace; even the bow was the simple bow of limited range and penetrating power. Given that the Egyptians had never fought anyone who had any more sophisticated weaponry than their own, this same weaponry had served sufficiently for more than a millennium. The *Hyksos*, on the other hand, were an army of mobility and firepower. The centerpiece of the *Hyksos* army was the horse-drawn chariot. They used the composite bow and penetrating axe and also carried the sword. In addition, the *Hyksos* wore helmets and body armor and carried quivers for rapid reloading of their bows. These weapons conferred a decisive military advantage, and the *Hyksos* made short work of the Egyptian army.

The Egyptian soldier must have been terrified by these new weapons. While the Egyptians had to anchor their positions with exposed infantry formations, they could be killed from a considerable distance by the arrows from the composite bow which exceeded the range of their own arrows by at least 200 yards. Worse, the Egyptian formations were immobile while the *Hyksos* could mount horse-drawn chariot charges from all directions. The horse must have had a great psychological impact on the Egyptian soldier, who had never even seen one.

The blade axe of the Egyptian soldier was no match for the killing power of the penetrating axe and, without body armor, the sword must have taken a heavy toll in close combat. In 1720 B.C. the *Hyksos* established their capitol at Avaris (modern Tanis), and in 1674 they captured Memphis. For the next century or so the *Hyksos* held control of most of Upper Egypt while Lower Egypt remained largely in the hands of the princes of Thebes.

Over time, the Theban princes rebuilt their power until, after a series of short, but bloody, clashes, Ahmose I (1570-1546) drove the asiatics from Avaris, and once again unified Egypt. Under Amenhotep I (1546-1526) Egypt began the process of establishing a great empire. Amenhotep pushed Egypt's borders beyond those of the Old Kingdom and established an Egyptian presence in Asia. Thutmose I (1525-1512), one of Amenhotep's generals, pacified the Nubian south, and his successor, Thutmose II (1512-1504), solidified the Egyptian presence in Palestine to the Syrian border. His successor, Thutmose III (1504-1450) became Egypt's greatest warrior pharaoh, and is known to history as the Napoleon of Egypt. Thutmose III established the empire far into Asia, exacting tribute from Babylon, Assyria, and the Hittites. He fought 17 campaigns abroad and was victorious in all of them. (See Map 2.) Thutmose III established a first-rate professional army through which Egypt reached its pinnacle as a military power.

It is also worth noting that the psychology of the Egyptian leadership had changed drastically. Prior to the *Hyksos* invasion and occupation, Egypt's strategic culture was marked by a concern for the status quo and a turning inward for a millennium. Unconcerned about foreign threats, Egypt concentrated on developing her high religious culture almost to the point of pacifism. The destruction of the Egyptian army and the occupation of the homeland by a culturally foreign power, the *Hyksos*, engendered in Egyptian culture a great fear of invasion. Accordingly, having eventually removed the *Hyksos* from Egyptian soil, the Egyptians continued to press outward from their borders in order to establish a series of weak states on the periphery that could act as a buffer to their territory in time of war. The new strategic culture of Egypt was marked


Cilicia
The Great Sea
Cyprus
Mesopotamia
Caspian Sea
Babylonia
Arabia
Red Sea
Persian Gulf
The Egyptian Empire
1560-1085 B.C.

Map 2.

by paranoia and a fear of being surrounded. As such, she became militarily aggressive in a search to control all possible threats to her east by a policy of preemptive military action and aggressive diplomacy.

The wars of liberation and expansion under the Thutmosides wrought a profound change in Egyptian society. For the first time there came into being a truly professional military caste. Military families were given grants of land to hold for as long as they provided a son for the officer corps. The army changed its structure and became a truly genuine national force based on conscription. Although the local militias continued to exist, they were thoroughly integrated into a national force structure and, more important, the local barons lost the power to challenge national policy or withhold troop levies. Thutmose III completely changed Egyptian weapons and tactics. He adopted the weapons of the *Hyksos*–the chariot, composite bow, penetrating axe, sickle-sword, helmets, and armor–and made further improvements in the design and tactical employment doctrine of the chariot in battle. Thutmose mounted his newly armed archers on chariots and produced the most important military revolution in ground warfare yet seen in Egypt.

The national army was raised by conscription, with the national levy being one man in 10 instead of the traditional one man in 100. The army was centrally trained by professional officers and noncommissioned officers. The pharaoh himself remained commander-in-chief and was expected to be a true field commander by leading his men in battle. There was also an Army Council that served as a general staff. The field army was organized into divisions, each of which was a complete, combined arms corps, including infantry, archers, and chariots. These divisions numbered 5,000 men, and each was named after one of the principal gods of Egypt. Later Ramses II organized Egypt and the empire into 34 military districts to facilitate conscription, training, and supply of the army. The rank and administrative structures were improved, and there were professional schools to train and test officers in the operational arts.

The two major combat arms of the Egyptian army were chariotry and infantry. The chariot corps was organized into squadrons of 25 machines, each commanded by a "charioteer of the residence." Larger units of 50 and 150 machines could be rapidly assembled and deployed in concert with larger ground units. The chariot corps was supported logistically by special units and staffs, including mobile repair stations and parts depots, whose task it was to keep the machines operational even when deployed. The fact that the pharaoh was usually pictured as leading a chariot charge clearly indicates that it was the elite striking arm of the Egyptian field force.

The infantry was organized into regiments of 200 men, each regiment identified by the type of weapon it carried. Units were further identified as being comprised of recruits, trained men, and elite shock troops. Each regiment was commanded by a "standard bearer." Below him in rank was the "greatest of fifty," who commanded a unit probably like a platoon. These platoons comprised a regiment, and several regiments were commanded by a "captain of a troop," who seems to have functioned as a brigade commander. Above this was a "lieutenant commander of the army," who was answerable to a senior general, often a royal prince, at division level. After the fall of Rome in the fifth century, European armies did not reach this same level of organization for more than a thousand years.

The administrative structure of the army was reformed and, we may presume, it was as highly bureaucratized as are today's armies. The Egyptians, after all, were remarkable record keepers. The army had its own professional scribes, the equivalent of the modern administrative officer. Logistical support was especially well-organized as befits an army that was expected to operate over long distances from its home base. Supplies were moved over hostile territory by ox-cart, and the Egyptians were absolute masters at integrating naval support into their ground operations. Then, as now, more supplies could be moved in a few ships than could possibly be carried by a ground army on the march.

The tactics of the Egyptian army were very well developed and supported by an excellent strategic and field intelligence

apparatus. Tactical expertise was increased by the presence of a trained professional officer corps quite accustomed to maneuvering various types of large units over different types of terrain. The Egyptian army employed agents and patrolling techniques similar to those used in modern armies to gather tactical intelligence, and were adept at moving their armies across hostile terrain without being detected. They also utilized counterintelligence and deception in order to gain maximum surprise. Prior to the formulation of final battle plans the Egyptians routinely used the commander's conference, in which the pharaoh presented his battle plan while senior officers were expected to give frank and open advice. The result of these practices was sound battle tactics that allowed Thutmose III to conduct 17 major battle campaigns and win them all.

On the battlefield Egyptian forces usually deployed chariots to act as a screen for infantry. Engaging the enemy with the long-range composite bow, the chariots began killing at a distance and then smashed the enemy formations by shock. If the enemy gave ground, reserve chariot units could be used to exploit the weakness or, more commonly, infantry units could be brought into play in an effort to further disrupt enemy formations. The mobility allowed by a light, highly-maneuverable chariot (the Egyptian chariot was so light that two men could carry it across a stream) allowed the use of mobile reserves for the first time in warfare. These could be committed at a propitious moment to turn a flank or exploit a breakthrough. Once a rout began, the chariot archers could engage in ruthless, rapid, and lethal pursuit. If tactical surprise had been achieved, as at Megiddo, chariot forces could engage an enemy that had not yet deployed for battle. If something went wrong, as at Kadesh, chariots could be used to rescue a desperate situation.

The battle of Meggido (Armaggedon in the Bible) demonstrated all the characteristics of a modern army in battle. Thutmose III moved his army of 20,000 men from Egypt to Gaza, a distance of 250 miles, in less than 9 days and did so undetected. He immediately undertook another 10-day forced march to Yehem, near the village of Aruna, where he prepared

to cross the mountains into enemy territory. Thutmose had to choose among three routes, two of which were easy marches but longer distances. The third was through a narrow defile but much shorter. Yet, this route would have placed the army in jeopardy since it would be strung out in file on the march and, if ambushed, would have been unable to defend itself. Thutmose's senior officers advised against the third route. Thutmose's intelligence units learned that the enemy was deployed to protect the easier routes. In a bold gamble, Thutmose risked security for surprise. Taking the dangerous route, he arrived completely undetected outside the city of Megiddo, where he faced only a screening force of enemy soldiers. The result was a smashing victory which would have been complete had the Egyptian troops not lost their discipline and stopped to plunder the defeated enemy's camp.

The battle of Megiddo provides an example of an army that utilized every major tactical device used by modern armies. Thutmose took advantage of his intelligence-gathering capacity and located the deployment of the enemy force. Using this information, he was able to achieve tactical surprise and to mass his forces at the point of the enemy's greatest weakness. He achieved flexibility of deployment by tailoring his units accordingly, and used his chariots to maximize his force at the point of attack (the *schwerpunkt*). His reserves were deployed to rescue the situation if things went wrong, as they did for Ramses II in 1295 at Kadesh, where a rescue force of Egyptian chariots prevented a disaster. Thutmose maintained excellent communications along the route of march by messengers and semaphore flags and, when engaged, used trumpets, flags, and horse messengers to coordinate the battle in much the same way as Wellington did at Waterloo.

The Egyptian army lacked only cavalry formations, an innovation that would be introduced 600 years later by the Assyrian army. The failure of the Egyptians to develop cavalry remains a mystery in light of their knowledge of the horse that they obtained from the *Hyksos*. Perhaps it was a case of an army emphasizing one item of "heavy" equipment (the chariot) that worked so well that it saw no need for a "lighter" and more maneuverable "vehicle" such as the horse. But in almost every

other respect the army of Thutmose III and later warrior-pharaohs was a modern army capable of conducting military operations in a modern manner, including the ability to mount seaborne invasions and to use naval forces in conjunction with ground forces for supply and logistics.

Conclusion.

The evolution of sophisticated armies and the conduct of war in Sumer and Egypt, while truly a major development in human history, by no means represented the ultimate development of warfare in the ancient world. Much to the contrary. As sophisticated as the armies were in these societies, they represented only the beginning of a period of military development, the Iron Age, that continued for another two thousand years. In this later period it is fair to say that with only a few exceptions, most notably the classical Greeks, the world witnessed a period of fifteen hundred years in which the conduct of war increased in scope, scale, lethality, and sophistication in an unbroken, upward trend that finally ended with the collapse of the Roman imperium in the 5th century A.D. And when that period finally did come to an end, it took the armies of Europe more than a thousand years to reach the level of sophistication in war that the armies of the Iron Age had so consistently demonstrated for more than a millennium.

During the Iron Age almost every aspect of war was developed to modern scale. Armies increased in size with a corollary increase in their destructive power, which further produced larger and larger battles resulting in higher and higher casualty rates. The integration of military structures with their host societies increased greatly, in some instances (Assyria) producing the ancient equivalent of the modern military state. This permitted armies for the first time to suffer major defeats while the state retained the power to continue military operations for years on end (Second Punic War). The productive power of the state to generate ever larger populations and more sophisticated economies for use in war also increased, culminating in the ability of some states to give birth to an even larger form of sociomilitary organization, the imperium.

At the same time there was a genuine revolution in military technology that increased the range and rates of fire of weapons, providing armies with an ever increasing killing capability. When this ability joined with the ability to logistically support and maneuver larger armies over greater and greater distances, the ability to conduct war increased almost exponentially over the level of the Egyptians and Sumerians fifteen hundred years earlier. Indeed, it seems likely that the period between the collapse of Sumer and the fall of Rome can legitimately be viewed as the most dynamic period of military development ever witnessed by man until the 20th century. Modern warfare and its corollary, the destruction of whole societies, were already facts of life in the ancient world. Seen in this context, the invention and use of mechanized weapons in the modern era represents more of a variation on a very old theme than a qualitative change in the evolution of warfare.

CHAPTER 3

THE MILITARY REVOLUTION

The period from 1500 B.C. to A.D. 100 was a time during which there occurred a genuine revolution in most aspects of people's existence and organization. It was a period also characterized by a revolution in the manner of conducting warfare. This 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. War, warriors, and weapons were now a normal part of human existence. Also at this time armies produced the prototype of every weapon that was developed for the next three thousand years. Only with the introduction of gunpowder would a new age of weaponry and warfare begin. A military revolution that eventually produced the age of modern warfare had begun.

One of the most important stimuli for this military revolution was the discovery and use of iron. Iron was first employed as a technology of war about 1300 B.C. by the Hittites. Within a hundred years the secret of iron making and cold forging had spread at least to Palestine and Egypt and, perhaps, to Mesopotamia as well. Iron weapons were heated and hammered into shape rather than cast, making them stronger, less brittle, and more reliable that bronze weapons. Within a few hundred years the secret of tempering was discovered, and iron became the basic weapons material for all ancient armies of the period. The importance of iron in the development of ancient warfare lay *not* in its strength or ability to hold a sharp

edge. Iron's importance rested in the fact that unlike bronze, which required the use of relatively rare tin to manufacture, iron was commonly and widely available almost everywhere. It was also somewhat easier to extract from its carrier ore, and the plentiful supply of this new strategic material made it possible for states to produce enormous quantities of reliable weapons cheaply. This fact made the weapons explosion possible. 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 dramatic increase in the frequency of war.

The armies of the Iron Age were the first to practice conscription on a regular basis. While the Egyptian army had used conscription several hundred years earlier, the scale and regularity with which conscription was used by Iron Age armies dwarfed the Egyptian experience. Conscription used by earlier armies was almost always limited to service in time of war. During the Iron Age the obligations of citizenship were extended to enforced military service as a regular and legitimate price to be paid for membership in the larger social order. Military service was no longer limited to defense in times of threat but extended to the need to control far-flung military empires and to prevent domestic and foreign threats by being ready to conduct military operations. The Iron Age gave birth to the national standing army based on citizen service and preceded the same practice by Napoleon, itself perceived as a revolutionary development at the time, by almost three thousand years.

Paradoxically, the emergence of the standing conscript army also gave birth to the professionalization of military establishments. A constant flow of conscripts required a permanent cadre of professionals to train, lead, and integrate the citizen soldier into the force. While conscripts could be used to fill out the garrison forces within the empire, only the fighting ability and political loyalty of professionals could ultimately be relied upon by an imperial government. The Assyrian army as well as the Persians always retained a large corps of loyal professionals as the centerpiece of their military establishments and ensured that they remained in control of

key logistics and supply functions of the various national units under imperial command. In the case of the Persians, for example, the professional army was responsible for training, directing, and ensuring the loyalty of an imperial force drawn from no fewer than 40 different national groups. For the first time on any scale, war and military service became a full-time profession, one that was highly valued by the political establishments of the day.

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 the Iron Age were changes in (1) the size of armies, (2) logistics and transport, (3) strategic and tactical mobility, (4) siegecraft and artillery, (5) staff organization, and (6) military training. 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 mechanical weapons and powerful machines of the present age to surpass the level of operational ability demonstrated by the ancients.

Size of Armies.

While the armies of the Bronze Age were quite large compared to those at the beginning of the period, they were minuscule by comparison to the armies that fought in the Iron Age. The Persians routinely deployed field armies that were ten times larger than anything seen in the Bronze Age. While the army of Sargon of Akkad in 2300 B.C. is estimated to have been as large as 5,400 men, an army of this size represented a supreme national effort and even then could be deployed in the field for only a short time. In any case, it remained the exception to the rule of much smaller Bronze Age armies.

Some examples of the size of Iron Age armies are instructive. The Egyptian army in the time of Ramses II (1300 B.C.) has been estimated at more than 100,000 men. This force was comprised largely 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 that could be deployed individually or as a combined force of several divisions. The Battle of Kadesh in 1304 B.C. between the Hittites and the Egyptians is the first ancient battle for which we have accurate strength figures. In that battle the Egyptians mounted a four division force of 20,000 men against the Hittite army of 17,000.

The Assyrian army of the 8th century B.C. was comprised of at least 150-200 thousand men and was the largest standing military force that the Middle East had witnessed to this time. An Assyrian combat field army numbered approximately 50,000 men with various mixes of infantry, chariots, and cavalry. In modern times the size of an Assyrian field army was equal 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 the front and 100 yards deep. The Assyrian army was also the first army to be entirely equipped with iron weapons.

Even the Assyrian army, as great as its size was, 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 comprised 300,000 men and 60,000 horsemen. General Percy-Sykes' analysis of Xerxes' army suggests that the total force, including support troops, numbered a million men! Even at the end of the empire the Persians could deploy very large forces. In 331 B.C., just before Alexander destroyed the Persian empire at the Battle of Arbela, Darius III fielded a force of 300,000 men, 40,000 cavalry, 250 chariots, and 50 elephants.

Philip of Macedon could field a combat army of 32,000 men organized in four divisions of 8,192 men each, and the army of Alexander sometimes exceeded 60,000 men. Roman military forces, which at the end of the empire totaled 350,000 men, could routinely field armies upward of 40,000. At the Battle of Cannae the Roman force arrayed against Hannibal was 80,000 men strong. Of these, 70,000 were destroyed in a single day! The one exception to the ability of Iron Age states to deploy large armies was the armies of classical Greece. Being products of relatively small city-states, classical armies were

unusually small even for the Bronze Age. Ahab, for example, at the Battle of Ai could field 30,000 men, while at the Battle of Marathon the Greeks were able to field only 10,000 men against the Persian force of 50,000. Thucydides recorded that at the beginning of the Peloponnesian wars in 431 B.C., Athens could field only 13,000 hoplites, 16,000 older garrison soldiers, 1,200 mounted men, and 1,600 archers. But even these small numbers represented a supreme military effort for Athens in time of crisis. Thucydides noted that after the military situation had stabilized a decade later, Athens could muster only 1,300 hoplites and 1,000 horsemen. It is little wonder, then, that battles of the classical Greek period usually involved no more than 20,000 combatants on both sides.

The growth in the size of armies in 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 bigger than anything the world had seen to this point. The armies of the Iron Age were truly modern armies in terms of their size. Following the fall of Rome in the 5th century A.D., few European states were able to muster such large military establishments until well into the 19th century. The large conscript armies of Napoleon were exceptions, and following his defeat European armies returned to the practice of retaining relatively small standing armies until well into the following century.

Logistics and Transport.

As the size of armies and the scope of battles increased, ancient armies had to master the task of logistically supporting these armies in the field. The logistical feats of ancient armies were often more difficult and often achieved more proficiently than in armies of the 19th century, when the railroad, mass production of weapons, standard packaging, and tinned and condensed food made the problem of supply considerably easier. 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, for example, required Egyptian forces to maintain repair depots and special mobile repair battalions to ensure that the machines remained functional on the march. The Assyrian invention of large cavalry squadrons 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 logistics branch, the *musarkisus*, was able to obtain and process 3,000 horses a month for the Assyrian army. It was not until the time of Napoleon that Western armies could once again equal this logistical feat. The integration of chariots with cavalry also forced the Assyrian army to become the first to learn how to sustain two types of transport. Advances in siegecraft required that armies transport siege towers and engines within their baggage trains, and artillery, introduced under the Greeks and brought to perfection under the Romans, added yet another requirement to transport catapults and shot. The need to manufacture, issue, and repair new iron weapons in unprecedented numbers required yet more innovations in logistics. In the Assyrian army the production and storage of weapons became a central feature of the army's logistical structure. A single weapons room in Sargon II's palace at Dur-Sharrukin contained 200 tons of iron weapons, and similar weapons warehouses were scattered throughout the empire. Of all the achievements of the ancient armies, those in the area of logistics often remain the most unappreciated by modern military planners.

