

*The Loulan Beauty*  
Illustration by Kelvin Wilson 1997

*The*  
MUMMIES  
*of*  
ÜRÜMCHI



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*W. W. Norton & Company*

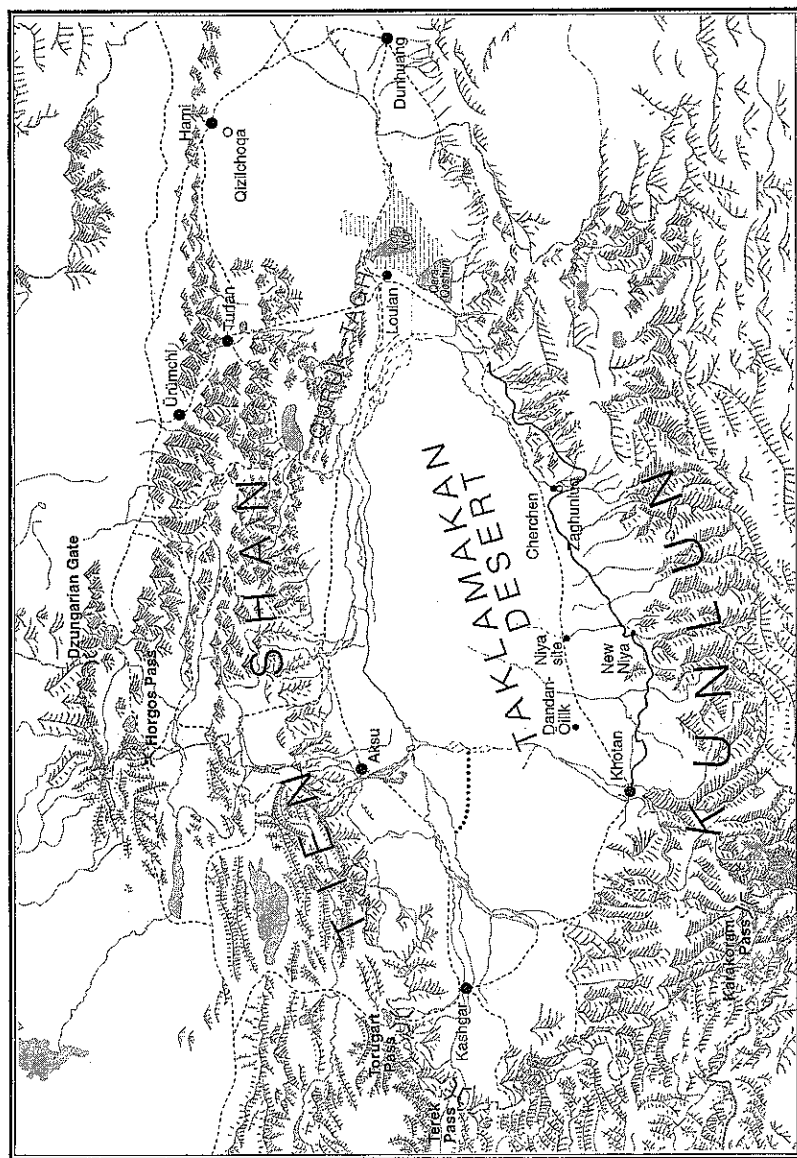
*New York • London*

## Pulses in the Heart of a Continent

THE CENTER of a great continent is a mysterious place, especially to those who don't live there. We speak with awe of the Amazon Jungle, the Roof of the World, the Heart of Darkest Africa, the Australian Outback, and Innermost Asia. Until air travel triumphed, our most reliable roads were always the waterways, and what we couldn't reach by boat kept its aura of mystery, spawning tales of Gold-Guarding Griffins, Abominable Snowmen, and the like. An archaeologist tracking bygone civilizations finds that the cultures stop at mountain ranges but cross rivers freely. Even a "nearby" place like Bosnia has stayed mysterious because its limestone underpinning produced a land with no rivers running to the sea, or even to each other, only local sinkholes draining each disconnected and landlocked valley, where age-old traditions and hatreds could simmer oblivious of the world outside: the Heart of the Balkans.

Hard to reach and hard to traverse, the Tarim Basin, like Bosnia, has no rivers that reach the sea, but for quite different geological reasons. It does at least have rivers. Sitting smack in the middle of earth's largest landmass, the Tarim Basin receives meltwater from mountains on every side, in streams that

*Opposite page:* Physiographic map of major features of the Tarim Basin. In many cases the ancient sites are deep into what today is the central desert, the Taklamakan. The dashed line indicates the course of the Silk Road, while the solid line shows the modern paved road across the south. Note how far into the present desert both the ancient road and many of the southern sites are—an indication of increased dryness of the area.



MAP 9.1

flow together to become creeks and then rivers. The Tarim River system itself is 1,300 miles (2,100 km) long in a wet year. But all that water either evaporates, or is used by living things, or sinks into the sandy floor of the basin, leaving the area unconnected with the rest of the world.

Such was not always the case. The geologic history of Innermost Asia is both complex and informative. From it we can piece together both why such splendidly preserved mummies should occur just here and why Stein, Hedin, and the other early explorers we have followed didn't find most of them.

It may be that they simply didn't look in the right place. But a careful glance at Stein's and Hedin's maps shows a powerful geological factor at work as well.

Sir Aurel Stein's chief interest lay in the spread of Buddhism from India into the Tarim Basin during the early centuries A.D.; to chase these relics was why he had come. In fact he viewed as a sort of "patron saint" the Chinese Buddhist pilgrim Xuanzang (older spelling: Hsüan-tsang, pronounced roughly *shwan tsahng*), who set out from China to travel the twenty-five hundred miles to India via the Tarim Basin in A.D. 628, at a time when the new Anglo-Saxon inhabitants of Britain were still writing runes and contemplating their first lessons in Christianity. He wanted to study Buddhism at its source and to bring back manuscripts that would instruct the Chinese in Buddhist thinking. Xuanzang actually succeeded in his mission—a feat we should remember the next time we complain about minor inconveniences like the airline's misrouting our luggage. The round trip took him seventeen years, and he wrote a record of it that Stein used (among other things) as a preliminary guide to what he should look for.

The Buddhist period sites that Stein found, like Niya and Dandan-Öilik (maps 9.1, 5.1), show on the maps as being typically thirty to fifty miles into the desert from the currently inhabited towns. *Sand-Buried Ruins of Khotan* he named his first major book.

What does that tell us? That the Taklamakan Desert is encroaching, that the rivers bringing the meltwater down from the mountains aren't getting so far as they used to before running out—that, in short, the Tarim Basin is considerably drier than it was fifteen hundred years ago.

Now double that. What about three thousand years ago, the date of the Cherchen finds?

We must remember that it takes only a little water to keep scrub and grasslands alive, and only a little bit less to kill them off. Differences that would be scarcely noticeable on the large scale of geologic time may make all the difference between life and death in areas poised on the border.

Dolkun Kamberi and his Ürümchi associates managed to find their mummies only six miles from a current town, Cherchen. But Dolkun remarks on the drying up of the bountiful southern "oasis corridor" into a series of small, dis-

connected areas that still have some water. "Today," he writes, "Chärchän county is like a lonely island in a sea of sand" thanks to the increasingly rapid encroachment of the desert. In the last forty years the road through the area has been moved out of the sand's way three times, displaced southward a full thirty kilometers (about nineteen miles). "But since 1971 [a mere twenty-five years]," Kamberi continues, "the natural environment has deteriorated more rapidly than ever before as a result of deforestation and the construction of dams up-river making reservoirs according to a government plan for new Chinese immigrations into the region."

The Ürümchi archaeologists mention that they know of early sites so deep—a hundred miles or more—into the Taklamakan Desert that to dig them will require the support not of modern four-wheel-drive Jeeps (which are hopeless in the deep, shifting sands) but of helicopters to bring supplies and personnel in and out, and global positioning systems to make sure the ground crew can always be found in the shifting sea of sand. Only with such major technology, and for very short seasons each year, can human will and curiosity force the mighty desert to give up a few more of its secrets.