Among the more important requirements of the logistics trains of ancient armies was the need to supply large numbers of men with adequate food and water. The animals required to haul supplies also had to be fed. The hot and dusty climate of the Middle East made the physical maintenance of the soldier's body even more difficult on the march. In this climate a soldier required 3,402 calories a day and 70 grams of protein to sustain him in *minimal* nutritional condition. In addition, a soldier

required nine quarts of water a day. Modern analysis reveals that the standard ration of three pounds of wheat a day produced only 2,025 calories, insufficient to maintain even minimal nutritional requirements for very long. Thus, Alexander's army of 65,000 men required 195,000 pounds of grain and 325,000 pounds of water to sustain it for a single day! The army also required 375,000 pounds of forage per day to sustain cavalry, baggage, and transport animals. The ability of ancient armies to provide these requirements was nothing short of amazing.

Since the Bronze Age, the standard means of transport for the Egyptian army was the donkey. In Sumer, the solid-wheeled cart drawn by the *onager* was used very early in the period. At the Battle of Kadesh, 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. Xenophon recorded that the normal pack load for a single ox-drawn cart in Greek armies was 25 talents, or approximately 1,450 pounds. Studies from World War I by the British War Office note that a mule could carry about three hundred pounds, and the camel just slightly less. The Persians used teams of oxen to haul their large wooden siege and mobile towers. Xenophon noted that 16 oxen were required to pull the tower, which weighed approximately 13,920 pounds!

While the ox-cart allowed armies to move larger 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 that were later introduced by the Romans. Most military movement was done across country or, less frequently, on narrow, foot-worn paths where width reduced the speed and flexibility of movement even more. In addition, the animal collar had not been invented yet and harnesses that pressed on the windpipes of the baggage animals increased their rate of physical exhaustion. Under the best of conditions an ox-cart could travel two miles an hour for 5 hours before the animals became exhausted. Moreover, ox-carts generated their own logistical burden. Carts required drivers and, because they needed constant repair, a large corps of repairmen. Repairs

required tools and lumber, all of which further increased the logistics load of the army.

As armies grew in size, the logistical burden threatened to reduce drastically their rate of movement and operational flexibility. The introduction by the Assyrians of the horse to military operations 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 8 hours. Equally important, the horse could move easily over all types of terrain, and five horses required only half the amount of forage required to feed a team of two oxen. Thus, the ox-cart could move a thousand pound load only 10 miles per day while a horse team could move the same load 32 miles per day at twice the speed on half the forage. The Assyrians never really reduced their primary reliance upon ox-carts, however, and the major introduction of the horse to the logistics train grew only gradually under the Persians while finally reaching its height under Philip II and Alexander of Macedon and, later, the Romans.

The Persian army introduced a major innovation in logistics. While the Egyptians had 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. The Persians were not much as sailors themselves, but they took full advantage of the shipbuilding and maritime skills of the peoples of their coastal provinces. They closely supervised the design of special ships to transport infantry, horses, and supplies, including shallow-draft vessels for use on rivers. Herodotus recorded that during Xerxes' expedition against the Greeks in 481 B.C., the Persians deployed 3,000 transport ships to sustain the army. Coupled with their extensive use of the horse in the supply chain, the supply system of the Persian army was more effective than anything the world had ever seen and allowed the world's largest armies to remain deployed far from home for months on end.

By the time of Alexander the logistical trains of ancient armies had matured to the point where they could regularly

supply large armies for longer periods; however, the problem of speed and flexibility of movement over rough terrain remained. The Roman supply system was qualitatively different from that faced by the empires of the past. The great distances encompassed by the Roman empire required speed of movement even more than Alexander did. Philip of Macedon was the first to solve the problem.

Philip discontinued the age-old practice of allowing soldiers to take along attendants, wives, girlfriends, and other service providers when they went to war. Under the old system, an army of 30,000 fighting men would have dragged along behind it almost the same number of camp followers. By forbidding the presence of these people, Philip reduced the logistics burden of his army by almost two-thirds. This change increased the combat power of the army and increased its rate of march. Alexander's army could routinely move at 13 miles a day, and separate cavalry units could cover 40 miles a day. These rates were simply unheard of before Philip's reforms.

Philip further increased rates of movement by eliminating the ox-cart as the standard logistics vehicle and replacing it with a mixture of horses and mules. A few ox-carts were still used to transport the wounded and disassembled siege engines and artillery pieces. This innovation more than tripled the army's rate of movement and increased its ability to maneuver over rough terrain. Like the great Roman military reformer Gaius Marius some 200 years later, Philip gained even greater speed and mobility for his logistics train by turning his soldiers into beasts of burden.

Both Alexander and the Romans made maximum use of the carrying capacity of their soldiers to increase logistics capability, and the soldier's load has been increasing ever since. Both the Greek and Roman soldier routinely carried 60-70 pounds on his back. By comparison, American troops in the Normandy invasion carried 82 pounds of equipment and supplies, while the soldiers at Waterloo carried 60-70 pounds. The British soldiers who stormed Bunker Hill hauled 80 pounds. Cavalry soldiers could carry even more by using their horses as transport. With soldiers carrying one-third the load that would be normally hauled by animals, an army of 50,000

men required 6,000 fewer pack animals than it would have needed, along with 240 fewer animals to haul the feed for the other animals. By requiring the soldier to carry his own equipment and food, Alexander created the lightest, most mobile, and fastest army the world had ever seen. These same reforms introduced in the Roman army by Marius in 99 B.C. produced the same results.

In the early Iron Age the ability to provide supplies for any army was hampered by the lack of any genuine medium of exchange. Most of the early Iron Age economies functioned on a barter system so that most military supplies were obtained as levies against various producers. The Persian invention and introduction of a uniformly acceptable gold currency changed this situation. Darius I was the first monarch to coin money, and used a standard coin weighing 130 grains of gold. Backed by the enormous Persian gold reserves, the *daric* became the only gold currency of the early ancient world and could be spent anywhere. Military establishments could now pay for what they needed. The use of currency also led to the establishment of uniform weights and measures, which allowed logistical planners to obtain military supplies in precise amounts and weights. Merchants emerged whose business was to provide military supplies on a regular basis, an activity that brought into existence the first military contractors. Moreover, money could be used to provision an army even when in hostile territory. The businessmen of Thrace and Macedonia sold supplies to Darius during the Greek campaign, and when the Persian army crossed the Sinai in its campaign against Egypt, local Egyptian merchants provided and prepositioned thousands of water skins at designated points in the desert to make the crossing possible.

In providing logistical support, imperial powers usually had the advantage of internal lines of communication, which made supply movement easier. Moreover, like Napoleon two thousand years later, armies often prepositioned stocks of supplies at the empire's rim in an attempt to reduce travel distances. Once in enemy territory, however, like every army after them until the very modern age, armies lived mostly off the land and captured enemy stores. This practice explains the

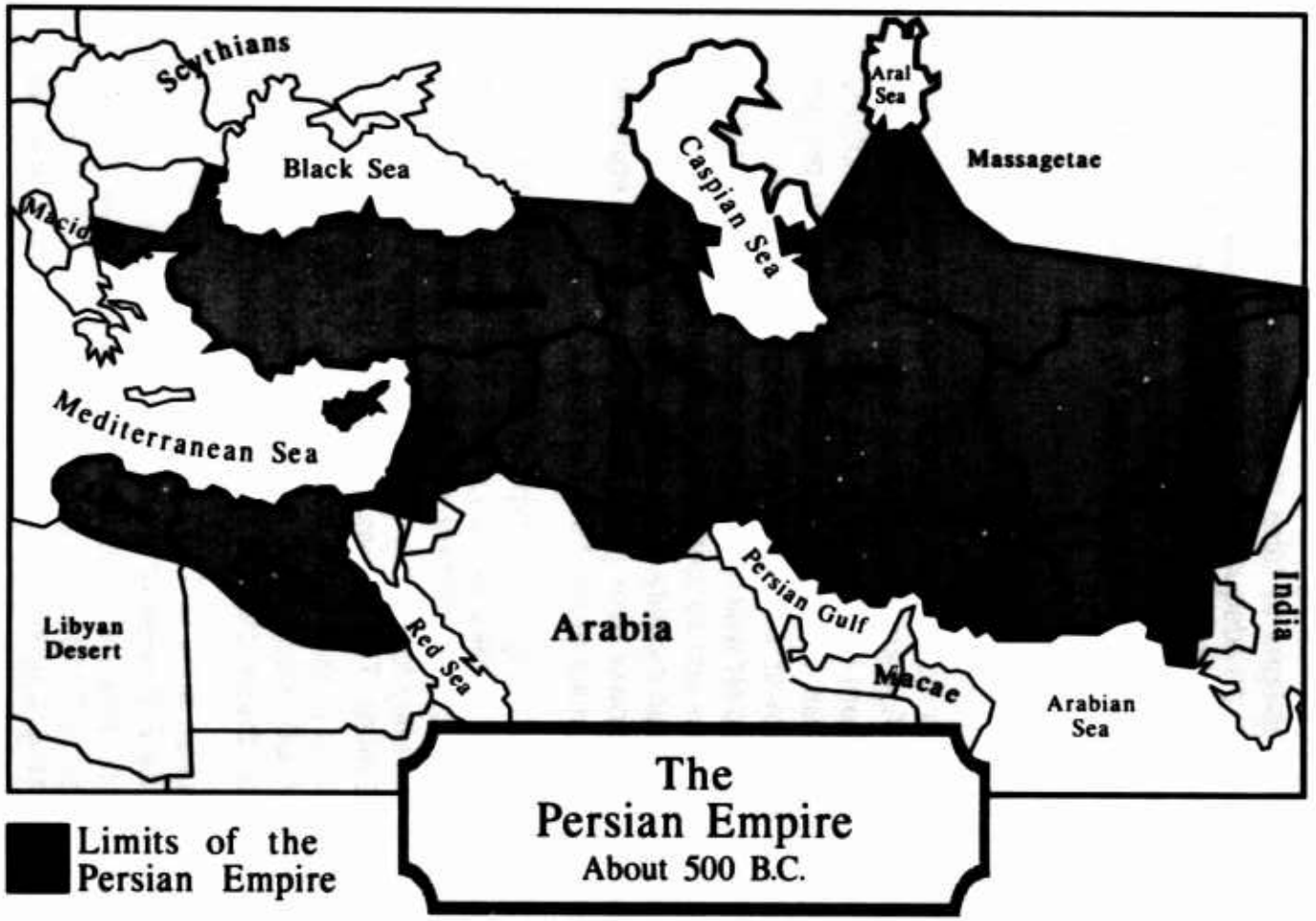
penchant of armies to attack cities even when it made little tactical sense. A review of Gustav Adolphus' route of march during the Thirty Years War (1618-48) shows precisely the same propensity for exactly the same reasons. Finally, armies often timed campaigns to take maximum advantage of the seasons to ensure an adequate food supply in captured enemy areas. Taken together, the logistics capabilities of ancient armies were excellent, often managing staggering feats of supply that only rarely were duplicated by armies before the 19th century.

Strategic and Tactical Mobility.

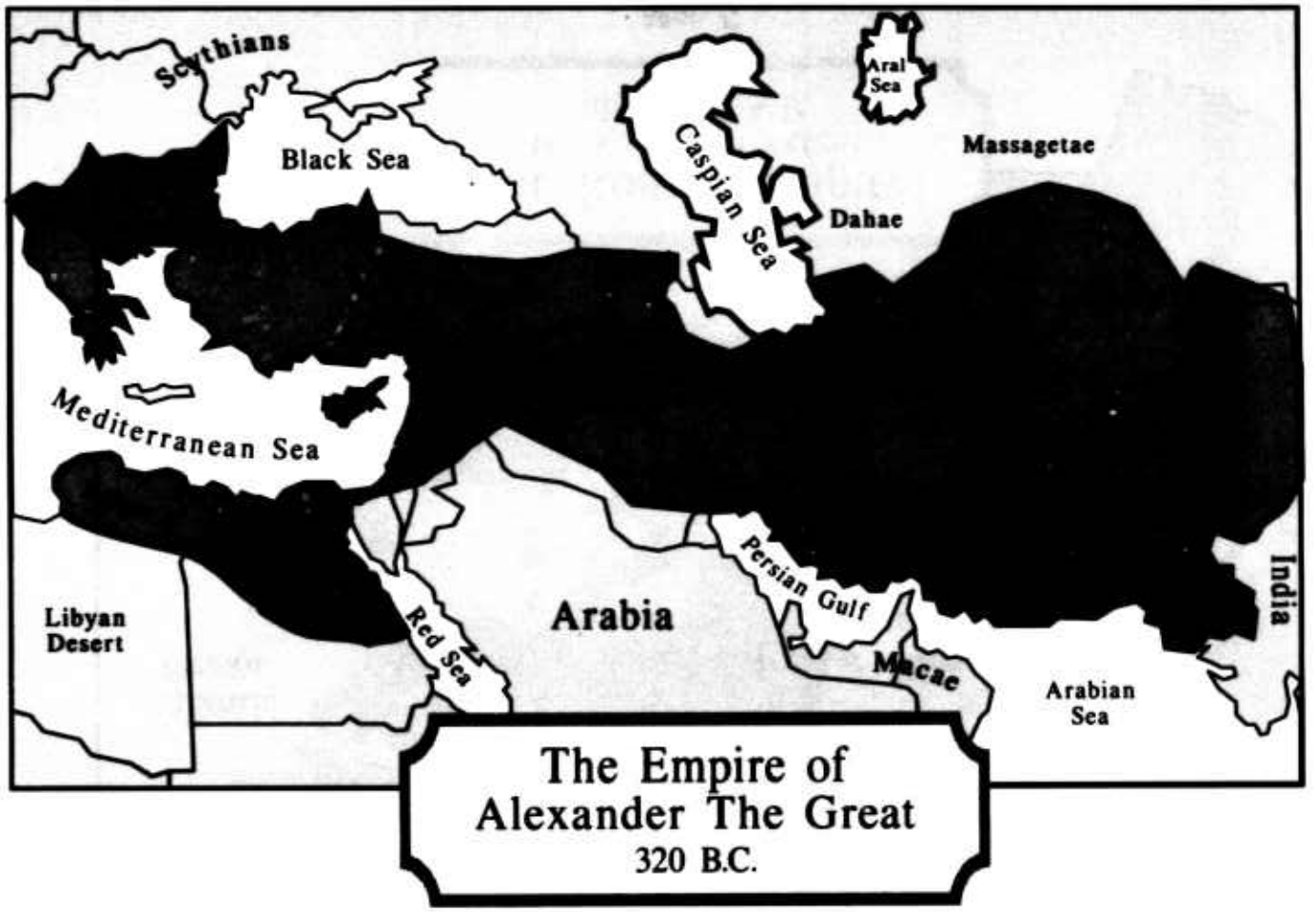
A tremendous increase in strategic mobility resulted from the ability of Iron Age armies to deploy larger and larger armies and to sustain them logistically in the field. Strategic mobility can be defined as the ability of a military force to project influence and power over a given geographical area. The greater the area over which a military force is able to conduct military operations and sustain them over time, the greater the degree of strategic mobility. The ability of Iron Age armies to project military power over great distances was not equaled again until the armies of the 19th century.

The strategic range of a typical Bronze Age army was approximately 350 miles by 150 miles. The armies of Sumer and Akkad conducted military operations ranging from the Upper Tigris Valley to the city of Ur, or a range of about 250 miles by 125 miles. The armies of Egypt in the period 3000 to 1400 B.C. could project force from the Nile Valley to Syria, or a distance of 600 miles by 200 miles. With the dawn of the Iron Age, however, these strategic ranges increased greatly.

The Egyptian army of 1300 B.C. had a strategic range of 1,250 miles by 200 miles or more than twice the range of the earlier period. Assyria conducted military operations from Assur to Susa to Thebes, an area comprising 1,250 miles by 300 miles. This was five times the range of the armies of Sumer. The armies of Persia, Alexander, and Rome (see Maps 3, 4, 5) attained strategic ranges typical of modern-day armies. The Persian army, for example, conducted operations from the


Scythians
Black Sea
Aral Sea
Caspian Sea
Massagetae
Macid
Mediterranean Sea
Libyan Desert
Red Sea
Arabia
Persian Gulf
Macae
Arabian Sea
India
The Persian Empire
About 500 B.C.
Limits of the Persian Empire

Map 3.


Scythians
Black Sea
Aral Sea
Caspian Sea
Massagetae
Dahae
Mediterranean Sea
Libyan Desert
Red Sea
Arabia
Persian Gulf
Macae
Arabian Sea
India
The Empire of Alexander The Great
320 B.C.

Map 4.


North Sea
Germania
Sarmati
Atlantic Ocean
Aral Sea
Black Sea
Caspian Sea
Mediterranean Sea
Parthian Empire
Qaetulia
Persian Gulf
Arabia
Red Sea
The Roman Empire
At its greatest extent
about 117 A.D.

Map 5.

Iaxartes and Indus rivers to Thrace, Cyrene, and Thebes, a strategic range of 2,500 miles by 1,000 miles. Alexander's armies ranged from the Hellespont to the Caspian Sea to the Persian Gulf, a range of 2,600 miles by 1,000 miles. The greatest strategic range was achieved by the legions of Rome, which controlled an area from Germany to Morocco and from Scotland to Armenia and Babylon, a strategic range of 3,000 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 armies of the Bronze Age. Even in modern times only a few of the armies of the world can match the strategic range of the armies of the Iron Age.

Strategic range was very much a function of the ability of Iron Age societies to place the resources of the entire state at the service of military operations. Range also increased as a function of logistics and staff organization that rationalized planning. The utilization of naval forces in support of ground operations far from home also increased range and flexibility. It is important to remember, however, that armies moved on foot. No army of the modern period equaled or exceeded the rates of movement of the ancient armies until the American Civil War, when the use of the railroad made faster, large-troop movements possible.

The increased mobility of Iron Age armies was also a function of the military road. Early imperial states had the advantage of regular travel over regular routes, a practice that packed down and widened dirt trails into usable, good-weather roads. Regular routes of travel also made the use of military maps a standard practice. Maps were an important military resource. During the period of tribal invasions in Europe after the fall of Rome, accurate mapmaking all but disappeared as a military art. Commanders of armies of the Middle Ages often spent weeks roaming around the countryside in search of the enemy simply because they lacked maps that accurately displayed road and trail nets. By the time of the Persian empire, states had begun to construct regular roads for military purposes.

The Persian empire was tied together by a system of royal roads that facilitated military control and communication with

the provinces on the empire's rim. The roads made it possible for the king to move forces quickly to any point within the empire to suppress civil unrest or meet a threat from outside. These roads were unpaved, packed dirt-tracks wide enough to support the movement of the mobile Persian siege towers drawn by teams of oxen. A system of bridges over streams and other terrain obstacles, more than the road surface itself, greatly increased rates of movement. The most famous of these roads ran from Sardis on the Mediterranean to the Persian capital of Susa, a distance of 1,500 miles. A messenger could travel this distance in 15 days using a series of horse relay stations. Without the road the journey would have taken 3 months.

The most effective and amazing system of military roads was the Roman roads, which crisscrossed the empire. The first Roman military road was built during the Samnite Wars and ran from Rome to Capua, a distance of 132 miles. Terrain obstacles were either leveled or crossed by bridges. Marshlands were crossed by raised roads built in the fashion of aqueducts. Low spots in the rivers and streams were provided with paved, underwater fording points. As Rome established her hegemony over the Western world, she connected the entire empire with a network of military roads. The Romans built over 240,000 miles of roads, 40,000 of which were paved, permanent roadways, most of which still exist. To place this achievement in perspective, the U.S. Interstate Highway System consists of 44,000 miles of paved roads. The effect on the mobility of the Roman armies was amazing. On dry, unpaved roads a Roman legion (6,000 men) could move about 8 miles a day. In wet weather, movement was almost impossible at any speed. On paved roads, however, a legion could move 25-30 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 the Iron Age also made revolutionary advances in tactical mobility and proficiency that 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 in order to increase the combat power of these units, thereby increasing the overall combat effectiveness of the army as a whole. The increase in tactical flexibility of small units in ancient armies resulted from a number of factors. While each one taken alone had only a small effect on unit combat power, when the factors were taken together the overall impact was truly significant.