Over the last few thousand years, then, the Tarim Basin has grown drier, stranding deeper and deeper in the desert the places where people once lived. Some geological reports state that the area has *not* dried up appreciably in the last several millennia. But that depends on who is there to appreciate it. Sven Hedin had to crawl across a zone of dead, dry trees for the last two days of his seven-day search for water as he came out of the sand dunes.<sup>1</sup> Clearly water had fed those trees in the relatively recent past, yet by 1900 a wide swath contained none.

Another of the scientists on Hedin's Swedish team in 1928 was a geologist, Erik Norin, who labored to trace the geologic history of the region. He too noticed this "progressive advance of the desert especially in the southern part of the basin." He points out that "the sand [is] steadily encroaching upon the cultivable regions in the south and west, thus forcing cultivation towards the border region of the Basin. As a result, the water used for irrigation of the new ground is absorbed to such an amount, that a considerable reduction of the volume of the rivers follows and thus also a reduction in their extension. Yet, this does not account for all the facts." Extensive geological fieldwork also showed that the glaciers that feed the rivers along the south side of the Tarim Basin are retreating, sending less and less water down their courses as the centuries pass. Stein too proposed this as a cause of desiccation.

These rivers spring from the meltwater of glaciers south of the Tarim in the

<sup>1</sup> Recounted in Chapter 5.

Kunlun range (map 9.1), the northernmost of many east-west strings of mountains making up the huge mass we think of loosely as the Himalayas. (Technically the Himalayas form only the more southerly strings, closest to India, with the high plateau of Tibet, the Roof of the World, between them and the Kunlun; maps 9.1, 9.2). Even the Tarim River, which flows mostly along the north side of the Taklamakan Desert, receives much of its water from the southwest and in the past received great tributaries from the south. This broad configuration suggests that the basin's underpinnings are somehow tipped so that most of the water from the south ends up eventually on the north side, whether flowing on the surface or under the sand to get there. The Tarim River in turn finally ends at the northeast corner of the Tarim Basin; so the entire area is ultimately affected by the Kunlun meltwater.

Some of the Kunlun glaciers, according to Norin, survived from the last Ice Age, whereas others melted off completely after that time. (The last major phase of ice peaked about 18,000 years ago, when the famous cave paintings of the Upper Paleolithic were being produced, with reasonable warmth returning by about 8000 B.C., roughly when the Neolithic era began in the Near East with its new technology of domestication.) The radical reduction in glaciers produced a sizable period when the basin suffered even greater dryness than today. Later still the glaciers briefly re-formed. Says Norin: "Sub-recent terminal moraines [piles of ice-scoured rock debris deposited at the bottom end of a glacier] indicate an epoch in Post-glacial time when the amount of snow accumulating along the K'un-lun watershed was larger than now, causing an advance of the glaciers to this limit, from which the glaciers have since been receding."

Thirty years after Norin's report a California geologist named Joe Birman noticed in the California Sierra Nevada the leavings of a slight readvance of the ice that ended around 3000 or 2000 B.C. (Geological dating uses a much grander scale than archaeological, let alone historical, dating.) Curious as to whether this event was only local or—as he suspected—global, Birman traveled to a comparable latitude on the other side of the world, to eastern Turkey and the sources of the great Tigris and Euphrates rivers, which had watered the ancient civilizations of Mesopotamia (maps 4.4, 9.8). Despite political difficulties in eastern Turkey (the area was and still is a militarized zone), Birman discovered all sorts of evidence for a brief return of the ice there at about this same date, showing that this colder period had indeed occurred widely.

To the best of my knowledge, no other such global cold snap, causing a notable advance of glaciers at that latitude, has turned up in the geological record between the third millennium B.C. and fully historical times. So the last renewal

of the Kunlun glaciers, and hence of the rivers along the south of the Tarim Basin, may date to around that time. They too fall at roughly the same latitude.

That suggests two things of great importance for the history of human habitation in the Tarim Basin. If indeed the Tarim Basin was even drier and less hospitable to life just before the brief and partial reglaciation than it is now, and if Norin's evidence for reglaciation truly dates to 3000 B.C. or slightly after, it seems unlikely that more than the tiniest handful of people could have lived there before then. But after that date, as the renewed supply of annual glacial meltwater pulsed seasonally down the rivers again, life in a wide oasis corridor around the Taklamakan would have become particularly lush and inviting, far more so than now. On these grounds the first attempt to radiocarbon date the Loulan/Qäwrighul culture, which gave 4500 B.C., seems highly unlikely, whereas the second attempt, which gave 2000 B.C., would be right in sync. Such relative wetness at that time would explain how these people came by forests of large trees to mark their burials as well as swamps thick with reeds for the matting that wrapped and cushioned their dead. Since then, as Stein's maps and Kamberi's observations attest, the basin has become ever drier.

ON THE huge scale of geologic time, however, this is only the tiniest tip of a much larger process of drying up in Central Asia. The sand-filled Tarim Basin once lay entirely under water. Hedin's summary of Norin's lengthy study begins as follows:

In late glacial times, according to Norin, the whole Tarim basin was filled in by an enormous lake or inland sea, a Mediterranean Sea, of whose great volumes of water the historical lake of Lop-nor is the last disappearing survival. At the southern foot of the Kuruk-tag [just north and northwest of Loulan; maps 9.1, 4.1], Norin found the line of the northern shore of the Tarim lake, as he names the inland sea, extraordinarily sharply and clearly defined, and entered it on his map. The shore-line forms a terrace-shaped bank.

This may well be the ancient terrace on which Wang Binghua discovered the Qäwrighul cemetery with its cargo of mummies now in Ürümchi.

Norin established that the north-eastern shore of the Tarim lake ha[d] in late glacial times been situated to the north and east of Lou-lan, and that the mighty lake, which together with its continuation towards the east ha[d] probably been as large as the Caspian Sea, ha[d] sent out long inlets towards the north-east. In this region the lake ha[d] been shallow and swampy. . . .

As Norin was able to determine by means of extremely accurate measurements of altitudes, the crust of the earth has undergone age-long changes of level since the Tarim lake disappeared; for the northern shore-line shows a very pronounced fall from west to east. If Norin marks a point on the shore-line to the north of Lou-lan with the value zero, then the same shore-line near Aksu [850 km or 525 miles due west] has a relative height of 300 metres [1,000 feet]. Further to the west the difference of altitude recedes again to 250 metres [800 feet].

That is, the Tarim Basin as we now know it has gradually bowed up in the middle, like a quilt over an awakening tabby cat, leaving the whole western half much higher than the east end, where Loulan and Lop Nor are today, and the center highest of all. Hedin continues:

Through this movement of the earth's crust . . . the waters of the Tarim lake were thrown towards the east and formed in the eastern part of the basin a lake which Norin calls Great Lop-nor. . . . The almost complete absence of mechanical deposits in the northern part of this new sea-bed indicates that the period of strongest melting of the ice-age had at that time already come to an end. . . .

This suggests why we find no Palaeolithic flint tools on the floor of the Tarim Basin: it was underwater. The water, however, was fresh, and

Norin supposes that men . . . dwelt on the shore of the Great Lop-nor; for on the north and west shores of the old lake he has found roughly-fashioned arrow-heads of jasper.

The next stage was gradual desiccation:

Now the lake had entered a period in the history of its development when the peripheral inflow was not sufficient to replace the loss of water that it experienced through the evaporation at the surface of the Great Lop-nor. Owing to this the lake shrank further and further back and was transformed into a constantly diminishing salt lake.

Eventually all that was left was the shallow salt-surrounded lake known to the ancient Chinese annalists as the Lop Nor, filled with fresh water from the glacial melt that funneled each year into the Tarim River.

By A.D. 330, however, the erratic seasonal swell of fresh meltwater had

whipped the river away from its course past Loulan, the river swinging like a gigantic fire hose on the loose, overnight shifting its nozzle—the little Lop Nor—a good 200 kilometers (125 miles) to the south, forming the Qarashum (maps 9.1, 4.1), and then whipping it back again in the spring of 1921, after an interval of sixteen hundred years.<sup>2</sup> But such is geologic time, vast and completely insouciant of how many mere fish or humans it might inconvenience. The Tarim River is not alone in this whiplike behavior. The Danube now empties into the Black Sea through a channel seventy-five miles north of where it flowed in Roman times, and several times within historical record—most recently in the nineteenth century—the last stretch of China's Yellow River has flipped its mouth some two hundred miles during flood season, debouching either north or south of the Shantung peninsula (map 9.2). Each of these vast switches has caused enormous loss of life, giving the Yellow River the nickname China's Sorrow.