The Assyrian invention of the leather jackboot provides an excellent example. Earlier armies of the Middle East wore the open sandal as regular military footwear. While sufficient in sandy desert climates, sandals were ineffective in preventing foot injuries to troops forced to conduct operations in rough terrain. Moreover, sandals offered no protection for soldiers who served in armies that had large horse contingents. The press of an animal's hoof upon a soldier's foot could cause frequent and debilitating injuries. Sandals provided little protection to the soldier who fought within a packed infantry phalanx and offered a severe disadvantage to soldiers fighting in cold climates. The lack of adequate footgear was a major factor in limiting the tactical mobility of the early ancient arrnies.

The Assyrian army was the first to improve on the military footwear of ancient armies. The Assyrian soldier wore a knee-high, leather jackboot with thick leather soles complete with hobbed nails to improve traction. The boot also had thin plates of iron sewn into the front to provided for protection for the shin. The high boot provided effective 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 and was one of the primary reasons why the Assyrian army was able to move easily over rough terrain in all kinds of weather. Following the Assyrian lead, military boots of various designs became standard equipment for all the later armies of the Iron Age.

The growth in tactical flexibility of small units 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 in the winter. Sargon II's campaign against the Urartu (Armenia) in 714 B.C. provided a textbook example of the development of improved tactical proficiency. The campaign was conducted almost 600 miles from the Assyrian capital in the late fall. Sargon's army, complete with contingents of infantry, cavalry, and heavy chariots, traversed mountains, streams, and rivers on the route of march. Travel through the mountain passes was complicated by heavy snows. One pass was so high and heavily blocked by snow that the enemy did not bother to defend it. Sargon negotiated the pass, caught the enemy by surprise, fought and won a major battle, and still had enough combat power left to besiege and capture a fortified city.

The Assyrians also fought well in marshlands. Placed aboard light reed boats, tactical combat units became waterborne marines who used fire arrows and torches to burn out the enemy hiding among the bushes and reeds of the swamp. The ability to mount military operations in all kinds of weather and terrain became a vital military capability for all later Iron Age armies. Alexander, Hannibal, and the Roman legions all developed the capacity to fight regularly in rough terrain and harsh weather.

The regular use of tactical engineering units provided yet another increase in the combat power of field units. Assyrian engineers mastered the technique of building the world's first military pontoon bridges from palm wood planks and reeds. At times they used inflatable animal skin bags for flotation devices for both men and animals. The large cavalry contingents of the Persian army required that their combat engineers become skilled at the rapid construction of bridges with vertical sides so that the horses could cross steep ravines without fear driving them to bolt. Persian engineers were capable of diverting the course of a river to deprive an enemy fleet of its water, a trick they performed in the war against Egypt. In the Babylonian War, military engineers diverted the course of a stream running through the city so that infantry could enter under the walls by moving along the dry stream bed. Military engineering, of course, reached its height in the ancient world among 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 was the ability to control his tactical combat units once committed to battle. For the most part, armies tried to control tactical units by semaphore flag signals and sounds from drums and horns. With the exception of the armies of Rome, few ancient armies succeeded very well. Alexander made good use of a corps of staff riders who could ride to the combat units and pass along instructions.The Romans also used this technique but improved on it by having a special signaler within each cohort. In addition, the Roman army stressed small unit tactical proficiency and discipline, and the soldier was well trained to respond instantly to a number of commands given by his unit leader. The result was that no army matched the proficiency of Roman tactical units in their ability to communicate or rapidly switch course while engaged.

While these individual factors contributed significantly to tactical proficiency and flexibility, they could do so only in an army whose tactical proficiency in the larger sense was already relatively sophisticated. The evolution of tactics over nearly 1,500 years is a fascinating tale of armies increasing their combat power by improving upon small unit tactics. The evolution of tactics proceeded in stages, each stage building upon solutions to problems confronted by the limitations of the previous stage. The results were evident as early as the 14th century B.C. when the Egyptian army first began to learn how to control large units of different combat capabilities, providing evidence of the emergence of a genuine combined arms capability.

The earliest armies were essentially infantry forces with little in the way of other tactical capability. While the early Egyptian army organized its infantry forces by the types of weapons they carried, this practice did little to increase tactical proficiency. 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 the defeated and increase the casualty rate. This situation changed with the Egyptian adoption of the chariot.

The chariot 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. Its archer crews could engage the enemy at long range. Upon closing, the crews switched to the javelin and axe and attacked as mobile infantry. Once the enemy infantry was scattered, the chariot could be used to mount a truly lethal pursuit. Moreover, the chariot could be used to inflict surprise, a tactic which had never been possible before with packed infantry units. The chariot also allowed another major innovation, the use of mobile reserves that could be committed at a propitious moment to turn a flank or exploit a breakthrough. It became the elite striking arm of the Egyptian armies and greatly expanded the tactical capabilities of Egyptian combat units.

The tactical proficiency of the Assyrian army relied upon providing a mix of units acting in concert. The infantry remained the major shock force of the army. The normal infantry unit was a highly trained maneuver company that could be easily tailored into units of 50-200 men, depending upon the tactical requirements of the moment. The firepower of Assyrian archer companies was increased by as much as 40 percent by introducing an innovation in the shoulder quiver that allowed the arrows to be brought within rapid reach of the bowman. The Assyrian chariot was a large and heavy vehicle that was pulled by three horses and carried a crew of four. Its tactical role was quite different; it maximized the role of shock. The idea was to attack enemy formations from as many directions as possible. 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 large scope of military action forced the Assyrians to fight in all types of terrain, a condition to which the heavy chariot

was often ill-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 the leg and heel pressure of the boot. (The spur and stirrup had not yet been invented.) These innovations made possible the first use of mounted archers, the famed "hurricanes on horseback" of the Old Testament. In set-piece battle the cavalry was used to pin the enemy flanks and to take up blocking positions to prevent a retreat. Once in position behind the enemy, the cavalry acted as an anvil against which the chariot and infantry units could drive the enemy. The ability of the horse to traverse uneven terrain made the cavalry especially lethal in pursuit. This same ability made cavalry forces highly flexible and valuable for reconnaissance in force and for providing flank security for the army on the march, two new tactical capabilities.

The Persians expanded the role of the cavalry in their fighting formations. By the time of Cyrus the Persian army's ratio of cavalry to infantry was 20 percent cavalry and 80 percent infantry. It was the largest cavalry force in the world. Although an elite force, Persian cavalry was used primarily to draw the enemy into infantry battle. The weakness of the Persian army, however, was its lack of heavy infantry, and the army usually relied upon sheer numbers to carry the day. Most Persian engagements were with tribal armies that also lacked heavy infantry and the capacity for ground maneuver. Whenever it confronted the heavy infantry of the Greeks, however, the Persian army was almost always defeated. The Greeks had discovered the secret of heavy infantry formations, and in the hands of Alexander, the secret revolutionized small unit tactics.

Heavy infantry had been the mainstay of Greek military tactics in the classical period. The heavily armored hoplite fighting in tightly packed phalanxes had the single advantage of being almost impervious to cavalry attack. The phalanx's major disadvantage was its inability to maneuver and conduct a pursuit. Under Alexander the phalanx was made even heavier. The densely packed formations of the Macedonian phalanx were armed with a 13-foot-long spear called the

sarissa, which weighed almost 18 pounds. Although trained in a number of maneuver drills and battle formations, the Macedonian phalanx was, on balance, even less maneuverable than the old hoplite phalanx. Yet, in Alexander's hands, its very stability gave it new tactical value.

Alexander's tactical contribution was to reduce the role of infantry as the primary striking and killing arm of the army. He used his heavy infantry formations 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. Alexander coupled this new tactical idea with another, the oblique formation. The infantry was not the foremost frontal point of the line but held back obliquely in the center while the heavy cavalry deployed in strength on the right, connected to the infantry by a hinge of elite cavalry. (General Schwarzkopf's tactical maneuver in the Persian Gulf war was essentially a copy of the Alexandrian model.) The idea was to engage the enemy on the flank and force him to turn toward the attack. As the cavalry pressed the right, the slower infantry advanced in hedgehog formation toward the enemy center. If the enemy flank broke, the cavalry could envelop while the infantry closed toward the center, using the infantry as an anvil against which the cavalry could hammer the enemy. If the flank held, the enemy still had to deal with the shock power of the infantry as it fell upon its center. Alexander was the first to use cavalry as the primary combat arm of an ancient 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 disaster for both the British and French cavalry forces.

The tactical proficiency of ancient armies had gone 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 instead 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 heavy, slow infantry formations as a platform of maneuver signaled the leading role of cavalry as

the primary striking force of the ancient armies. In each phase of tactical development, the role of infantry as the main maneuver and killing element of the battlefield declined. How much more surprising, then, that the next major army to appear on the ancient battlefield found its primary strength in the maneuverability and killing power of heavy infantry formations while relegating cavalry to a secondary role.

The spine of the Roman army was its heavy infantry formations. Unlike infantry formations of the past, the Roman maniples and, later, the heavier cohorts, were more maneuverable than any infantry formations that the world had seen. They also surpassed the killing power of earlier infantry formations to an almost exponential degree. The tactical proficiency and lethality of the Roman legion were not surpassed by another army for almost fifteen hundred years. The secret of the Roman killing machine was that the Roman soldier was the first 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 dreaded *gladius*, instead of the spear. The Roman *gladius* was responsible for more deaths on the battlefield than any other weapon until the invention of the firearm!

The basic tactical unit of the Roman army was the maniple (literally, "handfuls"), somewhat equivalent to the modern infantry company, with a strength of 160 men. The maniple was divided vertically into two centuries of 80 men each. Each century, as the name implies, was originally comprised of 100 men, but proved too large to be controlled by a single officer. The number was reduced to 80, but the name was retained. By 99 B.C., the army was reformed into cohorts, three maniples to a cohort. Ten cohorts comprised a legion of 6,000 men. This greater size made the legion less brittle to mass attacks commonly used by tribal armies, especially the Gauls and Celts, while retaining the flexibility inherent in the earlier maniple formation.

The infantry formations of earlier armies had been packed masses of men pressed against each other with no spacing between individual soldiers or other units. The result was virtual

tactical immobility on the battlefield. The Roman innovation was to build in spaces between soldiers and units, thereby greatly increasing tactical flexibility and mobility. Each maniple deployed as a small, independent phalanx with a 20-man front and 6-man depth, much lighter than earlier formations. The spacing between each soldier was sufficient to allow independent movement and fighting room within an area of 5 square yards. This allowed the soldier greater room to wield his sword. The soldier could move freely over 5 square yards of ground, seeking and destroying individual targets from all directions. Each maniple was laterally separated from the next by 20 yards, a distance equal to the frontage of the maniple itself. The maniples in each line were staggered, with the second and third lines covering the gaps left in the lines to their front. Each line of infantry was separated from the next by an interval of approximately 100 yards. This *quincunx* or checkerboard formation provided maximum tactical 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 would retire on 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 through one's own lines offered yet another tactical innovation. The inability of earlier infantry formations to replace the 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. Few armies would achieve this ability again until the time of Napoleon.

Unlike earlier infantry formations, the Roman maniples could operate totally independently of one another. Since their strength rested in flexibility and not mass, they could also

maneuver rapidly when placed on their own. This ability allowed Roman commanders to make maximum use of the element of surprise, something not achievable by infantry forces in earlier armies. A commander could position a few spare maniples in hidden positions, often at the flanks, and even attempt to insert them to the rear of the enemy. Once the main forces engaged, these maniples could be brought into action by flag signals and surprise the enemy with an attack from an entirely different direction. In rough terrain maniples could be used to guard approaches to the battlefield, secure a bridge or crossroad, or conduct a reconnaissance in force. Later, when the maniple formations gave way to the cohorts, the Romans learned to assemble these large (about 600 men) formations in any combination of lines, squares, rectangles, or circles. The result was an increase in combat power while retaining the maneuverability and flexibility of the old maniple. The Roman infantry formations were the most tactically flexible and maneuverable of all infantry formations produced by the armies of the ancient world, and they added a new tactical dimension to war.

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 for almost half a millennium until its fatal defeat at the Battle of Adrianople. The defeat of Roman infantry at the hands of barbarian cavalry shook the tactical thinking of the ancient world. Followed as it was by 100 years of invasions by tribal armies that stressed cavalry, the empire in the West collapsed, and with it went the primacy of infantry. The death of disciplined infantry forces was a natural consequence of the social and military superiority of the new tribal states of Europe. Infantry decayed, and the primacy of cavalry was complete. The Battle of Hastings in 1066 in which an infantry force was massacred by a cavalry army 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 Mongol threat to Europe reinforced the idea that infantry was no longer an effective fighting arm, and the European armies focused more on the role of the armored

mounted soldier. 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) that a disciplined infantry force could deal effectively with cavalry, and the Battle of Crecy (1346) demonstrated cavalry's vulnerability to the new long-range weapon–the long bow–cavalry remained supreme. The resurgence of infantry and tactical flexibility did not begin to reappear until the invention of the musket. And even then it took almost another 200 years before infantry could be reemployed with a skill resembling that of the ancient armies.

Siegecraft.

This remarkable innovation in warfare came into existence in an attempt to deal with one of the most powerful defensive systems produced by the Iron Age, the fortified city. By the Bronze Age there was unambiguous evidence of fortifications built exclusively for military purposes. The first undisputed example of a fortified city was Urak in Mesopotamia dating from 2700 B.C. It enclosed a population of 3,000 to 5,000. Within 200 years, fortification of urban areas had become the norm.

The fortifications of the Bronze Age were remarkable for the time. The fortress of Buhen built in the Sudan around 2200 B.C. was 180 yards square, surrounded by a mud-brick wall 15 feet thick and 30 feet high. The wall had firing bastions every 30 feet. A moat surrounded the outer wall and was 26 feet across and 18 feet deep, with yet another steep glacis on the inner slope. The gate complex was 45 feet high and stretched from the inner wall across the moat, allowing archers to control fire along parallel approaches. As impressive as this fortress was, it was dwarfed in size and complexity by fortifications of the Iron Age. The Israelite fortress at Hazor, for example, had walls that ran 1,000 meters by 7,000 meters. The city of Qatna had walls 4 miles long, and the Hittite capital of Boghazkoy had walls that ran for 6 miles. The entire wall of Boghazkoy and its supporting strong points were made of solid rock and brick. So important were fortifications to the ancient armies that the need to secure adequate wood and stone supplies led both Egypt and Assyria to occupy Lebanon for centuries on end.

Fortified cities put field armies at great risk. Safe behind the city's walls, defending armies could provision themselves for long periods, while the attacking armies were forced to live off the land until hunger, thirst, and 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 sought 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, 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. The ability to overcome fortifications was an art that no successful army could afford to be without.

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. By 2000 B.C., it was a normal implement of warfare. 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 to a low spot in the wall and then rolling large, covered battering rams into place to attack the wall at its thinnest points. 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 by using short ladders 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.

The absolute masters of rapid siege assault were the Assyrian armies of the 8th century B.C. The key was to coordinate several different types of assault on the walls at the same time but in different places. Battering rams supported by siege towers were brought into position at several points along the wall. At the same time scaling ladders with lever crews were deployed at other points. Sappers and tunnelers worked to gain entry from beneath by weakening and collapsing a section of

the foundation. At the appropriate time, scaling ladders were used to mount attacks over the wall at several points in an effort to force the defender to disperse his forces. The idea was to quickly mass more soldiers at the point of entry than the defender could bring to bear. As a rule of thumb, a city could mount about 25 percent of its population to defend against attack. Thus, a city of 30,000 could muster fewer than 8,000 men to defend against an attacking force that typically exceeded 30-40 thousand soldiers. The advantage almost always rested with the besieging army.

The armies of classical Greece, as in so many other areas of military expertise, were hopelessly primitive in the arts of siegecraft. These armies had no siege trains and relied primarily upon blockade and starvation to subdue a city, techniques far too slow to be used by an army trying to force a strategic decision. In the late classical period these citizen armies made a few rudimentary attempts at using siege engines. In 440 B.C., Artemon used siege towers in the siege of Samos, but failed to take the city. In 424 B.C. the Boetians may have used a primitive flamethrower–a hollow wooden tube that held a cauldron of burning sulphur, charcoal, and pitch at one end–against the wooden walls of Delium. In 397 B.C., Dionysisus successfully used siege towers and rudimentary catapults in the attack on Motya.

The steady development of siegecraft resumed once again during the reigns of Philip and Alexander. Philip realized that the new Macedonian army would remain a force fit only for obtaining limited objectives if it was not provided with a capability for rapidly reducing cities. Alexander's far-flung victories would have been impossible without this capability. Philip introduced the use of sophisticated siege operations 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.

The Roman ability to reduce fortifications was probably the best in the ancient world, but relied on organization and application rather than on engineering innovations. For the most part Roman siege engines were significantly improved

versions of the old Greek and Persian machines. Most important, Roman siegecraft depended upon manpower, organization, discipline, and determination more than machinery. Once the Romans were committed to a siege, the results were almost inevitable, no matter how long it took.

The Romans raised the art of circumvallation and countervallation to new heights. At Masada, they built a stone wall around the entire mountain. Manned at regular intervals with soldiers, the purpose of the wall was to prevent anyone from escaping the besieged fortress. When there was a threat of an attack from a relieving army, circumvallation was supplemented by countervallation, in which yet another wall was built so that troops could defend against an attack from a relieving force. These techniques often took a great deal of time. In the case of Masada, the Romans laid siege to the mountaintop fortress for 3 years. In the process they built a 3-mile-long sloping earthen ramp to the top, along which they moved siege machinery and troops for the final assault.

Artillery.

It was Philip of Macedon who first organized a special group of artillery engineers within his army to design and build catapults. Philip's use of siegecraft allowed Greek science and engineering an opportunity to contribute to the art of war, and by the time of Demetrios I (305 B.C.), known more commonly by his nickname "Poliocretes" (the Besieger), Greek inventiveness in military engineering was probably the best in the ancient world. Alexander's engineers contributed a number of new ideas. In honor of the Greek contributions, to this day the military art of siege warfare is called "poliocretics."

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 examples date from the 4th century B.C. and were called *gastraphetes*, literally, "belly shooter." It was a form of primitive crossbow that fired a wooden bolt on a flat trajectory along a slot in the aiming rod. 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 tactical mobility and deployment. One of these machines, the *palintonon*, could fire an 8-pound stone over 300 yards, a range greater than that of a Napoleonic cannon. These weapons were all used by Philip as weapons of siege warfare, but it was Alexander who used them in a completely different way–as covering artillery. Alexander's army carried prefabricated catapults that weighed only 85 pounds. Larger machines were dismantled and carried along in wagons.

Roman advances in the 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. As Josephus recorded in his account of the siege of Jerusalem, the largest of these artillery pieces, the *onager*, (called the "wild ass" because of its kick), could hurl a 100 pound stone over 400 yards. Vegetius noted that each legion had 10 onagri, one per cohort, organic to its organization. Smaller versions of these machines, such as the scorpion and *ballista*, were compact enough to be transported by horse or mule. These machines could fire a 7-10 pound stone over 300 yards. Caesar required that each legion carry 30 of these small machines, 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, which required a two man crew, could be used as rapid-fire field guns against enemy formations. They fired a 26-inch bolt over a range of almost 300 yards. Larger versions mounted on a wheeled frame were called *carroballistae* and required a 10-man crew. These machines could fire perhaps three to four bolts a minute and they were used to lay down a barrage of fire against enemy troop concentrations. They were the world's first rapid-fire field artillery guns.

The emergence of siegecraft as a basic requirement of Iron Age armies represented a major innovation in warfare. Without

the ability rapidly to reduce cities and fortified strong points, no army on the march in hostile territory could hope to force a strategic decision with any rapidity. The very idea of empire would have been militarily unthinkable in much the same way as it was for the classical Greek armies which had no siegecraft capability. The search for more efficient ways to destroy fortifications produced, perhaps somewhat by accident, the new combat arm of artillery. While Alexander was the first to use it, the Romans gave birth to the idea of using artillery as antipersonnel weapons. Both siege engines and artillery represent the birth of a major new idea in the technology of war, an idea that came to further fruition with introduction of gunpowder a thousand years later.