Virtually all the water in Central Asia comes from melting mountain snows. Rain itself never falls there—or so the guidebooks say, although our research team happened to drive into the town of Turfan just as it started to rain, one morning in June 1995. People stood around outside shaking their heads in amazement instead of seeking cover. The drizzle lasted an hour and then departed, perhaps not to return for decades.

Geology tells us why rain is so uncommon there and why precipitation of any kind is decreasing.

Eons ago—some twenty million years or so—when the continents as we know them still floated in separate pieces on earth's crust, the Indian subcontinent slammed slowly into the south side of Asia along a two-thousand-mile front, crinkling and squashing a huge mass of rock into what we know as the Himalaya Mountains (map 9.2). Tallest in the world, they are the deepest also, for like marshmallows floating in a punch bowl even more of their mass descends below the surface than rises above it. So thick is this rock mass—some 45 miles (72 km) thick—that it deflects a gravity pendulum away from true vertical. The gigantic barrier of the Himalayas helps keep the ocean out of Central Asia, for the whole Tarim area began sinking during the Upper Cretaceous Period, as the dinosaurs were dying out. It sank so far that the area just south of Turfan, the Turfan Depression, now rests more than five hundred feet below sea level (maps 9.2, 10.2). Recent research suggests, however, that the Tarim block itself is stronger than its surroundings, and, instead of crinkling up like the rest of the area, it has transferred pressure northward from the India-Asia collision,

<sup>2</sup> Hedin's expedition found evidence later that the river had probably whipped north and then south again once within this interval, somewhere between A.D. 1100 and 1600.

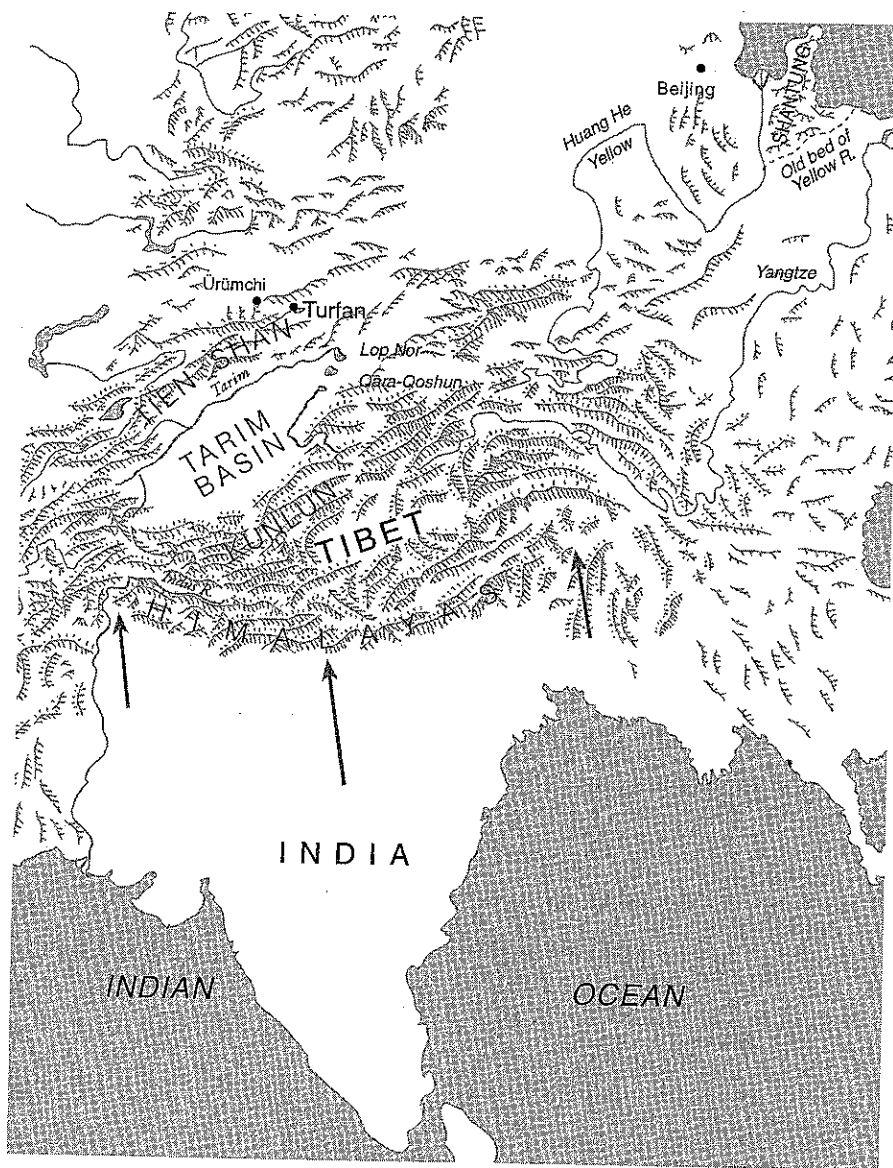


FIGURE 9.2

Twenty million years ago the Indian subcontinent, until then a northward-moving island, collided (arrows) with the Asian continent, shoving upward the Himalaya and Kunlun mountains plus the Tibetan plateau in between them. The hard block of the Tarim Basin didn't buckle but shoved north, pushing up the Tien Shan. The high mountains form a rain shadow, collecting all the moisture from the tropical air moving north from the Indian Ocean before it gets to the Tarim Basin. In recent times the mouths of both the Tarim River and the Yellow River (Huang He) have flopped back and forth over considerable distances.

causing the rise of the Tien Shan range that lines the Tarim along a thousand-mile-long front to the north. But all these mountains keep out rain as well as seawater.

When moisture-laden tropical air pushes northward over India each June from the Indian Ocean, it starts to dump its load. Air typically loses its burden of water whenever it gets either cooler or higher (thus thinner). The land, being higher than the sea, forces this warm, wet air upward, and down come the torrential monsoons. Then the traveling air hits the Himalayas, and up it goes some more. The farther north the mass of air journeys, the higher and colder it becomes, dropping more and more of its moisture as it moves. By the time it has passed over the Himalayas, Tibet, and the Kunlun, *they* are covered with snow and precious little water remains to fall on the other side. In short, the mountainous mass casts northward a rain shadow. Similar rain shadows exist elsewhere: much of the Pacific coast is wet, but great deserts lie just east of the Coast Range in California, the Olympic rain forest in Washington, and the Andes in parts of South America. Tiny rain shadows occur all over the Hawaiian Islands in the lee of the sharp volcanic ridges. Thus on Oahu, the rains that constantly pelt the upper Manoa Valley have spent themselves by the time the air, forced up and over the Pali from the Windward Side, reaches the university and downtown Honolulu. Three city blocks there can make a big difference in the year-round weather.

Inch by inch the Himalayas continue to push upward, slowly increasing the height of the barrier over a vast time. By the end of the Ice Ages, too little moisture reached Central Asia to offset evaporation—evaporation that rapidly increased as temperatures rose worldwide. And so, lacking new water, the huge freshwater lake that Norin named the Great Lop Nor began to shrink, like a puddle of water in a hot skillet.

If the water in the skillet were salty, it would leave a crust of hard, dry salt in the lowest dent in the pan as it boiled dry. So it was with the Lop Nor. After several millennia of evaporation, the small amounts of salt dissolved in typical runoff water had concentrated enough to make the lake brackish, then downright salty like the sea, and eventually much *more* salty than the world's oceans. The Dead Sea and the outlet lake of the Caspian, also landlocked, are like that.

At 20 to 25 percent salts the Dead Sea is so salty that essentially nothing can live in it, and if you should hazard swimming in it, as my grandfather once did, you will find it buoys you much higher than usual. Our family album shows Grandfather floating on his back with his Plimsoll line running midway between spine and bellybutton.

The Caspian Sea, having half the salinity of ocean water, supports copious life, but its "outlet" doesn't: that little knob midway down its eastern shore



FIGURE 9.3

Map of the Caspian Sea, its principal tributaries (the Volga and the Ural rivers), and its "outlet" (the Kara-Bog haz-Gol), a gigantic shallow lake where the water simply evaporates. The area due east of the Caspian is almost entirely a desert, the Kara Kum (Black Sand).

(map 9.3; the baby's rattle, if you imagine the shape of the Caspian as an upside-down swaddled baby facing east). At this spot a half-mile-wide cascade of Caspian water races down a rocky chute and leaps over a final waterfall into a

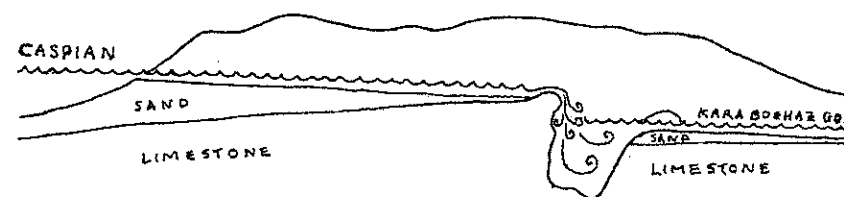


FIGURE 9.4

Cross-sectional structure of the straits and falls leading from the Caspian Sea down to the Kara-Bog haz-Gol. (Not to scale; after Garbell.)

ten-foot-deep, four-thousand-square-mile puddle called the Kara-Bog haz-Gol, Turkic for Black Gorge Lake (fig. 9.4). Blobs of the white chemical foam whipped up on the surface at the falls blow away for miles across the desert like tufts of cotton candy, while the water in the shallow lake cooks—titrates—in the desert sun. Here the dissolved chemicals soon reach saturation (about 30 percent of the brew; ocean water is less than 4 percent salts) and deposit themselves as beds of crystals on the surrounding rocks and flatlands. The Russians, to their surprise, found it more economical to set up a chemical collection plant for sodium sulfate (Glauber's salt) here on the isthmus between the Caspian and the Kara-Bog haz-Gol than to do so at the mouth of the Volga. That meant they had to ship the product four hundred miles up the Caspian before sending it on up the Volga to the paper factories that use it, but the preconcentrated nature of the water in the Kara-Bog haz-Gol made this much the cheaper method.

The fish coming down the chute get a surprise too. When they land in the water at the bottom of the falls, the concentrated salts kill them, and they are picked off as an easy meal by the eagles, pelicans, and gulls waiting on handy rocks and sandbars nearby. What the birds don't eat, the desert foxes and the nomads do, plucking the fish off the far shores of the Kara-Bog haz-Gol, where they wash up conveniently pickled by the brine. Wandering Turkmenian shepherds collect them by the bagful for future use, a rare bounty of nature in a harsh land.

The last step is for the pan to boil dry, leaving great shimmering flats of crystallized chemicals behind, such as can be seen today around Mono Lake and Great Salt Lake in the western United States. Beds of this sort made of sodium chloride (our table salt) occur in several parts of the world, mostly laid down in earlier ages and covered up by later deposits. The beds may run as much as 10,000 feet (3000 m) thick, as do, for example, the great Zechstein deposits under Germany. Other layers underlie parts of Austria and Central Europe and include the salt formations of Hallstatt that preserved the early Celtic plaid



twills (see Chapter 7). The salt bed east of the Tarim's terminal lake stretches for some 150 miles, according to Stein's and Norin's early maps (see map 4.1). Nor is this salt flat alone out there. The Swede charted several smaller salt beds northwest of the Lop region, filling basins here and there in the Quruk-tagh (Dry Mountains); other beds occur near Cherchen, where the locals discovered the ancient cemetery full of mummies while digging salt for their own use (see Chapter 2). Indeed, maps of the Tarim Basin are peppered with names containing *tuz*, the Turkic word for "salt," and these salt flats formed some of the most punishing terrain that Stein and his pack animals had to traverse.

Stein left us a sharp picture of the largest of the salt beds, encountered as he traced the ancient route between Loulan and Dunhuang (map 4.1), "a vast salt-encrusted plain" which he deemed "the true bed of the ancient sea":

Within half a mile from the "shore" the salt surface, so far tolerably uniform, turned into a seemingly endless expanse of crumpled puckered cakes of hard salt. The edges of the buckled-up slabs of salt, rising at an angle, protruded often a foot or more above others crushed in beneath them. . . . The ragged edges invariably showed the white of pure salt, while the upper surfaces of the cakes generally had a greyish hue, probably due to the admixture of fine dust.

Progress over this hummocky *shōr* [a native name for the salt crust] was tryingly painful to the feet, even when protected by stout boots. . . . After we had covered two miles . . . , the surface became even more trying than before. It now looked exactly like a choppy sea overrun with "white horses", one to two feet high and suddenly turned to hard salt. . . . The camels, moreover, found a fresh source of trouble from here onwards in the shape of strange gaping cavities, usually from three to four feet in depth and somewhat less in width at their mouth, which studded the ground, often in close proximity to each other. Their sides were invariably encrusted with heaped-up floe-like blocks of rather darker salt . . . leaning at sharp angles. . . .

The salt crust everywhere was so hard that they could scarcely drive iron tent pegs into it, and it cut the camels' soles so badly that the drivers had to resort to an effective, if painful, local custom of sewing protective leather patches directly onto the camels' feet. The white-encrusted humps, in places up to fifteen feet high and eroded into strange, rounded shapes, gave Stein an idea that these were the "White Dragon Mounds" mentioned in first century B.C. Chinese accounts of the route from Dunhuang to Loulan. Those travelers had also labored across this difficult ground slowly on foot. At one point Stein even found a trail of perfectly preserved early Chinese copper coins that had dribbled one by one from the pack of some ancient wayfarer too tired to notice. No surprise that the

old track cut across the salt-encrusted former lake bed at its narrowest point (map 4.1).

The modern terminal lake of Lop Nor still carries fresh water. (*Nor* or *nur* is, in fact, the Mongol word for "lake.") The Tarim River empties into it, bringing fresh meltwater, amplified by many tributaries, for some six hundred miles along the north side of the Tarim Basin; but the lake is much reduced in size. In 1941 Norin mapped the Lop lake as fifty miles long and twenty-five miles wide at its widest, near its southern end, while rumor has it that today almost no water remains.

AS WE come to see how this part of the world got so dry and so salty, we also learn why such wonderfully intact mummies lie precisely here. Dryness and salt: these are the factors that preserved them so splendidly. On a geologic scale the increasing dryness of the climate precipitated out the great salt beds of the Tarim Basin and helped desiccate the bodies when buried. But on the microscopic scale salt also *causes* dryness because it is a moisture hog; it absorbs water more easily than almost anything else around, so it tends to rob its surroundings of moisture. (That's why people used to put a few grains of rice in the salt shaker in damp climates: to absorb enough moisture back out of the salt that it would still shake.) Thus the presence and attributes of salt have aided greatly in the preservation of dead bodies as mummies, which occur precisely in the driest, saltiest part of Central Asia. The tomb diggers at Cherchen, in fact, had spaded through sandy topsoil into a layer of salt, so that the tomb walls consisted of pure salt.

The other geological trait that helped in mummification was the dry air of the desert. As Konrad Spindler, the archaeologist in charge of Ice Man, said, "the prerequisite of mummification by dehydration is a position in a dry but airy atmosphere." Ice Man died in a light snowstorm that covered his body with loose snow full of dry air. Thus desiccation could proceed quickly while the snow cover protected the corpse from predators. Loose sand can trap air too, and in the absence of rain, salty sand can rapidly absorb the body's moisture. This process must occur faster than microorganisms can eat the water-filled tissues. Spindler passes along an estimate that the entire process of mummification takes place in as little as a few weeks to a few months.