Staff Organization.

The emergence of large, complex armies in the Iron Age brought into existence the specialized military 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. The first military staff emerged in Egypt during the period of the Old Kingdom (2686-2160 B.C.). While the complete structure is unknown, an analysis of titles reveals ample evidence of a sophisticated staff organization whose organizational principle was based on function. There are titles for quartermasters, various officer ranks, types of commanders, and even specialist sections dealing with desert warfare and garrison functions. A clearer command structure emerged during the Middle Kingdom (2040-1786 B.C.), when titles for general officers in charge of logistics, recruits, frontier fortress, and shock troops were found. The command structure was almost fully articulated, and the appearance of titles for police patrols, district officers, and military judges suggested the presence of a military police force to keep order and discipline in the army. For the first time there is evidence of a military intelligence service, reflected in the title, "master of the secrets of the king in the army." The regular presence of scribes suggested that much of the administrative routine may have been committed to permanent record. By 1300 B.C., the Egyptian army showed

evidence of special field intelligence units and, most surprisingly, the use of the commander's conference for staff planning on the battlefield.

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. Earlier evidence reveals the presence 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 staff sophistication of earlier armies. The structure of Alexander's army was essentially an extension of his personality, and did not survive long enough to acquire any institutional foundation of its own.

The height of military staff development was achieved by the Romans. Warfare had become so complex that complex organizational structures were required to fight it. So effective was the Roman staff organization that more than any other, it still serves as the model for modern armies. Each senior officer had a small administrative staff responsible for paperwork, and the Roman army, like modern armies, generated enormous numbers of permanent files. Each soldier had an administrative file that contained his full history, awards, periodic physical examinations, training records, leave status, retirement bank account records, and pay records. Legion and army staff records included sections dealing with intelligence, supply, medical care, pay, engineers, artillery, siegers, training, and veterinary affairs. There was almost nothing in the organization or function of the Roman military staff that would not be instantly recognizable to a modern staff officer.

The degree of sophistication and organization evident in the military staffs of the Iron Age was not achieved again until at least the armies of the Civil War. Even the armies of Napoleon, as sophisticated as they were thought to be for their time, did not equal the level of organizational skill of the

Assyrian and Roman military staffs. In terms of operational proficiency, no army until the rise of the German general staff could match the Roman army.

Training.

As armies became more complex, the need to train the soldier in more skills increased. The first evidence of military training in any army 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 to induce discipline. The first good description of military training in ancient armies was produced by the Greek historian Strabo, who noted that Cyrus introduced universal military training among the Persians. The conscript underwent 10 years of military training, probably as a reservist, before being enlisted in the regular army. Training was vigorous and included physical conditioning, instruction in the bow and javelin, and horsemanship. Recruits were also trained to forage for food, prepare meals in the field, and make and repair weapons. The recruit was indoctrinated in the military code of the Persian army and taught to "ride well, shoot straight, and tell the truth."

The training regimen of the classical Greeks was directed more at general physical conditioning than the development of specific military skills. This focus was logical in light of the fact that the phalanx tactics of the day required little training to implement. What the phalanx required was discipline, courage, and stamina. It has been estimated that a soldier in the phalanx could fight no more than 30 minutes before being overcome by physical exhaustion. The Greek stress on physical conditioning above all else made good military sense.

In an army as organizationally complex as the Roman army, physical conditioning, while stressed, was not sufficient. 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 do some

mathematical calculations. The most intelligent were trained in the special skills needed by the army. As a professional army, the legions ran their own specialized training programs in everything from military engineering, medical support, to artillery gun repair. The complexity of war, as in modern times, for the first time made the mental skills of the soldier at least equally important as his physical skills.

The training regimen of the Roman soldier was necessitated in large degree by the use of sophisticated, open formations by the infantry. Denied the protection of the closely packed phalanx, the Roman soldier lived or died by his skill with the sword. The need to fight as an individual and to move over a designated area, selecting targets of opportunity while remaining still part of his larger unit, required courage, discipline, and skill with the sword and *scutum*, operating in concert. Roman tactics required the soldier to be able to respond instantly to commands to change the shape of his formation. In 105 B.C., the Roman army adopted the training methods heretofore used by professional athletes in the gladiatorial schools. For the most part the legions trained their own soldiers. Special training grounds, some in Scotland, were available to bring the army to proficiency. It was common practice for a legion being readied for deployment to spend the previous weeks in long field training drills, some of which required that they build three field camps a day. The result was a thoroughly professional army whose level of training was the best in the world.

No army in the West equaled the level of training of the Roman army until at least the 17th century. Prior to that, the primacy of cavalry forces over infantry had relegated the infantry to a minor role on the battlefield. The development of the musket changed this picture, as did the introduction of the bayonet. Now the infantry could deploy in lines instead of phalanxes and deliver more combat power. But the use of linear tactics required a highly trained soldier, one who could also master the 16 steps in loading a musket while under fire. One of the major reasons that Napoleon utilized the column formation instead of infantry lines was precisely because his use of conscript manpower made it impossible to train so many

men to the level of discipline and skill required by the linear tactics of his day. As a consequence, Napoleon's column formations represented a return to the use of the infantry phalanx, in which the safety of the packed herd and sheer courage would compensate for the infantryman's lack of skill.

Conclusion.

The military revolution of the Iron Age qualitatively increased the combat capabilities of ancient armies to levels never seen before in human history. Yet, what distinguishes modern warfare from ancient warfare is more than its level of military capability and destructive power. The key defining element of modern war is strategic endurance, and this quality is a function of the total integration of the social, economic, and political resources of the state in support of military operations. After the fall of Rome it was not until the Civil War (1860-65) that the West once again began to fight wars requiring the total integration of all social resources in support of the combat armies in the field. Quite naturally, the various elements of the supporting strategic infrastructure became necessary targets of military attack. Thus, the battles of the Civil War were won and lost as much in the factories and on the farms as on the battlefields themselves. The emergence of this level of warfare in the 19th century was not new. Total war had been a major defining characteristic of armies of the Iron Age more than two thousand years earlier.

For much of the early ancient period armies could often force a strategic decision with a single battle. The fate of individual states and even empires turned on a single victory or defeat. As the states of the Iron Age grew in social and organizational 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 ancient armies increased to a level equal to that of the armies of World War I.

Persia, for example, could lose almost every battle against its Greek adversaries for 200 years with little effect on the

stability of the empire. Time and again Persian armies sought to bring the Greeks to heel, only to fail on the field of battle, and still the empire survived and prospered. Even its eventual defeat at the hands of Alexander required a series of major battles. Rome's military efforts in the Punic Wars and in later conflicts clearly demonstrated that the new social organization of the state lent great military endurance to the nation with the moral and political will to use it. In 255 B.C. a Roman fleet of 248 ships was sunk in a storm off Cape Pachynus with a loss of over 100,000 men, a number equal to 15 percent of the able-bodied men of military age in all Italy. Rome's response was to build another fleet and continue the war against Carthage. Polybius called the Carthaginian War the bloodiest and costliest in history. Roman losses alone approached 400,000 men, a number equal to all the men lost by the United States in World War II! And still Rome fought on.

The politico-military endurance of the integrated states of this period was further evident in Rome's wars with Hannibal. Hannibal was able to move freely throughout Italy for almost 18 years, ravaging the countryside as he went. In 218 B.C. at Trebia, Hannibal destroyed a Roman army of 40,000 men and overran most of northern Italy. A year later, in June 217 B.C., a Roman army was trapped in a defile surrounded by hills near the shores of Lake Trasimene. Once again, almost the entire Roman force was slaughtered. Yet, with Rome having lost almost 100,000 men in less than 3 years, Hannibal could still not force a strategic decision against Roman political will. In an attempt to achieve final victory, in 216 B.C., Hannibal drew yet another Roman army into battle at Cannae. Hannibal caught the legions in a perfect double envelopment. Seventy thousand Roman soldiers were killed, and another 10,000 taken prisoner. The three defeats at Hannibal's hands cost Rome 150,000 men. and still the war went on. The staying power of the Roman state, even in these early days, was remarkable. Eventually, Hannibal was forced to withdraw to prevent a Roman strategic thrust at Carthage itself and was defeated by Scipio at the Battle of Zama. Carthage had won every battle and lost the war. The deciding factors were the endurance of the Roman political order and its ability to continue supplying military resources regardless of the defeats it suffered in the

field. And this same ability is precisely what defines the capability of states to wage modern war today.

CHAPTER 4

A TRANSITION OF WAR

Writing in 1744, Abbe Galliani noted that "empires being neither up nor down do not fall. They change their appearance." The barbarian invasions of the Roman empire for the first four centuries match precisely this description. Rome did not collapse as much as it metamorphosed into a decentralized state of quasi-Romanized Germanic fiefdoms each ruled by a warlord equipped with a private army. The Roman army had always to deal with the problem of hostile tribal orders on its boundaries. In Gaul, Spain, and Britain, Rome solved the problem through military conquest with the eventual Romanization of the tribal peoples resident in these areas. The problem on the German frontier, however, was different. Here the tribes were very large, culturally warlike, offered nothing in terms of resources that could be obtained by conquest, and occupied an area of dense forest, rivers, and mountainous terrain that was very difficult to conquer and occupy. The massacre of three Roman legions at the hands of the German tribal chieftain Armenius in 6 A.D. in the Teutorborg forest effectively settled the question of conquest for the Romans. Roman military strategy changed to the defensive, and was marked by the creation of a strong system of in-depth fortifications constructed along the German frontier.

The Barbarians.

Throughout the first and second centuries, the Roman strategy succeeded in repelling the repeated attempts at penetration by the Germans. It was not until 260 A.D. that the first significant penetrations succeeded when the Franks moved into Spain, the Alamanni moved into the Alvergne country, and the Goths crossed the Danube in large numbers. The Roman army, long garrisoned along the imperial frontiers, had begun to decay. Many of the frontier posts had become

large towns with large civilian contingents within them. Training and discipline declined. By the second century not more than one percent of the Roman army was comprised of native Italians, the rest being drawn from other nationalities of the empire still strongly socialized to Roman values and methods. By the middle of the third century, however, the army had become hollow, and the German tribes broke through in great numbers to settle large tracts of imperial land.

The Roman response was to reorganize the army with militia troops, the *limitani*, garrison the forts, and hold strong horse-born reserves at key garrisons within the empire that could rush to a point of penetration and stop the enemy advance. Most of the army by this time was comprised of barbarian soldiers in the pay of Rome. As Roman reliance upon these barbarian military forces grew, the organizational structure and values of the legion began to erode until, by the 4th century, the legions were no longer organized along traditional Roman lines. Instead, they reflected barbarian weapons, tactics, values, and were commanded by their own tribal chiefs. The fiction that they were paid allies of Rome continued until the 5th century when renewed waves of barbarian invasions crashed over Europe, effectively putting an end to the Roman military system.

The gradual barbarization of the legions had an enormous impact on Roman military organization. The decline in the administrative and support structure of the legion led to its replacement with a number of barbarian military practices. In effect, the tribal military forces within the empire became a state within a state that was beyond the power of the central Roman state apparatus to control. The Battle of Adrianople administered a military *coup de grace* to a social order that was already dying from within.

The Byzantines.

The centuries of invasion, civil war, and general decay took their fatal toll on the Roman empire of the West. From the 4th century onward the legacy of Rome was gradually transferred to its eastern capital, Constantinople, where Roman emperors

attempted to stem the tide of barbarism and preserve the essence of Roman culture. By 650 A.D. the empire of the east was resigned to the loss of the western provinces, and found itself confronted with numerous military threats, especially from Islam, closer to home. These threats occupied the empire's attention for the next 800 years, and it is a testimony to Byzantine greatness and skill that the empire survived and prospered for more than a millennium after the collapse of Rome until suffering its final defeat at the hand of Ottoman armies in 1453. The Western Roman empire had lasted for 500 years. The Eastern empire (395-1453) endured for over a thousand.

The imposition of Roman administrative machinery upon the Byzantine population in the early years kept the traditions of Roman military science and law intact, and preserved Roman culture and achievement for more than a thousand years until, as Allbutt noted, "Western Europe was once again fit to take care of them." Byzantium suffered no period of general degradation and decay like the Middle Ages in Europe and, for the most part, remained the most refined and developed culture in the world until the very end.

Vital to Byzantine survival was the maintenance of its military capability which, as Oman notes, "was, in its day, the most efficient military body in the world." Despite many evolutionary changes in details, the Byzantine military machine remained Roman in both its organization and values, and it continued to produce excellent soldiers and commanders long after the Roman legions had disappeared in the West. The basic administrative and tactical unit of the Byzantine army, for both cavalry and infantry, was the *numerus* comprised of 300-400 men, the equivalent of the old Roman cohort. Each *numerus* was commanded by the equivalent of a colonel. A division or *turma* was comprised of five to eight battalions commanded by a general. Two or three *turmae* could be combined into a corps commanded by a senior general called a *strategos*. The empire was geographically organized into provinces or *themes*, each of which had a military commander responsible for security with deliberately unclear lines between civil and military administration so as to give priority to military

defense. For more than four centuries the Byzantine army numbered approximately 150,000 men almost evenly split between infantry and heavy cavalry forces.

Military manpower was obtained through universal conscription, but in practice recruiting and stationing military forces within each *theme* allowed commanders to recruit the best manpower from within each province. The army attracted the best families for its soldiers, thereby avoiding the fatal mistake of the Western empire which relied heavily upon barbarian soldiers while the best Roman citizens served not at all. Whereas Rome had relied heavily upon infantry until too late, the Byzantines adjusted to the new forms of highly mobile mounted warfare by relying primarily upon an excellent heavy cavalry of their own. Byzantine military commanders were quick to adopt a number of weapons and tactics of their enemies, so that as the infantry legion had symbolized the might of Rome, the mounted heavily armored horseman, the *cataphracti*, came to symbolize the military might of Byzantium.

The organizational infrastructure of the army of Byzantium was every bit as well-organized and efficient as it had been under the old Roman legions. The army had organic supply and logistics trains comprised of carts and pack animals to speed mobility, excellent siegecraft capabilities to include the full range of Roman artillery and siegecraft specialists, a fully articulated staff organization professionally trained in military academies, and a powerful navy to support ground operations. The genius of the Romans for military organization was preserved intact in almost all its earlier aspects.

The Armies of Islam.

As the Byzantine Empire was reaching the peak of its cultural and military power in the 7th century, deep within the deserts of Arabia a power was stirring that would change the face of the religious world forever. From the Byzantine point of view, the desert tracts of Arabia offered little in the way of rewards for conquest so, as with their Persian contemporaries, the eastern Romans made no effort to control the area. Arabia's only wealth lay in a few merchant towns, Mecca and

Medina among them, that lay astride trade routes in the south. Into this world of Arab merchants and pastoral herdsmen was born Mohammed, the prophet of the religion of Islam, and a man destined to change the face of the world.

Beginning with a small band of zealot followers who started raiding the caravan routes, Mohammed forged the beginnings of an Arab army that within 100 years controlled all the territory from the Indus to the Atlantic along the North African littoral through Spain to the border of southern France. The armies of Islam, propelled by the *Jihad* belief that to die for the faith gained one paradise in the next life, gathered converts by the thousands wherever they marched. By 732, a century after Mohammed's death, the armies of Islam had destroyed the Persian Sassaniad empire, rolled back Byzantine power in the east to the Turkish border, incorporated all of Spain into the imperial realm, and narrowly missed overrunning France.

No one could have foreseen this staggering degree of military success, because for 300 years Arab armies were hardly armies at all. The early followers of Mohammed were desert tribes and clans called to the banner of the faith who fought in no organized formations. The idea of individual glory drove warriors to feats of great bravery, but at the same time made them impossible to organize as fighting units. For more than a century Arab soldiers fought with primitive weapons–the personal sword, dagger, lance–and wore no defensive armor or helmets. These conquering forces had no staff organization, no siegecraft capabilities, and no logistics trains. Tactics were almost nonexistent as these armies relied upon small hit-and-run raids, the *razzias*, and ambushes as their primary tactical maneuvers. Mobility was limited as most of the army moved on foot and fought as infantry accompanied by small contingents of camel cavalry. Even their size was small. The force that attacked and subdued Egypt (640-642) numbered no more than 4,000 men. But such corps of armed men could and did count on their numbers growing into the thousands as converts flocked to their cause along the line of march.

Arab military development was strongly influenced by experience and contact with other military cultures, most particularly by their wars with the Byzantines and Persians. In

635, an Arab chieftain, Khalid Ibn al-Walid, reorganized the Arab armies along Byzantine lines and created small combat units to replace the tribal levies. Whereas the tribal formations had deployed in long lines only three men deep, al-Walid created dense infantry formations after the Byzantine pattern. These new formations were organized into archer, infantry, and lance cavalry units and placed under the command of proven combat leaders who replaced the tribal and clan chiefs. He created the first Arab quartermaster corp, and even organized the women to carry knives and short swords to be used for stripping and dispatching the enemy wounded.

Horses were rare in Arabia (although not unknown), and the early Arab armies relied upon corps of special racing camels for transport and cavalry. The wars with the Persians brought the Arabs into contact with the horse, and the warriors of Allah were quick to grasp the importance of the horse as a military asset. Since Arab horses were brought into regular contact with their camel corps, the smell of the camel had no effect on them. The presence of camel cavalry, however, often spooked the horses of the enemy and weakened the opponent's force.

The empire reached its geographic zenith with its defeat by Charles Martel at the Battle of Poitiers in 732. Its expansionist phase over, the empire settled down to seven centuries of relative tranquility punctuated by violent caliphate rebellions and border wars. The defensive cast of the empire during this period was marked by the decentralization of the empire into a number of rival caliphates and the construction of military towns, *ribats*, which garrisoned special units of religious warriors to protect the empire and the faith. (Modern-day Rabat, Morocco derives from one of these fortress monasteries). At the same time the Arab armies adopted more and more Persian and Byzantine equipment and practices. By the 10th century, the chronicler al-Tabari recorded that the Arab warrior carried the following items of equipment: mail armor, breastplate, helmet, leg and arm guards, complete horse armor, small shield, lance, sword, mace, battle axe, bow case with two bows, a quiver of 30 arrows, and two spare bow strings. Added to this military capability was now a first-rate

siegecraft capability. In equipment and tactics, the armies of Islam had become indistinguishable from the armies of Byzantium.

The Middle Ages.

The period from 800 to 1453, the high Middle Ages, was a period of violent transition that began with the end of the Dark Ages and ended with the Renaissance. When this period began Europe was still attempting after years of barbarization to reestablish an imperium along Roman lines (the dream that drove Charlemagne), and when it ended the idea of an imperium was dead, replaced by the quilt-like pattern of the national state system that has survived to this day. For 700 years (800-1453) Europe was wreaked by dynastic struggles, religious wars, renewed invasions from outside European borders, brigandage, guerrilla war, and national conflicts. The Viking invasions of the 9th century added such havoc to an already chaotic state of affairs that the Church conceived of the First Crusade (to be followed by seven others) as a mechanism for deflecting the war-like spirit of feudal combatants toward other targets outside Europe. For 700 years, Europe knew little respite from the ravages of war and destruction.

The centralizing efforts of Charlemagne resulted in the solidification of the new feudal order marked by extreme decentralization in all political, economic, social, and military functions. The next seven centuries may best be defined by the constant struggle between the forces of centralization led by would-be national monarchs against the forces of decentralization and peripheralization which characterized feudalism as a form of societal organization. In the end, the forces of centralization overcame feudal pressures but proved unequal to the task of reestablishing any form of imperial order encompassing national identity and loyalty. In this way Europe gave birth to the nation-state.

The military organization of the Middle Ages was a direct reflection of the political, social, and economic decentralization of feudalism. Most wars were fought not by nation-states but

by rival monarchs who raised armies by levying requirements for soldiers and arms on subvassals. Accordingly, there were no centralized arms industries, no permanent standing military forces to speak of, and no efforts to maintain logistical organizations or to train armies. What few efforts were made in these areas were made by local vassals as they saw fit.