It is no accident, then, that the "coffins" containing well-preserved mummies near Loulan were shallow and had no bottoms—just wooden sides with hides over the top. The bodies lay on mats on the salty earth, which under the right conditions could suck them dry. In the much larger Cherchen tomb, the tomb builders had worked to provide real air space under the man's body by digging a foot-deep channel down the middle of the floor, across which they laid small



branches to support the willow mats on which the man's body would lie (fig. 2.14). The two women who were placed directly on the earth near his feet did not survive so well, especially the one squashed into the corner where airflow would have been worst (fig. 3.1). The woman at his head, however, lay on the mats with her middle (The wettest part of a body) over the end of the channel, and she came through in excellent condition. One suspects that the protein pastes used both at Cherchen and in the Andes to promote mummification drew away moisture and that the ancient "undertakers" used them deliberately for this reason. Like the Egyptians and unlike those cultures that do their best to hasten separation of flesh from bones at death, some of the ancient settlers of the Tarim Basin clearly *wanted* their deceased to mummify.

The best conditions for mummification may be signaled in fact by the mummies' heavy clothing. The Tarim Basin is extremely hot in the summer—temperatures of 120–130° F are quite usual—and fiercely cold in winter, far below zero. The relatively heavy, dark clothes, unsuitable for summer, suggest that these particular persons died in the cold season and, like Ice Man, mummified so well because the bodies became very cold very quickly, then dried while in a frozen or near-frozen state. Not all Tarim burials produce mummies; many other corpses from these same sites were reduced to mere skeletons, including the unusually deep burials of men inside the log circles near Loulan (figs. 4.6, 5.3). The soil's temperature changes much more slowly down deep than it does at the surface, so that in a cool climate like that of Europe a body decomposes far more slowly in a deep grave than in a shallow one. (So the extra depth of the fanciest burials suggests that the Loulan folk may have moved recently from a much more temperate climate, where such extra work for the elite would be worth the trouble.) But in the Tarim Desert, apparently, deep sand was too warm in both summer and winter to keep the body from decomposing. Shallow sand, providing little insulation, wouldn't preserve a body from rot in summer, but in winter it could well act as the perfect refrigerator while the body dried to a mummified state. Once thoroughly dried, the mummy would not react to ensuing heat.

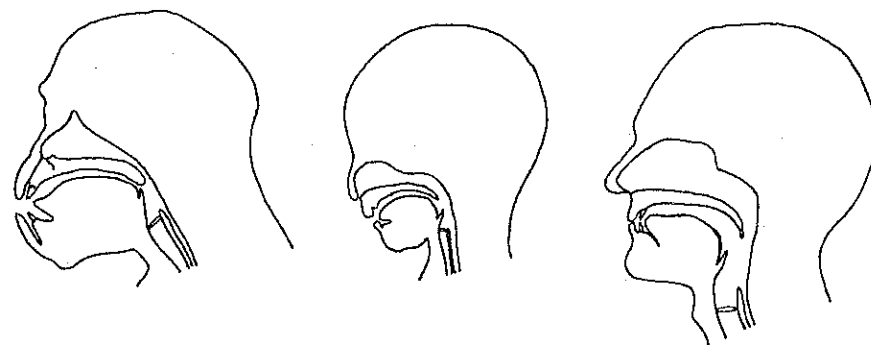
THE HEART of the Asian continent contains another pulse besides the grand geologic ebb and flow of ancient seas, salts, rivers, lakes, mountains, and temperatures. Within the limited time frame of human history, Eurasia has sent out wave after wave of emigrants—the Mongols, Huns, and Indo-Europeans, to name a few. Scientific study of ancient bones has shown that during the four million years since "ape-men" began walking on their hind legs, Africa functioned as the primary source of human dispersal, sending out one humanoid species after another until finally settling on *Homo sapiens sapiens* as its best

model, maybe 250,000 years ago. But once our direct ancestors had wandered forth from Africa and across Eurasia to populate the world, new centers of expansion developed outside Africa, one of them in the heart of Eurasia. We can see this in the archaeological, the genetic, and most particularly the linguistic evidence. To understand this last type of evidence, we must briefly pick up another thread.

When did humans begin to speak? We now think we have trapped that elusive date. A rapid evolutionary push about 150,000 to 100,000 years ago radically changed the shape of our throats and mouths. The changes shortened the jaw, moved the tongue forward, and introduced a right-angle bend into the system where the now-horizontal mouth turns down into the throat (fig. 9.5). These alterations had several effects: they made it harder to breathe, easier to choke on food, and easier to die of infections from impacted teeth (caused by scrunching up the same number of teeth in a shortened jaw). They also made possible the production of rapid spoken speech, something we doubt the contemporary Neanderthal people could produce, although their brains may have hummed with the symbolic thinking prerequisite to language. In language evo-

FIGURE 9.5

Evolution of the vocal tract (passage from lips and nose to windpipe) from our nearest living relative, the chimpanzee (left), to humans (infant, center; adult, right). Compared with the gentle curve of the chimp's air passage, adult humans have a sharp, right-angle bend, making strong breathing (as when running) much less efficient, and the human jaw is much shorter (leaving less room for teeth). From age 3 months on, the human tongue (now differently shaped) fills much less of the mouth/throat cavity and is differently anchored, having both the space and musculature to articulate speech sounds. Note how the newborn baby's tract is intermediate between those of the chimp and of the adult human—another case of individual development recapitulating evolution. The small lens shape at the top of the windpipe represents the vocal cords (inside the larynx, protruding as the Adam's apple), which make the vibrations we call voice.



lution, as in the acquisition of language by children, the brain runs the mouth. That is, there's no need to learn the intricacies of language if you have nothing to say: cognition comes first and drives the effort to obtain means to express it. The humanoid with the new mouth type were much more liable to kick the bucket early than were their fellows; they survived as the "fittest" of the humanoid lot because the ability to speak far outweighed all the inadvertent physical disadvantages. After all, language is the most powerful tool we've got.

Eighty to forty thousand years ago modern human populations expanded across Europe and Asia, eventually reaching New Guinea and Australia before heading to the Western Hemisphere. By 40,000 B.C. people were also carrying far and wide such new language-mediated behaviors as religion and art (things that other animals don't have or do), the existence of which shows that language was fully evolved by that time.

That being so, the language families we know today should reflect something of how our modern human population moved out across the planet.

Dr. Johanna Nichols, a linguist at the University of California, Berkeley, became intrigued with how to extract such embedded information from language. She applied sophisticated statistical analyses to a large sample of human languages from all over the world, including a few of the earliest languages ever recorded in writing, five to four thousand years ago. Some areas of the world, she learned, tended to pile up remnants of languages—"residual zones" she called them: areas like the Caucasus Mountains, the Pamir-Himalaya ranges, New Guinea, and the Pacific coast of North America. Other areas, which she named "spread zones," became centers from which waves of people radiated, taking their languages with them. The great spread zones include, for example, Mesoamerica, the South Pacific islands, part of sub-Saharan Africa (accounting for the recent spread of Bantu languages there), and—the most famous, perhaps the most active spread zone of all—the central Eurasian steppes (maps 2.9, 9.6). From this last zone we can document a series of linguistic spreads periodically over the last five thousand years.

The first of these Eurasian expansions was proto-Indo-European (see Chapter 6). Since the daughter branches share words for soft metals, earlier linguists concluded that all the Indo-Europeans (in effect, the proto-Indo-Europeans) already knew in common how to use them—principally gold, silver, copper. Therefore they must already have entered the first age of metals, the Bronze Age, before splitting up, and that would put the Indo-European breakup somewhat after 3000 B.C., when the use of soft metals became widespread. Recent archaeological finds from Turkey, however, show that people back at 7000 B.C. were already picking up hunks of raw copper and investigating their properties,

hammering and abrading them into hooks, pins, and other small items. (Copper sometimes occurs naturally in pure form, and Anatolia is one place where it does.) So a somewhat earlier date is not unthinkable.

Next came massive expansions, during the third and second millennia B.C., of the Indo-Iranian branch of Indo-European. During this time Indic speakers got all the way to India, while Iranian tribes flowed into an area running from southwestern Siberia, Russian Turkestan, and the Iranian plateau all the way to western Ukraine (map 9.6). Demonstrably Indo-Iranian and even specifically Indic names and vocabulary words turn up in written records of the Near East in the Bronze Age, starting soon after 2000 B.C., words like *ashva*, the Indic word for "horse," and names of typical Indo-Iranian deities like Mitra and Varuna.

Seven or eight centuries later a new wave of people emanating from somewhere in Central Asia snuffed out the Bronze Age cultures of the Mediterranean. Big black destruction layers throughout Greece, Turkey, Syria, and on down to the gates of Egypt attest to the extent and seriousness of the devastation. Only the Egyptians managed to beat the invaders off, in a pair of great battles ending in 1190 B.C. The pharaoh Rameses III depicted these battles, one on land and the other in the Nile Delta, on the stone face of his huge mortuary temple at Medinet Habu, in Thebes in Upper Egypt (map 9.6).

Interestingly, the intruders the Egyptians fought don't appear to have been steppe folk themselves, but rather some peoples displaced southward, domino-like, by incursions from the northern steppes into lands bordering the Mediterranean Sea. Like the boll weevil, they were jus' lookin' for a home. Later, when the dust settles and the smoke blows away, we find the Hittites, for example, living in Syria, just south of their former home in Anatolia, while Anatolia is filled with new Indo-European groups like the peak-hatted Phrygians (see Chapter 2).

During the Late Bronze Age the Hittites had learned how to smelt iron (which requires a far higher temperature than copper) but had kept the process secret by means of a royal monopoly. Thus the Hittite king Hattusilis III, about 1275 B.C., composed a letter to an Assyrian king who had requested presents of this wondrous iron, answering that he was sending an iron dagger but that his royal friend would have to wait awhile for anything more since the smiths had not finished processing this year's batch of ore. Nearly a century earlier Tutankhamon had received such a kingly dagger. But the demise of Hittite hegemony in 1200 B.C. shattered the royal monopoly, releasing the secrets of smelting iron. So began the Iron Age.

Although Indo-European groups such as the Greeks, Romans, and Celts continued to expand and contract in the west, the next great pulses from Inner Asia

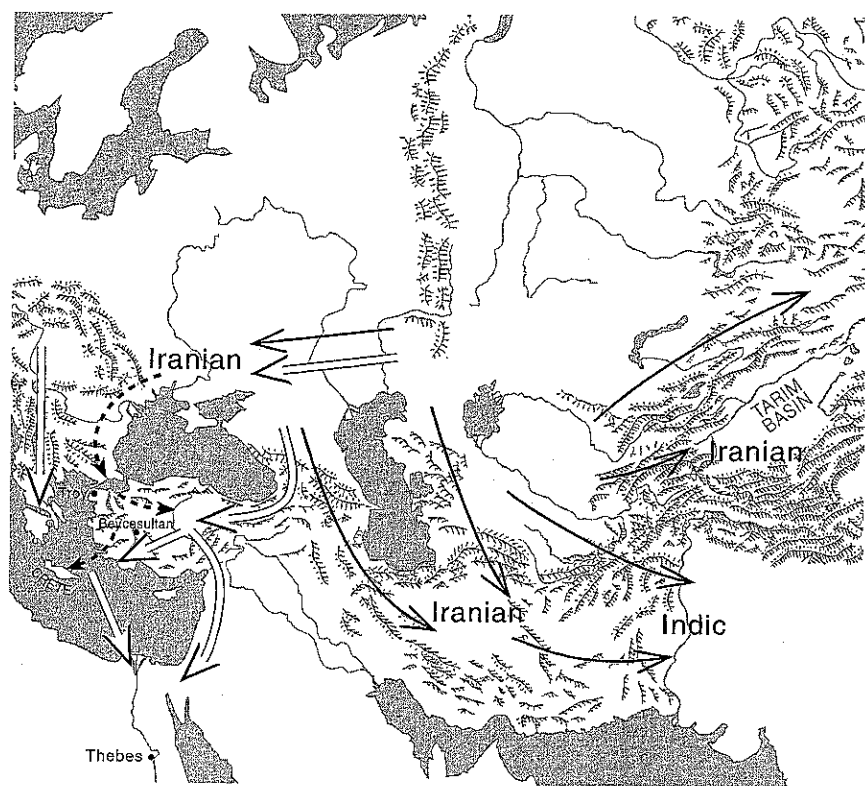


FIGURE 9.6

Mass migrations of the Bronze Age. Dashed arrows show a movement of peoples in southeastern Europe around 3000 B.C. Solid arrows show the deducible directions of spread of Indo-Iranians in the 2nd and 1st millennia B.C.; the eventual attested distribution of Indo-Iranian languages is labeled. Hollow arrows show the directions of movement of the Sea Peoples, who attacked and destroyed many civilized areas of southeastern Europe and the Near East around 1200 B.C. In this movement people pushing south into Greece and Turkey dislodged others, who in turn pushed south toward Egypt.

spread other language groups about. Beleaguered Europeans chronicled their arrival. The terrible Huns (a Turkic-speaking group led into Central Europe by Attila in the fifth century A.D.) came first, followed in rapid succession by the Avars (Turkic invaders of the sixth to eighth century, finally evicted from Hungary by Charlemagne), the Bulgars (Turkic speakers who invaded the Balkans

in the seventh century and left their name to Bulgaria), the Magyar (Finno-Ugric ancestors of the modern Hungarians who swept into Hungary in the ninth century<sup>3</sup>), and the Seljuk Turks (who began invading Turkey in the eleventh century). These were chased in the thirteenth century by the most feared invaders of them all, the Mongol hordes,<sup>4</sup> who killed 90 percent of the population around Kiev and penetrated as far west as Budapest, burning that city on Christmas Eve of 1241. Then to the surprise of the terrified Europeans, the Mongol invaders abruptly wheeled and rode away, back to where they had come from. Why leave now, abandoning such rich booty? Far away in Mongolia their king had just died, and when the warriors received the news, they stampeded home to elect a new leader. They never again gathered enough momentum to invade so far west, although they continued to harry the Russians for centuries. No wonder the Russians are still jumpy about their borders.

All six of these groups spoke Uralo-Altaic languages (fig. 9.7). Magyar (Hungarian), still spoken in Hungary, belongs to the Uralic half, being a distant relative of Finnish, while the other five are Altaic. The Altaic superfamily includes Mongol, Tungusic, and the Turkic tongues. To Turkic belong not only the Huns, Avars, Bulgars, Seljuks, and the Ottoman or Osmanli Turks now in Turkey, but also the Uyghurs, who by the tenth century had moved from Siberia into the Tarim Basin, today the Uyghur Autonomous Region. As Johanna Nichols points out, each of these language spreads seems to have its center farther and farther east within Eurasia (map 9.9).

Europeans to the west and Tarim peoples to the south were not alone in suffering from a spreading plague of steppe horsemen. China too, at the east end of the steppes, records its share of distress from barbarian onslaughts. Repeatedly in the first millennium B.C., the Chinese wrote in despair of the fierce Xiongnu (see Chapter 6), probably ancestors of the Huns, who excelled in ra-

<sup>3</sup> Stamp collectors will know that Hungarian stamps say "Magyar" on them. English still uses a name obsolete fifteen hundred years ago.

Many examples of such misnomers exist. For example, the Chinese call themselves the Middle Kingdom, conceiving of themselves—as so many nations do—as being the center of the universe, whereas Western Europe still uses a name derived from the Qin (Ch'in) Dynasty, which flourished in the late third century B.C. The Russians, for their part, use a name for China (*Kitai*) belonging to the nearest Asian group with Chinese admixture that the Russians knew of in the tenth century A.D., the Khitans, people who lived somewhere in Mongolia and Manchuria. Similarly, the Greeks for twenty-five hundred years have called themselves *Hellenes*, whereas the Romans (from whom we took our cue) called the Greeks by the name of the first Greeks they got to know, those who founded the first colony (Cyme) on Italian soil and who happened to be called *Graii* or *Graeci*.

<sup>4</sup> The English word *horde* is thought to come from the Mongol word for an encampment, *orda* or *ordu*. Because everyone had his (or her) own tent plus many carts full of baggage, the populous camps spread over enormous territory. The meaning eventually got transferred from the camp itself to the size of the group.