Military doctrine and tactics were almost nonexistent, and battles showed all the sophistication of armed scuffles and sword-swinging melees among groups of mounted men. It was, as one author has remarked, a period of squalid butchery. After each battle, the armies disintegrated as the knights returned home under the command of their local vassals. Tax collections for military purposes were highly sporadic, usually taken in kind, and, in any case, were left to local military commanders who were also the chief political officials. As the 14th century dawned, Europe was caught in a period of transition between feudalism and the rise of the embryonic national state.

The decentralization that characterized feudalism placed the armed knight at the pinnacle of the social and military order, and the form of mounted individualized combat at which the knight excelled had swept infantry from the field almost a thousand years before. Moreover, the development of infantry was further hindered by the nature of the social order that regarded it as the height of dangerous idiocy to arm the peasantry. The last time Europe had witnessed a disciplined infantry force was under Rome. The start of the Hundred Years War saw the supremacy of the mounted knight remain unchallenged. By the time this series of dynastic wars ended, new military forms had emerged which signaled the beginning of the end of that supremacy.

To counter the power of the mounted knight, the opponent had either to withstand the shock of a mounted assault against infantry or be able to deliver sufficient missiles from a distance great enough to inflict casualties on the mounted formation and prevent it from closing with the infantry. At the Battle of Paupen (1339) the Swiss infantry annihilated a force of mounted knights by the simple trick of reinventing the Macedonian phalanx complete with 18-foot pikes similar to the *sarissae*

used by Alexander's infantry sixteen hundred years earlier. The Swiss infantry, pikes at the ready, stood the shock action of the cavalry charge. Swiss halsberdsmen and axe throwers attacked the knights by chopping off the legs of the horses and butchering the knights as they lay helpless on the ground. At Crecy (1346), the English reinvented the second solution for dealing with the cavalry charge by destroying a force of French knights at a distance with hails of metal-tipped arrows fired from long bows. In both instances, the solutions represented the rediscovery and reapplication of ancient, long-forgotten techniques used by Alexander, the Romans, and the Persians for defeating heavy cavalry. For the first time in a thousand years, disciplined infantry forces once again began to appear on the battlefields of Europe.

CHAPTER 5

THE EMERGENCE OF MODERN WAR

The Hundred Years War (1337-1457) witnessed the beginning of national identity and loyalty to the nation-state as a series of dynastic wars served to crystalize national identities. The need for large military forces, including mercenary contingents, gave rise to the replacement of in-kind taxes with regular collections of specie. This, in turn, required the development of a centralized governmental mechanism as the embryonic states began to build a governmental infrastructure controlled by the king. Both during the war and for more than 100 years following it, Europe was plagued by bands of demobilized ex-soldiers who fought for pay and constantly switched sides. The problem was how to bring these military forces under the control of a national army. The solution was permanent pay, regular garrison locations, strict codes of military discipline, and the emergence of military rank and administrative structures. By the 1600s, for the first time since Rome, Europe once again began to develop stable, permanent armed forces directed by central national authorities and supported by taxation.

It was the emergence of a national authority that spurred the organizational, tactical, and technological development of armies during this period, and set the pattern for the next four centuries. A permanent army of professionals could be disciplined and schooled in new battle tactics and trained to utilize the new firearms to great effect. This, in turn, helped stabilize the emergent role of infantry whose musket and pike tactics now permitted thinner linear formations of infantry to be used on the battlefield. The invention and development of the firearm required a disciplined soldier, and this brought into existence a more permanent and articulated rank and administrative structure to train and lead the soldier. Permanent rank and military organization reappeared and, by

the time of the Thirty Years War (1618-48), all the major elements of the modern army had been set into place.

Weaponry.

The most significant invention in weaponry of the period of the Hundred Years War was the introduction of gunpowder which, when coupled with the introduction of new techniques for casting metal, produced the primitive cannon. The immediate impact of this new invention was the siege mortar used to batter down castle walls. In 1453, the Ottoman armies used cannon fire to destroy the remnants of the Byzantine Empire at Constantinople. Mobile siege guns, although still cumbersome, played a leading role in several battles of the Hundred Years War. This was the first effective use of field artillery in Europe. True field artillery appeared in the final decade of the 15th century when the French mounted light cast bronze cannon on two-wheeled carriages pulled by horses. The introduction of the trunion at this time increased the ability to mount and aim these guns with greater accuracy. By the 17th century, gunmaking had progressed to the point where range, power, and major types of guns were tc change little over the next two centuries.

By the 15th and 16th centuries, gunpowder was changing the battlefield. The appearance of the musketeer, the forerunner of the modern rifleman, and his firelock musket made it possible for tightly packed infantry formations to engage cavalry without having to engage directly in close combat. The slow rate of fire of these early short-range weapons, however, required that the musketeers be protected from the hostile advance, a problem that led to mixing musketeer formations with pikeman. Although the mix of pike to musket changed considerably over the next 300 years, the mixed infantry formation remained the basic infantry structure for the next three centuries.

The most immediate effect of portable firearms on the battlefield was, however, felt on cavalry. The invention of the wheel lock allowed the pistol to be aimed and fired with one hand. As the shock effect of cavalry was gradually reduced by

the introduction of the pike and musket to the infantry, the cavalry armed itself with saber and pistol and began to rely more on mobility than shock. At long last, after more than a thousand year interregnum, infantry was once more becoming the deciding force on the battlefield. Cavalry, no longer decisive, was used to pin the flanks of dense infantry formations in place so that they could be raked with artillery and musket fire. The siege mortar gave way to the smooth bore cannon that could act as genuine field artillery. By the 17th century, horse-drawn artillery was replaced by genuine horse artillery in which all members of artillery units rode into battle, a development that greatly increased the flexibility and mobility of field artillery, making it a full partner in the newly emerging maneuver warfare.

By the 16th century the feudal order was creaking toward its own demise, and in its place arose the nation-state controlled by the absolute monarch in command of a permanent standing army. The instrument of creating and protecting the nation-state was the professional army. Whereas feudal armies had attempted to capture the enemy's castle strongpoints, the new armies engaged in wars of attrition in which the destruction of the enemy's armed forces was the primary goal. The stage was set for a new round of national conflicts propelled by the new ideology of nationalism and dynastic rivalry. These conflicts spawned yet another cycle of development in new and more destructive weapons.

Among the most destructive of these conflicts was the Thirty Years War (1618-48) that began as a clash of feudal armies and ended by setting the stage for the development of modern war. During this period the musket revolutionized the role of infantry. The original musket was a firelock, itself a great improvement on the earlier matchlock. The matchlock required a forked stand to hold its long barrel. The rifleman had to ignite the powder in the touchhole with a hand-held burning wick, conditions which made the weapon very difficult to aim. The firelock used a trigger attached to a rod which moved a serpentine burning wick to the touchhole, thereby allowing the rifleman to hold the weapon with both hands and make an aimed shot. The lighter, more reliable, and more mobile firelock

could fire a round every 2-3 minutes. For the first time the infantry had a relatively reliable and accurate firearm.

The firelock was later replaced by the wheel lock in which a rotating geared wheel powered by a cocked spring caused the flint to ignite the powder in the flashpan. A century later the wheel lock was replaced by the flintlock in which a spring loaded hammer struck a flint igniting the charge. By the 1800s this mechanism was replaced by the percussion cap, a truly reliable system, and with each development the rifle became more certain to fire on cue while the rate of fire increased.

Corned powder was a significant innovation of this period. Early gunpowder for rifles and cannon tended to separate into its component materials when the powder was stored for long periods or when moved in the logistics train. The separation made it unlikely that the powder would explode evenly in the barrel, thereby increasing misfires and propelling the bullet at much lower velocity. The trick was to shape the component materials in gunpowder like little nuggets which reduced the problem of settling and made the powder more certain to fire evenly, thus maintaining the velocity of the projectile. The result was longer range and deadlier cannon and firearms.

In the 16th century the rifleman carried his powder and ball, ranging from .44 to .51 caliber lead shot, in small leather bags. In rainy weather the weapons often would not fire because of damp powder. The introduction of the paper cartridge by Gustavus Adolphus in the Thirty Years War greatly improved the reliability of the rifle and increased its rate of fire. Riflemen could now fire two rounds a minute instead of a single round every 2-3 minutes. By the end of the U.S. Civil War the totally self-contained modern cartridge with powder and bullet in a single metal container made its appearance and, by the Franco-Prussian War of 1871, the breech-loading rifle had become standard issue for European armies. Two decades later the clip and magazine-fed rifle revolutionized infantry tactics. The breech loading magazine-fed rifle made it unnecessary for the rifleman to stand or kneel to reload. This made possible the introduction of truly modern dispersed infantry tactics which further increased the ability of infantry to fire and maneuver.

Regardless of the type of firing mechanism, the musket remained an inaccurate weapon with limited range and slow rate of fire until the Civil War. The smoothbore musket was usually ineffective beyond 100 or so yards. By the early 1700s the British Brown Bess could hit a man at 80 yards with some regularity. But it was the Americans who truly revolutionized riflery by inventing the first reliable rifled barrel, the famed Kentucky Rifle. The invention and use of rifling made it possible to hit a target reliably at 180 yards and increased the range and accuracy by a factor of three.

The rifle made a significant impact on the battlefield. In feudal armies infantry was packed into dense squares to maximize firepower and resistance to shock from cavalry attack. As the rifle became more reliable and firepower more deadly at long range, it became possible to thin out the packed masses of infantry into lines while still providing sufficient firepower and defense from cavalry attack. Gustavus Adolphus was the first to deploy his infantry in lines four men deep alternating pikemen with musketeers. This was the birth of linear tactics that remained unchanged in its essentials until almost the 20th century. Linear tactics provided the infantry with yet more mobility without sacrificing firepower or defense, thereby opening the way for more sophisticated battlefield maneuvers and tactical deployments. No longer the primary striking force, the pikeman had the task of protecting the musketeers from cavalry attack. As muskets became more reliable, powerful, and accurate, thinner and thinner infantry formations could be used without sacrificing killing power until, finally, the pikeman disappeared from the field altogether.

The legacy of the pikeman remained in the form of the bayonet, still standard issue in modern armies. The first bayonets were plug bayonets inserted into the muzzle of the rifle. This, of course, made the firearm inoperable, and the musketeer still had to rely heavily upon the pikeman for protection. By the end of the 17th century the ring bayonet was introduced. This allowed the rifle to fire while the bayonet was in place, but the attachment arrangement was clumsy and unreliable. Shortly after the ring bayonet, the standard barrel bayonet attached to a permanent stud welded to the rifle barrel

made its appearance and, within a decade, became standard issue in all European armies. The musketeer had now become his own pikeman. Musket infantry was now expected to protect itself from cavalry attack and, when closing with the enemy, to fight hand-to-hand with the bayonet. By combining the functions of the musketeer with the pikeman, all infantry could now be armed with firearms. The result was that the killing power of infantry increased greatly. In 1746 the fluted bayonet made its appearance at the Battle of Culloden and has remained one of the basic close combat tools of the infantryman ever since.

Still other advances increased the power of infantry. In the mid-1700s the Prussians introduced the standard size iron ramrod replacing the nonstandard wooden model. The result, when coupled with good training of the soldier, was to double the rate of musket fire. At the same time, infantry began to diversify its weapons capability as the primitive hand grenade made its appearance. The first hand grenades were little more than hollow iron balls packed with black powder and ignited by a burning wick. Within a decade, however, the infantry grenadier had become a standard feature of European infantry formations.

The most significant advances in firepower and range came in the area of artillery. At the beginning of the Thirty Years War, artillery was still handcast by individual craftsmen. The weight of these individualized artillery pieces was often too great to make them mobile enough for effective use against enemy formations, although they served well enough in sieges. Gustavus Adolphus standardized the size of cannon and shot, and produced the first lightweight artillery guns. He also standardized infantry rifle barrels and musket shot. This system of millimeter caliber measurement was adopted almost universally, and is still used today in most modern armies. Adolphus standardized artillery firing procedures as well so that his artillery gunners could fire eight rounds from a single gun in the time it took a musketeer with a firelock to fire a single round.

Over the next century the French introduced a number of innovations in artillery including mounting the gun on wheeled

carriages and the trunion to improve aiming. Until this time most artillery was drawn by horses while the artillery crews walked. This arrangement slowed considerably the mobility of the artillery on the battlefield, and it was common practice never to move the guns once they had been deployed. Frederick the Great of Prussia introduced the idea of mounting the guns and crews on horseback and wagons, the invention of horse artillery. This innovation greatly increased the mobility of field artillery so that commanders could routinely move the guns around and change deployments for maximum effect. At the same time, of course, guns were becoming lighter and the aiming mechanisms more accurate. The result was the introduction of a truly deadly combat arm that would, over time, be responsible for more casualties than any other weapon.

The range of smoothbore cannon gradually increased over the years until, by the Napoleonic era, cannon could fire about 300 yards, or about the range of the Roman *ballistae*. Up until the Crimean War (1854), 70 percent of all cannon shot fired was solid ball shot. But as early as the 1740s artillery gunners had various types of artillery rounds at their disposal. Heavy rounds that exploded on contact were used primarily by howitzers while artillery guns, those with a flatter trajectory, commonly used canister, chain, and grapeshot against cavalry and infantry formations. Later, these rounds were coupled with exploding charges ignited by timed wicks that made it possible to burst artillery rounds over the heads of the enemy, greatly increasing lethality and casualties. In the Civil War rifled cannon came into its own with a corresponding increase in range and accuracy. Still later, advances in breech loading, gas canister sealing, and recoil mechanisms greatly increased rates of fire.

The Dawn of Modern War.

The period between the 15th and the 17th centuries witnessed the emergence and consolidation of the nation-state as the primary form of sociopolitical organization and as the most dynamic actor in international affairs. With the collapse of feudalism the new dynastic social orders of the West had to develop new forms of social, economic, and military

organization, all of which eventually influenced the course of weapons development and the conduct of war. At the beginning of the period the most common form of domestic political organization of the nation-state was the monarchy. By the 17th century the monarchs had gradually subdued or destroyed all competing centers of political power and parochial loyalty within their national borders, and the Age of Absolutism began, a period where national monarchs wielded absolute power over their politico-social orders. One consequence was almost 100 years of war declared at will by various monarchs upon one another, often over trivial and personal concerns.

Over the next century, however, the power of the national monarchs was gradually circumscribed by other sectors of society, some of them arising as a consequence of the changing economic structure. Expanding domestic and international economies brought into existence new classes of domestic political claimants who demanded a share in the power of the political establishment. By the 19th century this process of empowerment of new societal segments culminated in the rise of representative legislatures which gave these new classes at least limited participation in public policy. Not surprisingly, the increased influence of these new domestic political actors was in some proportion to the degree that they were valuable to the monarch in continuing his conduct of war and foreign policy.

As the social and economic structures of the nation-states became more complex they gave rise to merchant and financial classes that gradually began to challenge the monarchical order, usually based upon the support of the landed aristocracy as the primary source of wealth and power, and to demand a greater share in the political process. The emergence of new financial instruments (hard currencies, banking systems, letters of credit, international trade, cross-national financing and manufacturing) to cope with a developing international economy forced the national monarchs into an every greater degree of dependence upon the new classes to raise armies and fight wars. By the 18th century, few national monarchs

could afford to maintain armies or fight wars without the help of the merchant and financial classes.

Economic concerns began to drive military ambitions at least equally with political and military concerns. The internationalization of economic affairs made it impossible for any one state to secure solely by itself the resources for war. The result was that it was no longer possible for any single state to gain military dominance over all other states or even a coalition of states for very long. The military adventures of any one state could only hope to achieve marginal gains at the expense of others. Under these circumstances, the international order became characterized by a constantly shifting (and thus unstable) balance of power among many national entities.

The economic costs of weapons and warfare increased enormously, and wars of this period often produced near or actual financial collapse for the participants. Professional armies and weapons were extremely expensive to produce and maintain relative to the resource base needed to sustain a large military force, and a number of major states were forced into bankruptcy. Moreover, the destruction and economic dislocation measured by the loss or transfer of manpower from agriculture and industry, the high costs of borrowing on domestic and international financial markets, and the disruption of domestic and international trade, all served to make even a successful war a near financial disaster. These circumstances gradually forced the monarchs to share power with the new merchant classes who controlled the financial sinews of war.

By the early 1800s the transition from the old feudal orders to the modern national era was complete insofar as weaponry, tactics, and military organization were concerned. The old monarchical political order hung on for yet another century, but more in form than in substance. Militarily, the pike had all but disappeared from the battlefield, and the new musket infantry had come of age fighting in disciplined linear combat formations. Mobile artillery had also come into its own and had become a major killing combat arm that could be used in coordination with cavalry and infantry. Most importantly,

standing armies in a genuine modern sense had come into being, with organization, logistics trains, and hierarchical structures comparable to those found in modern-day armies.

Napoleon introduced a new element into this equation and, in doing so, revolutionized the conduct of war. Until Napoleon, armies were essentially professional forces whose manpower was drawn from the least socially and economically useful elements of the population. Most common soldiers were drawn from the ranks of the urban poor who had no skills, or the excess rural population that had no land. Even the officer corps was drawn from the second and third sons of the nobility, the first son remaining behind to manage the family's estates or business interests. Loyalty of these forces was based largely upon regular pay and draconian discipline. Napoleon's revolution was to introduce the mass citizen army based on conscription, and to develop an officer corps selected for its talent (and ideological loyalty) rather than its social origins. While a number of industrial and agricultural innovations made it possible to extract ever larger numbers of manpower from the economic base without serious disruption, the size of Napoleonic armies was impossible to maintain unless the entire social and economic resources of the state were also mobilized for war. The age of modern war was beginning to dawn.

The old idea of loyalty to the king and regular pay were replaced in the Napoleonic armies with loyalty based upon national patriotism fired by the idea of social revolution. This made it possible for Napoleon to raise mass armies that came to characterize the national armies of the next two centuries. The idea of a "nation in arms" based on national patriotic fervor and sacrifice to ideals meant that all segments of the population were expected to contribute to the war effort. National economies were now marshaled to support war and, in a sense, private control of the resources of war passed under the control of the state. The economic structures of the state were required to produce the sinews of war on command, its weapons and manpower, even to the detriment of other aspects of economic and social activity if necessary. The most

significant contribution of the Napoleonic era, then, was the production of a new national model for war.

Historians often call the American Civil War (1860-65) the first truly modern war, for it was the first conflict to take maximum advantage of the new efficiencies of production brought into being by the Industrial Revolution. For the first time a war involved the entire populations of each combatant. Large conscript armies, larger than the world had ever seen, required a large industrial and agricultural base to feed, clothe, and supply them for combat. The Industrial Revolution, most particularly the factory system and machine mass production, along with technological innovations in metallurgy, chemistry, and machine tools, provided for an explosion in military technology. New means of economic organization and impressive increases in productivity made it possible to free large numbers of men for military service without bringing with it serious economic dislocation in the national wartime economy. The newly developed railroad system allowed the transport of men and supplies to support military operations on an unprecedented scale. The result was a war in which the civilian population that manned the productive base of the war machine became at least as important as the war machine itself. It was, as well, the first time that the production base and the civilian industrial manpower pool became legitimate and necessary military targets.

The Crimean War (1853-56) witnessed the first use of rifled and breech-loading cannon by the British army. Both of these improvements had been used as early as the 16th century, but only as prototypes. Technical problems in barrel casting and breech sealing had prevented their development on a wide basis. By the end of the Civil War no fewer than half the Union artillery was comprised of rifled and breech-loading guns. Rifled cannon had longer ranges, more penetrating power, and greater accuracy than the old smoothbore, and had a much greater rate of fire. Improved black powder also added to the shell's velocity and range. Near the end of the war the first primitive recoil mechanisms further increased the rate of fire and accuracy of the rifled field artillery cannon.

The musket, of course, had acquired rifling long before the Crimean War. The most important innovation to Civil War musketry came with the introduction of the conoidal bullet. Shaped like a small egg, it had a hollow "basket" behind the penetrating head. Cast in one piece soft lead, the new bullet expanded the "basket" as the hot combustion gases filled the rear of the bullet upon firing. The soft lead expanded outward to force the raised spirals on the bullet into the rifled grooves in the barrel. The result was greater sealing of the propulsive gases in the barrel and a tighter grasp of the rifling by the bullet. Both range and accuracy increased greatly. During the Civil War a rifled musket could easily kill at 1,000 yards and was deadly accurate at 600 yards.