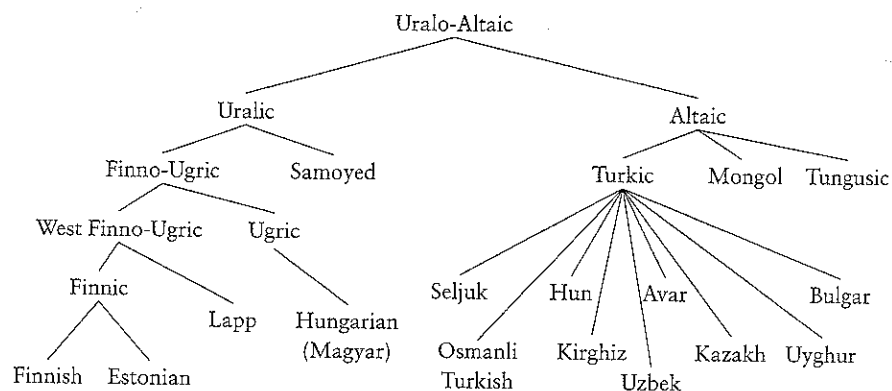


FIGURE 9.7

Tree chart showing the relationship among some of the languages in the Uralo-Altaic family, which extends across much of northern Eurasia. (Not all the modern descendants have been listed.)

capacity. Chinese defense troops even adopted nomad-style horse riding and trousers, around 400 B.C., to meet and fight the intruders on their own swift terms. Numerous Iranian words to do with wheeled transport, magic, medicine and the like (see Chapter 6), borrowed early into Chinese, tell us that Iranian expansion reached all the way to China at some point in the Bronze Age.<sup>5</sup>

Finally, A.D. 1260, after two thousand years of skirmishing, the Central Asian nomads won. Led by the great Kublai Khan, the Mongols overpowered the Chinese altogether and set up their own government on Chinese soil. For a short while this Mongol domain stretched from the Pacific Ocean to the Black Sea, the largest empire ever assembled before modern times.

What makes these pulses occur? What causes Central Eurasians suddenly to hop onto their horses and flatten everything to either side of them, like so many locusts? And why should the heart of the spread be shifting east?

Surely one important factor in their dominance is the periodic appearance of some politico-military genius like Attila or Genghis Khan, one able to organize and inspire a group of followers to overwhelm and incorporate neighbors into a bigger group that can in turn annex still more neighbors and so forth. The most effective leaders set up empires that reached all the way to Europe; the less

<sup>5</sup> In fact, three graves excavated just north of Beijing, at Baifu, belong to a "northern" culture contemporary with China's great Bronze Age culture, about 1000 B.C. But this culture and its graves possess quite different characteristics that link them with Western horses and Caucasian peoples. See Chapter 10 and fig. 10.5.

effective ones, perhaps, merely started those dominolike shoving matches that we have noted here and there among the recorded disturbances. Brilliant leaders may explain pulses, but not why central Eurasia should be the heart of so many.

Perhaps we are back to geology and ecology. All these steppe people lived from their great herds of sheep, cattle, and horses. As we have noted, however, it takes only a little water to keep grasslands alive and only a little bit less to kill them off. Studies of climate suggest that in addition to long-term worldwide changes like the Ice Ages, each region has its own small cycles. For example, Southern California experiences a fairly rapid shift between serious drought and flooding rainstorms on a cycle of about eleven years. When the rains come and the dry washes (by now full of houses built by irresponsible developers) fill with water, the destruction makes national news. Although the Eurasian steppes may be subject to short pulses of this sort too, we suspect that a longer cycle of greening followed by drought operates over two to three centuries. When the grass dries up, herds and herders must move or die.

Hunters have always followed the food, but hunting doesn't support a large population. Herding does. So a new ecology began when people near the western end of the grass belt or steppes got the idea that one could domesticate animals and then herd them for a living. Archaeology tells us that domestication first began in the hilly zone running in an arc to the east, north, and west of Mesopotamia—the so-called Fertile Crescent (map 9.8). We have evidence for domestication in Syria before 8000 B.C., first for domestic dogs, then for domestic sheep and wheat. Goats, cattle, flax, barley, legumes, and other species soon followed. These cultigens made possible the change to a settled way of farm life nicknamed the Neolithic Revolution.

Two big breakthroughs of importance to the steppes occurred around 4000 B.C., however. One, first noticed and worked out in the 1980s by the English prehistorian Andrew Sherratt, has been dubbed the Secondary Products Revolution. Sherratt noticed evidence that prior to about 4000 B.C. people used their domestic animals only as a supply of meat and hides, killing all but a small breeding flock as yearlings. But then archaeological finds show a change: people get the idea of harvesting useful things from their living animals, so they start keeping them alive to a ripe old age. Vessels for milk and milk products appear (food), processing of wool begins (clothing), and use of draft animals to pull a more efficient plow commences (energy). Getting your food and clothing from a live animal means you can hoard wealth on the hoof.

The second change was the domestication of the horse, which we know first from a Ukrainian horse jawbone of about 4000 B.C. that shows special tooth wear from chewing on a man-made bit. As people grew more skilled in con-

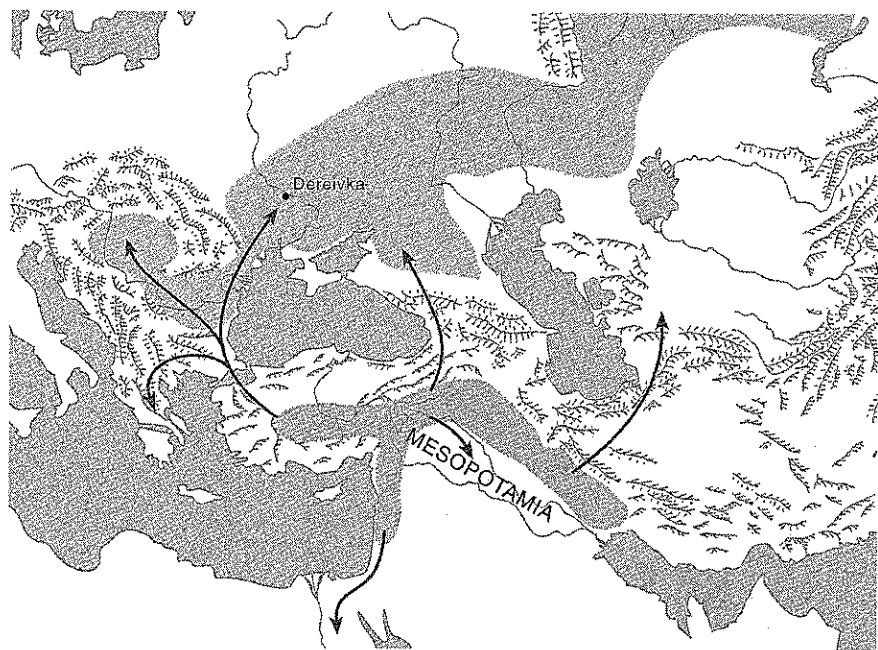


FIGURE 9.8

Map showing the so-called Fertile Crescent (darker shading, curled around Mesopotamia and into Anatolia), where the domestication of plants and animals began over 10,000 years ago. The arrows show roughly how it spread into other areas—e.g., across the Bosphorus into southeastern Europe, across the Caucasus into the steppes (lighter shading), and across the Iranian plateau and the Kopet Dagh into the oasis zone.

trolling horses, they could use these splendid beasts to manage not just little flocks but vast herds of sheep and cattle. And so the stage was set for steppe nomadism, the first lifestyle that made living in the grasslands efficient.

Clearly we should not expect pulses of invading herdsmen to stream out of the Asian grasslands until after this new nomadic lifestyle had both begun and had time to take hold and develop. We could, however, expect that the first people who worked out the powerful economy of large-scale herding should be the first to mow down their neighbors.

Who might they have been? Let's look at the timetable. The newly woolly sheep seem to have spread into southeast Europe from the Near East by about 3500 B.C., and we can probably assume the same for spreading into the steppes.

Around 3000 B.C., we pick up a pulse of intruders out of the Ukrainian steppes into western Anatolia, with the founding of Troy and other important sites, and movement—dominolike?—into Crete from Anatolia (map 9.6). Our first surviving evidence for felt—another crucial ingredient in developing the life of the Eurasian nomad—occurs soon after, around 2600 B.C., at Beycesultan in central Turkey (map 9.6).