Near the end of the war the Spencer repeating carbine appeared. This rifle was a .56 caliber repeating firearm with a seven shot capacity. In the hands of a competent rifleman, this weapon could expend all seven rounds in the time it took a musket rifleman to load and fire a single round. Advances were also made in handguns, long the mainstay of the cavalry, that could fire six shots of .44 caliber ball before requiring reloading. Infantry firepower continued to increase with the introduction of the first primitive machine gun, the Gattling Gun. This mechanized contraption was a multibarreled gun which rotated each barrel in succession into firing positions by means of a cast gear as the firing handle was turned. The Gattling Gun was capable of a sustained rate of fire of 100 rounds a minute, almost equal to the rate of fire from 40 infantrymen. By 1900, Hiram Maxim, an American, invented a truly modern machine gun capable of a sustained rate of fire of 600 rounds a minute.

A number of other technologies of the Industrial Revolution were turned to military use during this time. Probably most important for its impact on military operations was the railroad. Industrial nations lived by rail transport, and modern armies soon discovered that it was possible to move very large quantities of men and material over great distances very rapidly by using the rails. Mobility of deployment increased dramatically, as did the means of sustaining large forces in the field over vast distances by supplying them by rail. It is important to remember that until the introduction of the railway

to war, no army could move any faster than foot or horse could carry them. A limitation on tactical mobility that was six millennia old disappeared in less than half a decade.

Tinned food, although first used in small amounts by Napoleon, now became common and contributed to logistical capability, as did the first use of condensed food. The telegraph made it possible for the first time for corps and army level commanders to exercise relative tactical control over their subordinate units. When the telegraph was used in conjunction with the railway, it became possible for units to achieve both tactical and strategic surprise at force levels never witnessed before. The iron-clad steam powered ship signalled the end of the era of wood and sail, and the regular use of the balloon for military purposes presaged the use to which the early airplane would be put in the next century.

Behind these military applications lay a multitude of innovations brought into being by the Industrial Revolution. Among the most important of these were the factory system, mass production, and the use of machines to make any number of military weapons and products from canteens to boots to jackets. The factory system represented an entirely new form of socioeconomic organization for work in that it made possible the gathering into one large workplace larger numbers of workers directed at a specific task than had ever been possible before. Mass production, especially Eli Whitney's concept of interchangeability of parts, made possible levels of weapons production never before imagined. Making things by machines meant that rates of production rose to unprecedented levels as energy and mechanical power was applied to the work task. Implements of all types could be manufactured at a faster unit production rate, and since machines do not require rest, productive schedules could be extended around the clock.

The lesson that European powers learned from watching the Civil War from afar was that military might now required a sufficient industrial base and supply of manpower that had, except for the brief period under Napoleon, never before been placed under arms. Unfortunately, none of the European military establishments seem to have appreciated the fact that the Industrial Revolution had brought into being a qualitative

change in the nature of combat killing power. As European armies adopted each new weapon, they foolishly retained the traditional and familiar unit formations and battlefield tactics, both of which had already been made fatally obsolete by the range and firepower of the new infantry and artillery weapons. Thus, when the British finally adopted the machine gun to their infantry formations, they assigned only one gun per battalion, relying upon the traditional rifleman to provide the firepower for the defense. Not a single European power recognized that the qualitative change in killing power had made offensive operations a deadly practice. The battlefield advantage had swung almost entirely to the defense.

The lessons regarding manpower and industrial production, however, were not lost on the European general staffs, and the armies of Europe began to expand to record size. These armies created even larger reserve forces that could be mobilized on short notice and moved along military rail nets to augment the standing forces in one large-scale, and almost irreversible, deployment maneuver. The railway officer who could plan and implement deployment schedules became the most valuable officer on the newly created professionalized general staffs. In Germany, almost the entire civilian railway service was staffed by retired professional sergeants still under military obligation as reserve forces. As the Industrial Revolution developed one innovation after another, more and more military applications were found. The result was that the armies of the early 20th century had at their disposal a killing and destructive capacity greater than anything the world had ever seen. The fatal flaw was that they did not know it.

In the half-century between the end of the Civil War and the start of World War I there were no fewer than six military conflicts involving one or more of the major powers as combatants. Almost a score of smaller colonial wars were fought in the same period. These conflicts provided the impetus to apply the inventions and technologies of the Industrial Revolution to new weapons. These frequent, if short, wars provided laboratories to test the new implements of destruction.

Among the more important developments of this period was the total replacement of muzzle-loading smoothbore cannon with rifled breach loaders. By 1890, every major military force in the West was equipped with this type of cannon. Time fuses were developed in France around 1877, and served to make overhead burst artillery more lethal than ever. The first smokeless powder, more stable and potent than black powder, was developed in 1884, and in 1891, the British synthesized a new shell explosive, cordite, that became the standard artillery explosive by 1914. In 1888, modern long-recoil hydraulic cylinders were introduced to stabilize artillery pieces, an improvement that almost tripled the rate of fire and accuracy of field artillery guns. The rifled breech loading artillery gun now operated with "fixed ammunition," brass and steel shells in which powder, fuse, and projectile were one piece. The introduction of shrapnel shells added even more to the destructive power of artillery. In 1896, wire-wound heavy guns were constructed, making gun barrels much stronger and less brittle than cast barrels. A short time later, frettage, a method of manufacture in which hot steel tubes were shrunk one into another to make gun barrels, allowed the introduction of more durable and much higher caliber guns. Improved breeches and gas sealing systems completed the development of artillery in this period. In 1897, the French 75mm field gun was introduced and incorporated all of the improvements mentioned above. The maximum rate of fire of this gun was 25 rounds per minute. In the 1880s, massive siege cannon, often mounted on railway cars, began to make their appearance as the antidote for hugh concrete and steel fixed fortifications. The Krupp siege cannon, "Big Bertha," could raise an 1800 pound shell 3 miles into the air and hit a target at very high velocity 10 thousand yards away.

In 1870, the French had deployed the *mitrailleuse*, a highly reliable, if somewhat cumbersome, 25 barrel machine gun capable of firing 125 rounds a minute while accurate at two thousand yards. By 1900 Hiram Maxim had invented a truly modern and portable machine gun with a rate of fire of 600 rounds a minute. At this rate of fire a single machine gun could produce as much fire as 100 riflemen. In 1870, the Prussian Dreyse "needlegun" introduced the modern firing pin system

for the rifle, once again increasing rates of fire. The introduction of the magazine (Lee-Enfield) and clip-fed (Mauser, Springfield) bolt-action rifles by the time of the Boer War increased the firepower and mobility of the infantry yet again.

The Russo-Turkish War of 1877-78 was the first war in which the infantry was uniformly equipped with modern repeating rifles and the artillery with breech-loading rifled cannon. By the outbreak of the Russo-Japanese War (1904-05) the use of indirect heavy artillery fire was standard military practice. The invention of improved panoramic sights, goniometers for measuring angles, the use of the balloon for directing fire, and the field telephone allowed forward artillery observers to direct artillery fire on targets the gunners could not see. Advances in fire control made it possible for the first time to mass the fire of an entire artillery corps upon a single target.

Naval and Air Weaponry.

Between the 15th and 18th centuries the development of naval weapons was hardly perceptible. Ships remained platforms for carrying infantry and, later, as basic gun platforms. Sail and wood construction limited the role of the ship and greatly reduced the number and caliber of guns that could be placed upon them. In the 1800s a new form of propulsion, the steam engine, began to change the role of the ship. The first steam-powered naval ships were produced in the 1820s, but the need for side paddlewheels and huge engines still limited the ship's role as a gun platform. By 1850, the first screw propeller made the side-wheeler obsolete, and freed deckspace necessary to carry more guns. The modern artillery shell, however, had already made the wooden-hulled vessel obsolete and, in 1855, the French introduced iron plating along the wooden hull for increased protection. Even so, the need for heavy modern guns and large steam engines placed too much strain on wooden-hulled ships and, in 1860, the British launched H.M.S. *Warrior*, the world's first iron hulled warship.

The armored turret was first used on ships in 1868, and gradually the advances in artillery weapons–quick firing, fixed ammunition, breech-loading, rifled guns–were seriously applied to naval guns. Ships began to mount multiple turrets, first with one gun per turret and, finally, by 1900, a standard four guns per turret. The caliber of guns grew from 12-inch guns (1908) to 15-inch guns as standard by 1914. The last decade of the 19th century saw the introduction of steel construction for naval vessels. By 1913, naval vessels were powered by oil instead of coal boilers, greatly increasing propulsive power while reducing space. All of these advances culminated in the production of the dreadnought-class warship, the first modern battleship. In less than 100 years, naval ships of the line had gone from the first simple iron-clads to modern battleships. H.M.S. *Dreadnought* was launched in 1906 and displaced 17,900 tons, was 527 feet long, and 82 feet at the beam. She carried ten 12-inch guns, twenty-seven 12 pounders, and five 18-inch torpedo tubes. Powered by 23,000 horsepower engines, she could make 21 knots. In less than a decade she had become obsolete.

The invention and improvements in mines and, later, the guided torpedo, made even the largest warships vulnerable. The controlled mine was developed by the United States in 1843, and was detonated by electric current from wires leading to shore. Chemically triggered contact mines were in use as early as 1862. By World War I, the mine had become a potent defensive weapon capable of sinking the largest ships. The torpedo–called the "locomotive torpedo" because it proceeded under its own power and did not have to be towed like earlier models–made its appearance in 1866. The first models, developed by the Austrians, had a range of 370 yards at 6 knots, and packed an 18-pound explosive warhead. By 1877, the contra-rotating propeller was fitted to a torpedo, an innovation that kept the torpedo steady on course. Soon the torpedo was fitted with a horizontal rudder to keep it at constant depth as it ran to its target. By 1895, the invention of the gyroscope improved the torpedo's accuracy, and by the turn of the century a torpedo could carry a 300-pound warhead to 1000-yard range at 30 knots. This weapon called into existence

a new class of cheap, fast, and destructive naval vessels, the torpedo boat.

The most revolutionary naval advance of this period was the submarine. By 1900, the gyroscope, the gyrocompass, and the use of steel hulls, a safe method of propulsion in the internal combustion engine and the accumulator battery, combined to make the submarine possible. The development of the reliable torpedo provided the submarine with an excellent weapon of attack. In 1900, the six major navies of the world had only 10 submarines among them.

In 1905, an American submarine, the USS *Holland*, became the prototype for other navies with submarine forces. Displacing 105 tons, the *Holland* had three separate water-tight compartments housing her engine, control, and torpedo rooms. Her second lower deck housed the tanks and battery engines. The *Holland* could make almost 9 knots while submerged. A few years later the British introduced the conning tower and periscope, while the Germans in 1906 contributed the development of double-hulls and twin screws for propulsion and stability. By 1914, the six major naval powers of the world put 249 submarines to sea.

In 1903, Orville Wright made the first sustained powered flight, twelve seconds, in a heavier-than-air flying machine powered by the new internal combustion engine. In just 2 years the Wright Flyer had improved to the point where it could stay airborne for 40 minutes at a speed of 45 miles per hour. In 1907 the pusher biplane was flown and, by 1908, the Wright airplane was staying in the air for 2.5 hours. The invention of ailerons to control the aircraft around its roll axis greatly increased the maneuverability of the machine. For the most part, however, military men saw the airplane as performing the limited functions of the old balloon, observation and reconnaissance.

In 1910, the American Eugene Eli took off in an airplane from a platform erected on the deck of a naval cruiser and, a year later, it was proven possible to land the aircraft back on the flight deck. In 1911 another American, Glen Curtis, became the first man to carry out a practice bombing run against a naval ship touching off a fierce debate about the vulnerability of ships

to air attack. In the same year two-way radio communication from an airplane to the ground was accomplished, an invention that made possible aerial artillery observation and fire direction. Also in 1911, Glen Curtis manufactured the first seaplane and foresaw its use as a weapon against the submarine. In that same year the U.S. Army dropped the first live bombs from an airplane, and the first machine gun was mounted on an aircraft, the French Nieuport fighter. A year later monocoque construction was introduced, a method of arranging stress points in aircraft construction that made possible greater loads on aircraft structures. In that same year airplane flying speed increased to over 100 miles per hour. In April 1912, the establishment of the Royal Flying Corps in England gave birth to the first official air force.

In 1913, speed (127 mph), distance (635 miles), and altitude (20,079 feet) records were set as the airplane began to improve its capability as a weapon of war. The Russians introduced the world's first heavy bomber, the *Sikorsky Bolshoi*, with a wingspan of over 90 feet. During the Turko-Italian War (1911-12) in Libya the world witnessed the first military use of the airplane in war. The Italians first employed the airplane for artillery observation, and were the first to introduce aerial photography. Italian pilots were the first to drop bombs against an enemy force in combat. The age of the modern strike and bomber airplane as major implements of modern war was underway.

World War I.

The social, political, and economic context in which armies were raised and wars were fought had changed considerably in the 75 years since the Civil War. The political structures of the national states of Europe were under attack from new ideologies of the left and center that greatly weakened the power of the executive while increasing the influence of the legislatures. Traditional ruling elites now had to share power or were replaced by elected leaders. The monarchies, while retained in form, lost most of their substantive power. The need for political leaders to sustain their electoral bases required that conflicts be cast in highly moral and ideological terms. Wars

now became moral crusades, a fact which made them easier to start and more difficult to resolve short of total victory.

The search for economic self-sufficiency led each major power to engage in the quest for colonial empire that could provide stable sources of raw materials and secure markets for manufactured goods. Inevitably, conflicts in peripheral colonial areas brought the major powers into collision on the rim of Europe until, in 1914, these conflicts engulfed the heartland of Europe itself. The rapid development of military technology led to a continuous arms race. This state of affairs, in turn, provoked a spate of alliances and counter-alliances among the major powers and the fragmented smaller states of eastern Europe. The stage was set to draw the larger states into direct conflict whenever the smaller states collided with one another.

The size of the standing armies of the day grew in response to the need to take advantage of the new military technologies. The destructiveness of modern weapons required that large numbers of fighting men be readily available. Propelled by the strategic doctrine of the day that held that the side that mobilized quickest would have the advantage of striking a lethal blow, nations established large reserve forces that could be mobilized and deployed within days. Once mobilization plans were set in motion, however, they could not be easily stopped without conceding a significant military advantage to one's opponent. Once war broke out, the entire economy and productive capacity of the nation was to be marshaled for war. If Napoleon had created the new reality of a nation in arms, it was World War I that gave birth to the idea of a nation at war.

On the eve of World War I, Europe was a tinderbox waiting to explode. National economies were prepositioned for war, large standing armies faced one another across unclear and disputed territorial boundaries, civilian populations were capable of being put into uniform within days of mobilization, the major powers were caught in a series of entangling alliances with small unstable states whose local conflicts could quickly escalate into war, an arms race fed a growing fear, and the strategic doctrine of the day required one to strike first. Superimposed upon it all was a political process which

produced unstable political leadership that had to sustain itself by appearing strong and uncompromising on national security issues which, in turn, were driven by ideological and moral perspectives that made compromise almost impossible. When a stray shot was fired in the narrow streets of Sarajevo, it produced a genuine world war. And the lights went out all over Europe.

World War I became known as the "machine gun war," and it is estimated that fully 80 percent of all British ground casualties were caused by the machine gun. In a war of fixed positions, artillery guns grew larger, firing ever larger shells in concentrated barrages for days at a time. The siege mortar reached almost 42 inches in diameter, and railway guns fired 210 millimeter rounds 82 miles. Trench mortars reached 170 millimeter caliber, and could fire poison gas shells, mustard and chlorine, as well. Poison gas released from canisters made its appearance in 1915, and the age of chemical warfare was born. The gas mask became standard military equipment, and the pack howitzer for use by mountain infantry made its battlefield debut, as did the first antiaircraft guns.

A truly revolutionary development was the first operational battle tank. The early tanks were very unreliable as temperatures in the crew compartments often exceeded 100 degrees from the heat of the engine. By 1917, however, a much improved tank, the Mark IV, was introduced at the Battle of Cambrai, and history's first massed tank attack, involving over 476 tanks, took place. In the spring of 1918 the French introduced the lighter and faster Renault FT, the first tank to use a revolving turret. By the end of the war over 6,000 battle tanks had been build and deployed by Allied armies. The age of armor had begun.

The war at sea remained deadlocked. The British countered the German submarine threat by inventing the ship convoy. Of the 16,070 ships that sailed in British convoys, only 96 were lost to submarine attack. In 1915 the first use of the hydrophone made it possible to detect submarines by sound. A year later the first submarine was destroyed by yet another deadly invention, the depth-charge. By that time naval forces routinely used the seaplane, and in 1917 HMS *Furious* added

the world's first operational flight deck to her forward superstructure. In the same year HMS *Argus* became the first naval vessel to be built with both a take-off and landing deck. With the incorporation of the American deck catapult and arresting gear, the prototype of the modern aircraft carrier was born.

The war quickened the development of the first aircraft designed for military use. The interrrupter gear made possible the mounting of machine guns on aircraft by allowing the guns to fire through a turning propeller. Improvements in design, materials, and structure of aircraft manufacture made it possible for aircraft to fly at 140 miles an hour at altitudes of 22,000 feet. The first bombers capable of 2,000 pound bomb loads appeared. The devastating capability of the strike aircraft was only a decade away.

World War II.

Europe emerged from World War I almost bankrupt. While research and development into new weapons continued during the inter-war period, it did so on a much smaller scale than before the war. Overall expenditures on military equipment and manpower declined as the nations of Europe tried to find the money to repair their devastated domestic infrastructures. The political and social institutions of the European powers were badly shaken by the lingering effects of the war. The war had produced revolution in Russia leading to the establishment of a Soviet state. In Italy, Benito Mussolini deposed the Italian monarchy and produced the first Fascist state. Germany's monarchy was replaced with a weak republican government that proved unable to deal with the increasing social instability, succumbing in the end to Nazism. France's republican institutions were attacked from within by both left and right so sapping the political will of the citizenry that, in the spring of 1940, the French surrendered to the German army without hardly firing a shot. In England the hold of the traditional ruling classes was weakened considerably by an assault mounted from the left. Only America, whose losses in the war had been very light, seemed immune from the destabilizing aftershocks of the Great War.

Most of the European powers could no longer sustain large military establishments. In 1918, German military forces were reduced by the dictate of the victorious powers, and spent almost nothing on military development until 1932. England reduced her air and ground forces significantly. By 1939 her navy was a shell of its former self. France reduced her expenditures as well, choosing to concentrate on ground forces, leaving her naval, air, and armor forces too small to counter the German threat. The United States rescinded military conscription and reduced military expenditures across the board. American ground forces shrunk to under 200,000 men, armor was nonexistent, and the air force could deploy only a handful of obsolete machines. Soviet attempts at military growth were crippled by famine, political terror, and civil war. By the early 1930s, however, the new Red Army had the largest artillery and tank forces in the world. But as a result of Stalin's purges, these formations were broken up and the officer corps killed or imprisoned. When the Soviets finally came to blows with tiny Finland, they were barely able to achieve a victory.

Only in Japan and, to a lesser extent, in Italy did military expenditures and weapons development increase significantly. After 1932, Germany embarked upon a major rearmament program under the Nazis. In Japan the need to build an industrial base sufficient to maintain a modern military establishment led to the creation of a military society whose every effort went toward increasing the military prowess of the state. The Japanese reliance on overseas sources for critical raw materials forced it to engage in wars of conquest in Asia to gain control of oil fields, steel deposits, and other raw materials needed as sinews of war. Mussolini's attempt to make Italy a great power foundered on the insufficient resource base of Italy. Italy never obtained sufficient coal, steel, and oil supplies required by a first-rate military machine. By 1939 when Italian military prestige was at its highest and Italian airplanes, ships, and small arms were among the best quality in the world, the fact remained that Italy's industrial base was never adequate to sustain a large modern military machine for very long.

Yet, it would be incorrect to assume that the development of weaponry came to a halt during the inter-war years. The tank, for example, continued to improve markedly with the appearance of the low profile hull, the revolving turret, better gunsights, and improved tracks and suspension. By the 1930s the Russians had developed the famed T-34, the best tank of its day. Tank cannon grew larger to 90 millimeter guns, and new propellants and shot, the sabot round, made these cannon even more deadly. The tank called into existence the first antitank guns. The German *Gerlich* gun, for example, fired a 28 millimeter round of tungsten carbide at 4,000 feet per second, and was capable of penetrating any known tank armor. A later German invention, the "eighty-eight," was originally developed as an antitank weapon but doubled as both an antiaircraft and direct fire gun. It is generally adjudged the best weapon of its kind in World War II.

Developments in aircraft design–the stressed metal skin and the monoplane–made the introduction of fighter aircraft possible. Engines over 1,000 horsepower made speeds of over 350 miles per hour commonplace. The long-range bomber capable of flying at altitudes over 40,000 feet at ranges of 5,000 miles was developed. At sea the light and fast destroyer was built to protect the larger battleships. More sophisticated submarines could remain at sea for 60 days at a time. A new torpedo, the Type 33 Lance, driven by oxygen and leaving no track appeared with a range of 25 miles at 36 knots. Torpedoes now typically carried warheads of 400 pounds of high explosives. The aircraft carrier came into its own. The Japanese carrier, *Kaga*, carried 60 aircraft and displaced 39,000 tons. The American carrier, *Lexington*, displaced 36,000 tons and carried 90 aircraft. The integration of naval and air forces within a single combined combat arm was almost complete.

The destructive power of the combat arms–infantry, armor, and artillery–greatly increased in World War II. Infantry, armed in large numbers with the new all metal submachine gun, delivered firepower at rates five times greater than the infantryman of World War I. Infantry carried its own antitank weapons in the form of the American 3.5 inch Bazooka (named

because of the sound it made when fired) rocket launcher or the German *Panzerfaust*. Dependable motorized transport, the Jeep, the "deuce and a half" truck, and the armored personnel carrier–fully tracked, half-tracked, or pneumatic tire vehicles–increased infantry mobility twentyfold and enabled it to keep pace with the rapid armor advance.

The tank saw a remarkable increase in its combat capability and, for the first time in almost 700 years, cavalry again played an important role on the battlefield. The Russian T-34, originally produced in 1935, was possibly the best battle tank of the war. Mounting an 85 millimeter gun with a new muzzle-brake to reduce recoil, the T-34 made 32 miles an hour with a range of 180 miles. It introduced the sloped armored glacis in front to deflect antitank rounds, and had a ground pressure of 10 pounds per square inch which, on its American-designed Christie suspension, allowed it to traverse terrain that most Allied or Axis tanks could not. The American Sherman tank introduced cast armor to replace the old welded armor, the volute-spring bogie suspension, and rubber block treads that increased track life by 500 percent. The Sherman used a revolutionary hydroelectric gun stabilizing system and improved triangle sights. Tank engines grew more powerful and more reliable, and the tank quickly became the centerpiece of the striking forces for all armies except the Japanese.

Artillery's developments came in response to the need to defend itself against armor and air attack. The result was the self-propelled artillery gun. These guns, often reaching 8-inch or 122 millimeter caliber, were mobile artillery mounted on tank chassis. Self-propelled artillery came in two forms: the assault gun and the light assault gun. The arrival of the ground attack fighter required improvements in antiaircraft guns. The Bofors 40 millimeter cannon was capable of firing two rounds per second over a slant range of 4 miles. The American M-2, 90 millimeter gun fired 25 rounds per minute to a height of 9 miles. The introduction of reliable electronic fire control systems with radar detectors and trackers linked to primitive computers provided great advances in the lethality of antiaircraft guns.

Unguided rocket artillery, first used by the Chinese one thousand years earlier, reappeared in the form of the German

15 centimeter *Nebelwerfer* that could fire six 70-pound rockets in less than 3 seconds. The Soviet *Katusha*, first at 90 millimeter and then 122 millimeter, fired over 40 rockets at once. The American entry, the Calliope, fired 60 rockets at a time. Used as area saturation weapons, these rockets caused large numbers of psychiatric as well as physical casualties. The variable timed fuse introduced by the Americans increased the lethality of artillery fire by a significant degree. Each shell contained a tiny radio transceiver within it that could be set so that the round exploded at a precise distance above the ground. This innovation increased the killing power of artillery by 10 times over shells fitted with conventional fuses.

The war at sea saw the demise of the battleship as it became increasingly vulnerable to air and undersea attack. The aircraft carrier became the major naval weapon. Carriers like the *Essex* and *Midway* class carried over 100 strike aircraft, were 820 feet long with beams of 147 feet, and could move at 32 knots. Carrier-based aircraft were remarkable machines. These aircraft carried 2,000 pounds of bombs, flew at 350 miles per hour, attacked with rockets, torpedoes, and machine guns, and ranged over 300 miles. Although submarines operated with new electrical motors to make them increasingly difficult to detect, antisubmarine technology improved markedly. Radar and radio sets allowed antisubmarine aircraft to detect submarines at night. New depth charges provided surface vessels with new means of submarine destruction. By 1944, the submarine was no longer a significant threat to surface combatants.

The air war saw the emergence of greatly improved strike aircraft. The British *Spitfire* and other aircraft on both sides could range outward for hundreds of miles at speeds over 400 miles per hour. Ground support tactics developed rapidly as strike aircraft made heavy firepower at close ranges available to advancing infantry and armor. The heavy strategic bomber was capable of bomb loads of 20,000 pounds. The B-29 *Superfortress* carried 20,000 pounds of bombs 3,250 miles at an altitude of 31,850 feet. By war's end the Germans (ME-262), the British (Vampire), and the Americans (P-59 Aircomet) had all produced prototypes of jet powered aircraft. In August 1945

the United States unveiled the most awesome weapon of war yet invented by man, the atomic bomb, and devastated the civilian population centers of Hiroshima and Nagasaki. Warfare had undergone yet another revolutionary change.

Post-World War II.

The debut of nuclear weapons makes it necessary in modern times to clearly distinguish between nuclear and conventional weapons. Only 8 years after Hiroshima, nuclear artillery shells were invented, and 3 years later these shells were small enough to be fired from a 155 millimeter howitzer. By 1970, U.S. and Soviet navies had deployed nuclear torpedoes capable of sinking the largest aircraft carriers with a single shot. Nuclear bombs that in the 1950s, weighed many tons became smaller so that they could be placed under the wings of fighter aircraft. In the 1950s, nuclear reactors were used for the first time to power a strike carrier. Within 10 years nuclear powered missile frigates and cruisers appeared. Nuclear missiles mounted on nuclear powered submarines capable of staying submerged for months were developed and deployed by the 1960s. These missiles grew in range until it was possible to place several Multiple Independent Reentry Vehicles (MIRVs)–(warheads)–on a single missile. By 1985 the *Trident* II submarine carried 24 missiles each mounting 10 separate warheads of almost half a megaton each. Firing submerged, the *Trident's* missiles have a range of over 8,000 miles. Land-based strategic missiles are capable of destroying cities from 10,000 miles away in a single blow.

There is a sense, as Napoleon is supposed to have remarked, that quantity conveys a quality all its own. The increase in destructive capacities of conventional weapons have also been enormous, so much so that in any other age these quantitative changes in destructive power would have been regarded as qualitative revolutions in the nature of war. In the modern age, nuclear weapons provide the baseline from which weapons effects are measured. Thus, it does not seem so horrendous, for example, that whole battalions can be exterminated by a single barrage from new artillery weapons when it is possible to exterminate whole cities in the time it

takes a flash bulb to burn out. Like most things in modern life, even the destructive effects of war have become relative.

In 1980 the U.S. Army estimated that modern non-nuclear conventional war had become 400 to 700 percent more lethal and intense as it had been in World War II depending, of course, on the battle scenario. The increases in conventional killing power have been enormous, and far greater and more rapid than in any other period in man's history. The artillery firepower of a maneuver battalion, for example, has doubled since World War II while the "casualty effect" of modern artillery guns has increased 400 percent. Range has increased, on average, by 60 percent, and the "zone of destruction" of battalion artillery by 350 percent. Advances in metallurgy and the use of new chemical explosives has increased the explosive power of basic caliber artillery by many times. A single round from an 8-inch gun has the same explosive power as a World War II 250 pound bomb. Modern artillery is lighter, stronger, and more mobile than ever before. Computerized fire direction centers can range guns on target in only 15 seconds compared to 6 minutes required in World War II. The rates of fire of these guns are three times what they used to be. So durable are the new artillery guns that they can fire 500 rounds over a 4 hour period without incurring damage to the barrel. Range has increased to the point where the M-110 gun can fire a 203 millimeter shell 25 miles. The self-propelled gun has a travel range of 220 miles at a speed of 35 miles per hour. Area saturation artillery, in its infancy in World War II, has become very lethal. A single Soviet artillery battalion firing 18 BM-21 rocket launchers can place 35 tons of explosive rockets on a target 17 miles away in just 30 seconds. The American Multiple Rocket Launching System (MRLS) is a totally mobile self-contained artillery system that can place 8,000 M-77 explosive rounds on a target the size of six football fields in less than 45 seconds. Air defense guns have developed to where a single M-163 Vulcan cannon can fire 3,000 rounds of explosive 20-millimeter shot per minute with almost 100 percent accuracy within 2 miles of the gun position. Modern antiaircraft guns command 36 times the airspace around their position as they did in World War II.

Tanks have improved in speed, reliability, and firepower. Modern tanks can make 40 miles per hour over a 300 mile range, or three times that of earlier tanks. A tank equipped with modern gunsights and a cannon stabilization system has a probability of scoring a first round hit of 98 percent, 13 times greater than World War II tanks. Modern battletanks, unlike any earlier variety, can also fire while on the move. Their probability of hitting the target while moving is almost 10 times greater than the probability of a World War II tank firing from a stabilized position. New propellants and ammunition design have increased the lethality of the modern tank. During the Iraqi-U.S. war in 1991, Armor Piercing Discarding Sabot (APDS) rounds moving at 5,467 feet per second pierced 4 feet of sand in bunkered berms and still destroyed enemy tanks. Tank gunsights, lasers connected to computers, can locate a target in the dark, smoke, rain, or snow at 2,000 yards.

The armed combat helicopter has produced a revolution in tank and armor killing power available to the combat commander. These weapons can be configured to kill either troops or tanks, and are truly awesome weapons. The *Apache* gunship carries 16 *Hellfire* antitank missiles that need only minimal further direction after they are fired to home in on the target. New sights allow the helicopter to acquire its target from more than 5 miles away. The helicopter has added new mobility and stealth to the battlefield permitting a division commander to strike with troops or antitank weapons 60 miles to his front, four times the range in World War II. The infantry, too, has increased its range, mobility, and firepower with new armored personnel carriers and infantry fighting vehicles. Infantry can also bring to bear shoulder-fired antiaircraft missiles and Jeep and Hummer mounted TOW antitank missiles with devastating results.

The modern battlefield is a lethal place indeed. To place the increased intensity of the modern non-nuclear conventional battlefield in perspective, one need only remember that, in World War II, heavy combat was defined as 2-4 combat pulses a day. Modern combat divisions are configured to routinely deliver 12-14 combat pulses a day and to fight around the clock by night operations. A modern U.S. or Soviet motorized division

can deliver three times as much firepower at 10 times the rate as each could in World War II. By these and any other historical (or human) standard, even conventional weapons have in a very real sense become quite unconventional.

Conclusion.

The concentration of sheer destructive power in the hands of modern armies is, in itself, a truly significant change in the nature of warfare. However, perhaps more important than the exponential change in the *tools* of war is the *manner* in which modern wars are fought. In this regard two characteristics of modern war are so significantly different from the nature of past wars as to be regarded as substantial *qualitative* revolutions.

The first qualitative revolution in modern war is the ability of the technology of target acquistion to literally destroy any target that ventures upon the battlefield. Modern military forces are equipped with a wide range of electronic, laser, infrared, satellite, and optical devices that can turn the nighttime battlefield into day. Modern tank sights can easily locate a target in complete darkness at 3,500 yards. Even when the target cannot be seen by optical enhancing devices, its silhouette can be discerned by infrared and laser sights. Further, modern armies are now in their third generation of "smart munitions" which make it possible to virtually guarantee that if a target can be located it can be killed with alarming certainty and rapidity. One major result of these technological developments has been the disruption of the historical nexus between the size of combatants and their lethality. Now, for the first time in history, the size of an army is far less important to its ability to achieve victory than the degree of killing technology that it can bring to the battlefield. If the 1991 Gulf War proved anything, it was the demonstration of this proposition.

A second qualitative revolution in the conduct of war is the manner in which it is fought. Modern war is a war of speed, mobility, penetration, encirclement, envelopment, and, ultimately, of force annihilation. World War II was a linear war in which combat occurred along a generally well-defined front line with usually safe rear areas. World War II was also a

tactical war in which most of the fighting was accomplished by units of division strength or less. The conventional war of the future presents a far different set of circumstances.

In modern conventional war, linear tactics are replaced by "swirling tactics." The combat reach of modern armies is so long and the mobility of combat vehicles–both air and ground vehicles–so great that armies must now plan to fight three battles at once. Combat doctrines require that units be able to fight the "direct" battle–that is, to engage units directly to their front. But doctrine also requires that armies be able to simultaneously fight the "deep" battle, to reach out and strike deeply behind the enemy's lines with large combat forces to disrupt timetables, supplies, and reinforcements. Of course, one side's deep battle is the other side's "rear" battle so that armies must plan to deal with sizeable enemy forces engaged in attacking the rear. Some idea of the ferocity of these "rear" battles can be gained from the fact that the units attacking the enemy's rear are of division size or larger. Simultaneously, attack aircraft and helicopters roam hundreds of miles behind the lines wreaking havoc with their weapons.

Accordingly, the entire battlefield is highly unstable, a war not of fixed lines, but of swirling combat in which units will be expected to fight isolated from parent units. Units will be trapped, decimated, bypassed, isolated, and often expected to fight until they can no longer do so. In short, modern war is not a war of offense and defense as in World War II, but a war of meeting engagements in which all units are expected to conduct a continuous offensive.

Modern conventional war is no longer a tactical war in which most of the fighting is done by relatively small units of division size or less. Instead, modern war is an operational level war in which the scope of command and control moves back from the line divisions to the corps and theater commands. Larger units are simultaneously committed for objectives of greater scope. The operational level of war produces far more intense and destructive battles ranging over greater areas often, paradoxically, over shorter periods of time. These battles require the total integration of all combat resources within the theatre of operations to maximize the application of force.

Modern battles are fought around the clock until objectives are achieved. The fall of night, historically the respite of the combat soldier, will come no more.

Taken together, then, it is fair to say that the qualitative revolutions in the technology of target acquisition and destruction when coupled with the qualitative revolution in the manner in which wars must be fought on the modern battlefield combine to produce a style of warfare that is itself qualitatively different from almost all war that has gone before. The challenging task for the modern officer is how to master these new circumstances.

CHAPTER 6

LETHALITY AND CASUALTIES

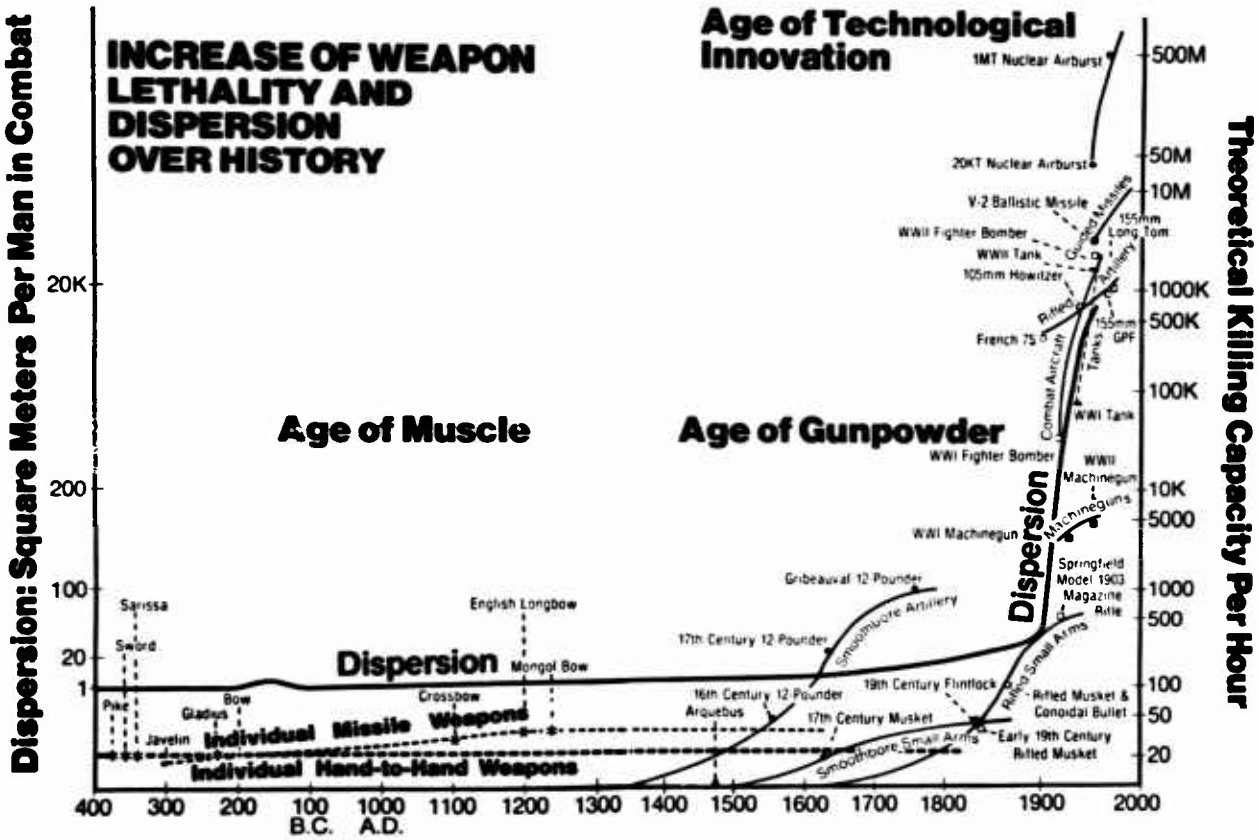
Beginning in 1860 the pace of weapons development increased enormously as the Industrial Revolution produced one technological advance upon another. Among the most important consequences of the factory system, mass production, and machine manufacture was the great reduction in time required between new ideas and the manufacture of production prototypes. New concepts were quickly reduced to drawings, then to models, then prototypes, and finally to full-scale implementation within very short periods of time. The wide-spread introduction of technical journals quickened the time it took for innovations in one discipline to have an impact in another related field. The result was a rapid increase in information transfer. The overall consequence of these circumstances was the rapid application of new weapons and other technologies of war to the battlefield at a pace never seen before in history with the corresponding result that weapons became more lethal than ever.

Lethality in war is always, however, the sum total of a number of factors that go quite beyond the inherent death-dealing capabilities of a military technology. For example, before a new weapon can reach its killing potential, military commanders have to discover new methods of fighting in order to bring the new weapon to bear in a manner that maximizes its killing potential. Once the killing power is exposed for all to see, however, one's opponent adopts passive and active means for limiting the most deadly effects of the weapon. This, in turn, requires new changes in tactics and combat formations in an attempt to preserve the killing power of the new technology. Inevitably, the result is a dynamic balance of behavior and technology that usually results in a state of affairs where the killing power of the new weapon remains somewhat higher than the weapon it replaced, but

often not greatly so. It cannot be stressed too strongly in calculating the killing power of weaponry that any failure to adapt either weapons or tactics to new circumstances can be catastrophic. Thus, the failure of the World War I armies to alter their battle tactics in light of the machine gun's enormous rates of fire resulted in horrendous casualties in the early days of the war. The similar refusal of British commanders at the Somme to change their practice of massed infantry attacks against entrenched positions resulted in 54,000 men being killed or wounded in less than 10 hours. Similarly, Saddam Hussein's insistence in the Gulf War of meeting American firepower with the same defensive tactics he had employed in the Iran-Iraq war resulted in the destruction of large numbers of soldiers in less than 100 hours of fighting.