Were these first “pulsars” Indo-Europeans? Perhaps; or perhaps their close kin.<sup>6</sup> Being Indo-European is technically a linguistic attribute, requiring linguistic data to pin it down. But the timing of the first noticeable pulses matches nicely with the linguists' internal evidence for when the Indo-Europeans started splitting up.

The geography matches too. The proto-Indo-Europeans must have lived east of the Dniepr River (map 7.6, 9.9)—must, because they did not know of an important tool that developed in Central Europe from 5500 B.C. on: the warp-weighted loom. As one moves east, the Dniepr is where the archaeological evidence for that tool stops. Those Indo-Europeans who ended up farthest to the south and east used other looms, and those who ended up west of the Dniepr *borrowed* from other languages all their words to do with the warp-weighted loom. So they could hardly have spent the Neolithic living right there in Central Europe, where it was invented. This line of the Dniepr, east of which the proto-Indo-Europeans must have lived, lies not far from the textile zone that yields the earliest-known plaids and twills. In short, the evidence from that central industry, cloth, suggests that the proto-Indo-Europeans (by definition, this linguistic group before it spread out) lived on the Pontic and Caspian steppes, the area where the horse was domesticated and the nearest steppeland to the Near East and its crucial ideas of domestication.

We have another fix on where the proto-Indo-Europeans lived: Johanna Nichols's observation that the centers of linguistic spread shift farther and farther east (map 9.9). The Mongol invasions—the latest—stem from far, far to the east (map 9.9, area 4); the ancient Turkic center—providing the next earlier pulse—lay to the west of Mongolia along the upper Yenisei River (area 3). Be-

<sup>6</sup>I am thinking in particular of the Anatolian language family, which has yet to be proved on linguistic grounds to be a daughter of Indo-European rather than a cousin. (My archaeological hunch is that they are cousins.) I have long suspected these early intruders into western Anatolia, via Troy, to be the Luwian branch of the Anatolian family, while their strange, hollow spindle whorls (see Chapter 8) suggest they came ultimately from far to the east, rounding the north side of the Black Sea on their way west. Some of the yet earlier inhabitants of Eurasia, whether a large group or small, must also have belonged to still older trunks and branches attached to this linguistic line of descent, for the stock that gave rise to the Anatolian and Indo-European languages (as recorded and reconstructed) had to have lived somewhere.

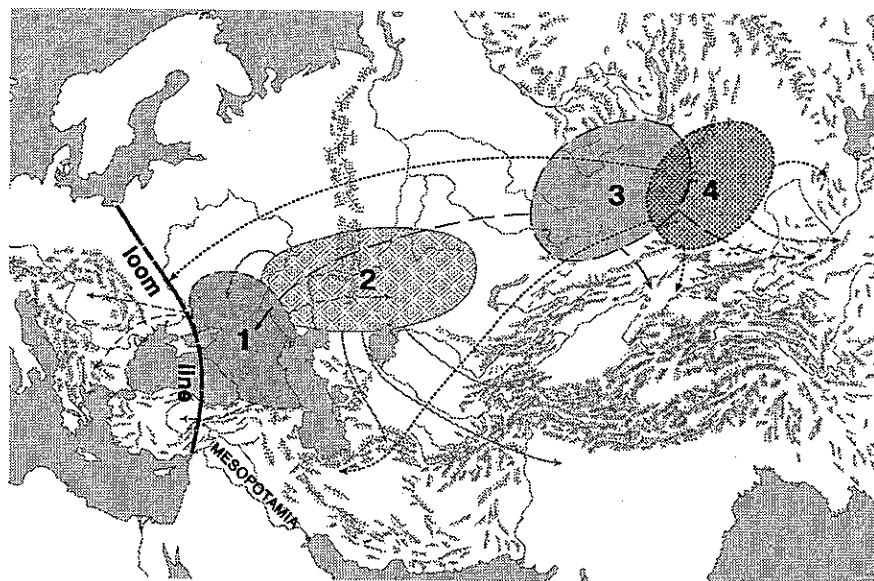


FIGURE 9.9

Map of postulated successive spread zones of language groups in Eurasia. Circles indicate postulated starting zones and arrows approximate directions of spread. (1) Indo-European (whose starting zone cannot lie west of the line marking the east edge of the warp-weighted loom, a basic tool unknown to the proto-Indo-Europeans), before 3000 B.C.; (2) Indo-Iranian, before 2000 B.C.; (3) Turkic, before A.D. 400; (4) Mongol, before A.D. 1000. Note that the centers of the movements keep shifting east, along the steppe belt and away from Mesopotamia and the Fertile Crescent (where animal domestication began).

fore them, the Indo-Iranians started from still farther west (area 2; although scholars argue whether that point was just east or just west of the southern Ural Mountains). At any rate they spread south into today's Iran (ancient Persia) and India and west into Ukraine. The earliest of the lot was the spread of the proto-Indo-Europeans. If we place their old center west of the Indo-Iranian starting area but east of the warp-weighted loom, there they are again on the steppes north of the Caspian and the Black Sea or Pontus (area 1).

The first people to work out nomadism would have had such an edge over everyone else that they must have been the first to overrun their neighbors' pasturage. It looks more and more likely that the Indo-Europeans got their original edge this way, just happening to be the people sitting in the right place, the

East European steppes, at the right time, the fourth millennium. They have been spreading ever since.<sup>7</sup>

One more tool is now being developed to help solve these puzzles of how groups of people spread: the analysis of human DNA. Studies already show something of how human populations spread. In Europe alone five ancient expansions can be detected by DNA analysis, three of which can be traced in Central Asia, in particular among the Uyghurs. As we learn more about which genes control what, we may eventually be able to follow unusual traits like blue eyes or very tall stature, which we can trace now in the archaeological record only through random findings of ancient paintings and of skeletons.<sup>8</sup> Adequate DNA samples from a variety of mummies like those in Ürümqi, compared with modern and ancient populations, will help enormously in sorting out the picture.

The samples, however, must come from bodies fresh out of the ground, properly taken to avoid contamination. Genetic material that old is badly degraded, and the polymerase chain reaction that makes multiple copies of DNA fragments is much more inclined to work on DNA that's in good condition than on the scrappy stuff. So even a couple of flakes of skin from the excavator's hand or scalp can contaminate the sample and skew results. The Italian geneticist Paolo Francalacci recently succeeded in taking adequate samples from a newly excavated mummy of about 1200–1000 B.C. at Qizilchoqa, as well as samples from several other mummies. To provide cross-checks against contamination of one or another sample, he tried to select tissue from several protected places on each body. Of the specimens taken, he reports that he was allowed to analyze five samples from two individuals.

Results suggest connections with Central Europe—just as the linguistic and

<sup>7</sup>Nichols would place the Indo-European center far to the east of the Urals, yet that not only clashes with her own observation of the centers' moving east, but more seriously, it ignores the fact that these rapid spreads clearly result from the new lifestyle of nomadic herding. Vast expanses of steppe separate the Urals from the ancient centers of the Near East; that region is too far east to fill the bill. The cradle of the lifestyle and thus the first center of spread had to be far enough west to receive the key ideas of domestication from the Near East—and to receive them first.

<sup>8</sup>The occupants of the Shaft Graves at Mycenae, who depicted horse chariots on their grave-stones and were almost certainly early Greeks (ca. 1600 B.C.), were over six feet tall. (Since later Philistine sites are full of pottery derived from Mycenaean models, it has been suggested that Goliath was an over-six-footer of Mycenaean descent—a veritable giant when pitted against the local five-foot Mediterranean stock.) Mallory also cites evidence of a tall, robust Cro-Magnon type (associated in the late Palaeolithic with the northern forest steppe) turning up in Ukraine already in the fifth millennium. These tall skeletons occur in the Dniepr-Donets culture, thought by many to be one of the key ingredients of early Indo-European culture. But all we have at the moment are a few tantalizing signposts in the dark; we badly need the light DNA can shed.

textile analyses do. But far more needs to be done to clarify the picture, both by analyzing more samples from new excavations and by continuing to analyze the genetic components of the modern population of Xinjiang (as is being done currently by the Chinese Academy of Sciences). Such studies await us in the twenty-first century.

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