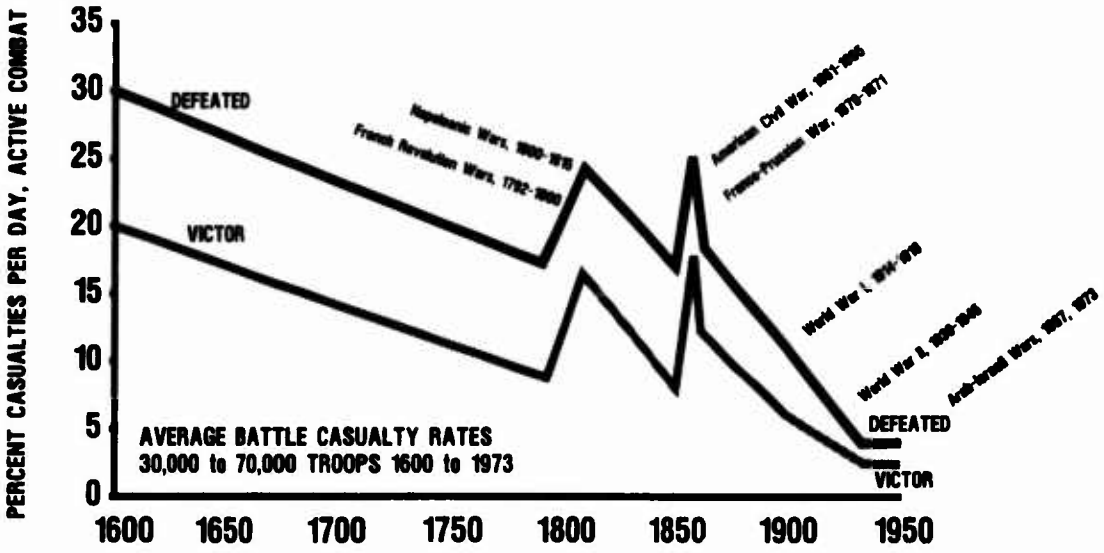
T.N. Dupuy has calculated the effects of weapons as their killing power is affected by changes in a number of objective factors such as rates of fire, number of potential targets per strike, relative incapacitating effect, effective range, muzzle velocity, reliability, battlefield mobility, radius of action, and vulnerability in order to calculate what he calls a Theoretical Lethality Index for each weapon that specifies its lethality power. But such objective factors, when calculated against the single variable of dispersion, change radically in their ability to produce casualties under actual battlefield conditions. The result is that, when measured over time, the measurable casualty effects of modern weapons paradoxically result in far less casualties when measured against the weapons of the past.

Dupuy notes that when measured against the nongunpowder weapons of antiquity and the Middle Ages, modern weapons, excluding nuclear weapons of course, have increased in lethality by a factor of 2,000. But while lethality has increased by a factor of 2,000, the dispersion of forces on the battlefield made possible by mechanization and the ability of fewer soldiers to deliver exponentially more firepower has increased by a factor of 4,000! The result, as Figure 1 demonstrates, has been that wars since 1865 have killed fewer soldiers as a percentage of the deployed combat force than was the case in previous wars. Except for the Napoleonic wars



Source: T.N. Dupuy, *The Evolution of Weapons and Warfare* (New York: Bobbs–Merrill, 1980), p. 288.

Figure 1. Relationship of Lethality to Dispersion.



Source: T.N. Dupuy, *The Evolution of Weapons and Warfare (New York: Bobbs-Merrill, 1980), p. 314.*

Table 1. Casualties-Lethality-Dispersion Over Time.

which utilized the tactical field formation of the packed marching column, every war since 1600 (Table 1) has resulted in fewer and fewer casualties as a percentage of the committed forces for both the victor and defeated.

The impact of the dispersion of forces on this equation is evident from the data in Table 2. It is clear that as weapons became more and more destructive, armies reacted by adjusting their tactics to increase their dispersion of forces so as to minimize the targets provided to the new weapons. Again, the overall result has been a decline in battle casualties even as the lethality of weapons increased.

Some historical examples help clarify the point. Until the Napoleonic wars the proportion of casualties, killed and wounded, to total effective forces under the system of linear tactics had steadily declined from 15 percent for the victors to 30 percent for the losers in battle during the Thirty Years War to about 9 and 16 percent respectively during the wars of the French Revolution. Napoleon's use of column tactics forced

	Antiquity	Napoleonic Wars	American Civil War	World War I	World War II	October War
Area Occupied by Deployed Force, 100,000 Strong (sq km)	1.00	20.12	25.75	248	2,750	4,000
Front (km)	6.67	8.05	8.58	14	48	57
Depth (km)	0.15	2.50	3.0	17	57	70
Men Per Sq Km	100,000	4,970	3,883	404	36	25
Square Meters/man	10.00	200	257.5	2,475	27,500	40,000

Source: T.N. Dupuy, *The Evolution of Weapons and Warfare* (New York: Bobbs-Merrill, 1980), p. 312.

Table 2. Historical Army Dispersion Patterns (Army or Corps of 100,000 Troops).

him to reduce the dispersion of forces in the face of increased killing power of musketry and artillery. The result was an increase in Napoleon's casualty rates to 15 and 20 percent. By 1848, dispersion had once again become the basis of tactics and increased with each war over the next 100 years. The result was a decline in the number of soldiers killed per 1,000 per year. In the Mexican War, U.S. forces lost 9.9 soldiers per 1,000 per annum. For the Spanish-American War the corresponding figure was 1.9, for the Philippine Insurrection it was 2.2, for World War I it was 12.0, and for World War II it was 9.0. Only during the Civil War, which saw many battles in which massed formations were thrown against strong defensive positions (a violation of dispersion) did the rates of the North, 21.3, and the South, 23.0, again begin to approach those of the Napoleonic period. Thus, barring incredible tactical stupidity, as lethal as modern weaponry is and as intense as modern non-nuclear conventional wars are, they generally produce less casualties per day of exposure than the weapons and wars of the past. Even in the Gulf War of 1991 which saw a force of almost 400,000 hammered by unlimited

conventional airpower for a month and attacked by a large modern mobile armor force with an enormous technological advantage in weaponry, the estimated casualty figure for Iraqi forces equals approximately only 7.1 percent.

Adamson's study of casualty rates from antiquity to Korea reaches the same conclusion with respect to mortality rates. Given that weapons changed little from the times of antiquity through the period of the Middle Ages, it might be somewhat safely assumed that the data provided for the Greek and Roman periods were roughly similar to that of the later periods of antiquity prior to the advent of gunpowder weapons. Table 3 presents the mortality data for various wars at different periods of history with the lethality of weapons factored in along the time dimension. The results of the data demonstrate that although weapons became more and more lethal with each war, the mortality rates for each war tended to decline with the highest found during wars of antiquity and the lowest reflected in modern wars. Once again the conclusion is that adjustments in tactics, mobility, and dispersion have by and large offset the increased killing power of modern weaponry.

Conclusion.

It has been only 350 years since the early prototypes of the modern gunpowder armies of the present day first emerged on the battlefields of the Thirty Years War. In that time the destructive power of weapons and the organizational sophistication of military forces have proceeded at a developmental pace that has no historical precedent. Both of these elements, in turn, are the products of larger social and technological forces that have truly revolutionized the manner in which man lives out his life. For more than 5,500 years of man's existence in organized human societies, since early Sumer, the means and methods by which men destroyed each other in war changed only little. In the last 350 years they have changed so drastically as to be quite literally beyond the imagination of the soldiers and commanders who have gone before us. In this sense the advent of modern weapons can only be seen being among man's most ingenious innovations.

Personnel Involved	Total	Died	% Mortality
"Iliad"			
All casualties	213	192	90.0
Close range	147	138	93.5
Long-range	66	54	82.2
"Aeneid"			
All casualties	180	164	91.0
Close range	120	115	96.0
Long-range	60	49	81.6
Crimea			
British Army	26,083	5,498	21.5
World War I			
Canadians	122,672	51,678	42.2
British Army	2,216,976	573,507	25.8
World War II			
Australians	2,637	516	19.5
Normandy Troops	2,452	962	39.3
Korea			
U.S.A.	142,091	30,928	21.7
Commonwealth	6,080	1,263	20.9
British			
all casualties	1,337	216	16.2
gunshot wounds	694	127	18.2

Source: P.B. Adamson, "A Comparison of Ancient and Modern Weapons In The Effectiveness of Producing Battle Casualties," *Journal of The Royal Army Medical Corps*, Vol. 23 (1977), p. 97.

Table 3. Battle Mortality from Antiquity to Korean War.

What has not changed one iota, of course, is the death and the pain. Regardless of weaponry, the wounded soldier still bleeds, still endures pain, and still fears that he will not survive his wounds. The psyche which rests at the core of man's very humanity still must endure terrifying fear, and the fear of death and maiming which drove the ancient soldier to psychiatric collapse seem not to have been abated at all by his modernity, nor driven from his consciousness once shot and shell begin to fly. And for most men in combat the risk of being driven mad by those fears remains as real as it was for those who stood

at Marathon, Pydna, or Arbela. Regardless of his social and technological progress, man remains as fragile a creature as ever in his bones and in his heart. Nowhere is this fact more evident than in the hospital and surgical wards of the military surgeons who, since earliest times, have attempted to stem the tide of death.

CHAPTER 7

CONCLUSIONS

The purpose of this volume is to provide the reader with an introductory overview of the history of weapons and warfare from the time of its inception in the fourth millennium B.C. until the present. Given the magnitude of the goal, it is clear on the face of it that this book can hardly have been expected to have achieved its goal in a manner that could lay claim to comprehensiveness. In order to stress the general trends in the development of warfare we have been forced by the press of obvious necessity to omit more material than we have included. Nowhere is this clearer than in the absence of footnotes and other documentary material. Since the goal was as much to entice the reader's interest in military history as to inform, the reader's attention is drawn to the bibliographic essay at the back of the book that provides a list of additional books to which he or she may turn to explore many of the aspects of military history that could only be mentioned in these pages.

But why should anyone, even a military audience, study military history at all? Clearly, the modern world is so vastly different from those that have gone before that there is no real danger that history will truly repeat itself. Perhaps so. Yet, the study of the past offers the researcher the unique opportunity to *understand the past within its own terms of reference* and, it is worth stressing, that frame of reference is scarcely different from that of modern men. One cannot truly appreciate the value of history unless one first grasps a central truth: that the men and women who lived the past were no different from us in any significant way. They were physically like us and, more important, they were emotionally and psychologically like us and just as mentally facile. Accordingly, they met the challenges, threats, and opportunities of their lives in much the same way as we do. To neglect the study of the past on the

grounds that it is irrelevant is to reject this common heritage. It is only possible to know where we are by understanding where we have been.

The study of history has great functional relevance for comprehending the future. Men think in analogies after all, and many of the problems of the past are quite analogously similar to those we face today. What is one to make of the fact that with the exception of the United States and the Western European powers (none of which were in existence at the time), the coalition of powers that defeated the Iraqis in the Gulf War was exactly the same coalition of powers that destroyed the Iraqi (Assyrian) empire in 612 B.C.? Or that the problem of mass migration due to tragic economic circumstances that may be provoked from Eastern Europe in the next decade confronts the Western European states with the same problem encountered by similar migrations from the same area into the Roman empire in the third century? The study of historical situations that are truly analogous to modern problems faced by political actors expands the analyst's frame of reference when attending to the solutions of those problems. Without a deep frame of historical reference the temptation is all too great that policy makers will conclude that they are dealing with an historically unique problem, a condition which increases the probability that they will select options that have already been shown to be unworkable, had the past been known.

Finally, the study of history by military men and women has a unique imperative about it. It is soldiers, after all, who plan and fight wars and are in the unique social position of being the only genuine repository of the horrible and destructive experiences that accompany war. Moreover, in modern politico-military establishments, the soldier is strategically placed to bring his knowledge and experience to bear upon the policy process and, thus, to greatly affect decisions concerning peace and war. Paradoxically, the soldier is in the best position to speak about war and, thus, among the most strategically placed decisionmakers to prevent it. The study of war and its tragic historical consequences for human beings expands the experiential and informational ken of the soldier as decisionmaker in the policy process and provides him with a

powerful set of resources to bring to bear upon the process to prevent war.

No doubt the idea that it is possible to banish war from the human experience will be seen by some as a dangerously naive idea. The idea that soldiers in their roles as advisors to political leaders can play an important role in eliminating war might strike some as even more naive. Yet, who better than the soldier is in a position to assess the destructive consequences of a political policy gone awry? Who, if not the soldier, can offer an assessment of the destructive power of modern weapons seen from the perspective of actual experience? And who, if not the soldier, can more accurately assess and express the cost of war in human suffering and pain? If the soldier can be enticed to place his own experience of war within a larger historical context, then he or she, more than any other member of our society, is in a position to restrain the hand of the politician in making war. It was, after all, a great American soldier, Chief Joseph of the Nez Pierce Indians, who expressed the great hope of soldiers everywhere and in all times when he said, "I will fight no more...forever."

BIBLIOGRAPHIC ESSAY

The bibliographic entries that appear below are designed to provide a short and handy list of sources to which the student of military history may refer in his or her quest for deeper knowledge about various aspects of the discipline. There are any number of general sources which stress a chronological and developmental approach to the history of weapons and warfare. Archer Jones, *The Art of Warfare in the Western World* (Chicago: University of Illinois Press, 1987) is among the most recent of these works. A detailed and more academic treatment of the subject can be found in Hans Delbruck, *The History of the Art of War* (4 vols.) (Lincoln: University of Nebraska Press, 1990). This book was first published at the turn of the century and marks a high watermark of German historical scholarship. Delbruck's footnotes, often running to several pages, are goldmines of information. Robert Laffont, *The Ancient Art of Warfare* (2 vols.) (New York: Time-Life Books, 1966) is most interesting for its illustrations, tables, and charts which effectively compress information into compact wholes for student use. T.N. Dupuy, *The Evolution of Weapons and Warfare* (New York: Bobbs-Merrill, 1980) and T.N. Dupuy and R. Ernest Dupuy, *The Encyclopedia of Military History* (New York: Harper and Row, 1987), are both excellent general works on the subject.

Two books are particularly interesting for their treatment of the problem of the origins of war. Arther Ferrill, *The Origins of War* (London: Thames and Hudson, 1985), provides a developmental history of the archaeology of war while Richard Gabriel, *The Culture of War* (Westport, CT: Greenwood Press, 1991) places stress upon the biological arguments that surround the question of why men fight.

On the subject of war in the ancient world, Richard Gabriel and Karen Metz, *From Sumer To Rome: The Military Capabilities of Ancient Armies* (Westport, CT: Greenwood Press, 1992) provides the most recent and most empirical analysis of the subject. The best and most comprehensive of

available works dealing with war in ancient times is Yigael Yadin, *The Art of Warfare in Biblical Lands* (New York: McGraw-Hill, 1963). The work is richly illustrated and provides many interesting insights into the archaeology of war.

The definitive work on the Sumerians is still Samuel Noah Kramer, *The Sumerians: Their History, Culture, and Character* (Chicago: University of Chicago Press, 1963). A more detailed cultural history of the area that is highly recommended is Georges Roux, *Ancient Iraq* (New York: Penguin Books, 1964). Regarding the armies of ancient Egypt, Leonard Cottrell, *The Warrior Pharaohs* (New York: G.P. Putnam, 1962) is a delightful and adventurous little book. Important information on the Egyptian armies can also be found in O.R. Gurney, *The Hittites* (Baltimore: Penguin Books, 1962). The best work on the organization of ancient Egyptian armies is R.O. Faulkner, "Egyptian Military Organization," *Journal of Egyptian Archaeology*, 39 (1953).

A.T. Olmstead, *The History of Assyria* (Chicago: University of Chicago Press, 1951) is still among the best works on the subject.The definitive work on the Assyrian military is H.W.F. Saggs, *The Might That Was Assyria* (London: Sidgwick and Jackson Ltd., 1984) and labors mightily to make a very complex subject easy to read and comprehend.

As regards Persia, A.T. Olmstead, *The History of the Persian Empire* (Chicago: University of Chicago Press, 1948) remains the most comprehensive work available. A good work on the history of the Persian military per se can be found in Yaha Zoka, *The Imperial Iranian Army from Cyrus to Pahlavi* (Teheran: Ministry of Arts and Culture Press, 1971). This work is readily available in many military libraries. A glimpse into time can be obtained by reading the original works in the words of the ancients themselves. Two works by Xenophon, the *Anabasis* and the *Cyropaedia*, are highly recommended.

A generally good work on warfare during the period of classical Greece is Peter Connolly, *Greece and Rome at War* (Englewood Cliffs, NJ: Prentice-Hall, 1981) while J.F. Lazenby, *The Spartan Army* (Wiltshire: Aris and Philip, 1985) is generally considered definitive on the subject. A truly interesting and

extraordinary work of great value addressing the Alexandrian period of Greek warfare is found in Donald W. Engels, *Alexander the Great and the Logistics of the Macedonian Army* (Berkeley: University of California Press, 1978). Also worth examining is W. Kenrick Pritchett, *The Greek State At War* (Berkeley: University of California Press, 1971).

There are any number of solid works on the Roman army. Probably the best for the beginning student of the subject is Graham Webster, *The Roman Imperial Army* (Toronto: Barnes-Noble, 1985). Providing greater detail into the nature of military life in Roman times is G.R. Watson, *The Roman Soldier* (Ithaca: Cornell University Press, 1969). A good perspective on the nature of field combat in the Roman army is found in Robert L. O'Connell, "The Roman Killing Machine," *Quarterly Journal of Military History* 38 (Autumn, 1978). The definitive work of developmental history of the subject is Michael Grant, *The Army of the Caesars* (New York: Charles Scribner, 1978).

Not much in the way of general works are available dealing with the armies of the Dark Ages. None are particularly comprehensive, and the researcher is forced to rely upon more scholarly articles for good information. Nonetheless, one might read Tim Newark, *The Barbarians: Warriors and Wars of the Dark Ages* (London: Blanford Press, 1985). A more scholarly treatment of the barbarian armies as they relate to the fall of Rome is found in Walter Goffart, *Barbarians and Romans: The Techniques of Accommodation* (Princeton: Princeton University Press, 1980). Some good work on the armies of Byzantium is found in George T. Dennis, *Three Byzantine Military Treatises* (Washington, D.C: Dunbarton Oaks, 1985); some good sections on military life are found in Tamara Talbot Rice, *Everyday Life in Byzantium* (New York: Dorset Press, 1967).

An old and much respected source of information on war in the Middle Ages, first published in 1898, is C.W.C. Oman, *The Art of War in the Middle Ages* (Ithaca: Cornell University Press, 1953). A good general history, heavily illustrated, of war from the Thirty Years War to the Waterloo is found in H.W. Koch, *The Rise of Modern Warfare* (Englewood Cliffs, NJ:

Prentice-Hall, 1981). One of the better academic works on warfare in this period is William H. McNeill, *The Pursuit of Power* (Chicago: University of Chicago Press, 1982). By far the best overall work on the Napoleonic period is David Chandler, *The Campaigns of Napoleon* (New York: Macmillan, 1966).

Once into the modern period, especially that following the Civil War to the present, an industrious student ought to have little trouble finding his or her way in the discipline. Libraries are full of excellent works on specific aspects of weaponry and war, so much so that any selection listed here would be sorely incomplete, almost random in nature, and as likely to mislead as to inform. Accordingly, having taken the student from the ancient period to the dawn of the modern age of warfare, it is now time to leave him or her to their respective mental devices, and to close by simply noting that the expansion of the mind in search of new information rests ultimately with the individual.

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Karen Metz and Richard Gabriel are frequent collaborators in works of military history. Their most recent work (1992) is *A History of Military Medicine* (2 vols.) published by Greenwood Press, and is the first comprehensive history of the subject to be published.