9th grade Global summer reading questions.

Directions: Answer the questions below on a separate sheet of paper. Be sure you answer in complete sentences and provide examples from the articles to support your answers.

Handcrafted Implements

1. Define the following terms and circle them in the reading
    a. Systematic
    b. Functional
    c. Embellished
    d. Utilitarian
2. During what era did humans begin to use tools?
3. What practices indicate/imply that tools held great importance?
4. Give an example of how tools could be used for multiple purposes.

Overcoming Fear of Fire

1. Define the following terms and circle them in the reading
    a. Ingenuity
    b. Intriguing
    c. Neolithic period
    d. Underpins
2. How has man's relationship with fire changed over time?
3. Who is Otzi, during what era did he live?
4. Why were the two pouches found with Otzi significant?
5. What new technology will allow us to take advantage of new forms of energy?

Cultivating Revolutions: Early Farmers...

1. Define the following terms and circle them in the reading
    a. Hunting-gathering groups
    b. Convoluted
    c. Agriculture
    d. Haphazard
    e. Anatomical
2. What are the two arguments for the spread of agriculture?
3. How did farming/agricultural revolutionize social life in Europe?
4. What methods did people of the Middle East use to get to Europe?
5. Who were the ancestors of the first farmers? How did climate change impact their culture?
6. What were the founder crops of the Neolithic farmer?
7. How are scientists using cranial shape to develop their argument?
8. How did hunters and gatherers feel about the arrival of agriculture in Europe?
9. How did farmers change their environment?

Last Hours of the Iceman

1. How do scientist know that Otzi walked through hop hornbeam?
2. Where was Otzi found?
3. What item with Otzi signifies his importance/wealth?
4. List 3 items found with him?
5. How has the hypothesis of how Otzi dies changed over time?
6. Why do scientists believe Otzi was murdered?
7. How was the iceman's body preserved?

Dig Into History

1. Why did farming develop so much later in Egypt than in Mesopotamia?
2. Did Middle Eastern people bring farming techniques and seeds to Egypt or did farming develop independently?
3. Why did the Faiyum's farmers seem to continue a semi-mobile lifestyle, while Neolithic Mesopotamian farmers settled in towns?

Hand-Crafted Implements

Among the first items shaped by early human beings were tools. Even in the first portion of the Stone Age—the Paleolithic era—scrapers, points, and other primitive implements were fashioned from bone, horn, and pieces of flint chipped to the necessary sharpness. By the latter part of the Paleolithic era, these tools were often beautifully made, and occasionally decorated with geometric patterns or engravings of animals. Finely finished implements and ornaments have been found in the ceremonial burial plots of most early societies. There is even evidence to indicate that both the decorative and tool-making arts were taught in a systematic manner as early as the Paleolithic times.

During the Mesolithic and later Neolithic eras, tools were created by grinding and polishing where there was sandstone available for this purpose. Pottery, wooden, and woven-straw implements were also common during the later part of the Stone Age, and implements were decorated with increasing frequency.

Throughout these early stages of human tool-crafting development, it was common for a single type of implement to be used for a multitude of purposes. The knife that was used in war as a weapon was used also as a hunting tool, and again as a household implement to cut hides or meat. The same was true of scrapers, picks, chisels, and other common tools. As the materials and skill used by the artisans became more refined, during the Bronze and later Iron Age, a decorative element was increasingly added to the handles, hilts, and even to the basic shape of the axe-head and spear-point molds themselves.

Just as people have seen fit to embellish their clothing and furniture, rather than leaving them plainly functional, so too they have found it desirable to add touches of artistic beauty to the very tools and implements with which they work.

For example, this assortment of early Eskimo implements and decorative objects (Figure 18). Carved from animal tusks and horns, stone, and wood, these objects served a variety of utilitarian and ceremonial functions, but they are alike in the

excellence of their design quality. The comb at left, for example, is beautifully proportioned, and the thin line design carved into the handle relates nicely to the linear design effect of the comb's teeth. A tiny running figure appears to have been carved in the center of the comb handle, probably representing the hunter who harpooned the walrus from which the ivory was taken.

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Overcoming Fear of Fire

Lessons from the Neolithic Age

BY ROGER WOODWORTH

Some thrive. Others are lost to the ages. What makes the difference?

Ingenuity. Or, to be more precise, applied ingenuity. After all, a better idea without action is nothing.

Those more apt to succeed first assess threats based on facts. Then they apply resources in new ways to make things better. Those who do otherwise will certainly weaken and eventually fail.

To illustrate, consider this story about the first known transmission of energy.

Ingenuity for Survival

Humans in the Stone Age feared fire. Fire was mysterious and unpredictable. Like creatures in the wild, people saved themselves by running away from flames. From today's vantage point, we can see this fear was self-limiting.

Pre-historic records reveal that our ancestors from this time were hunter-gatherers, few in number, small in stature and limited to warmer climes.

As a strategy for survival, fear of fire made great sense at the time. But then someone figured out a better way. Our representative for this new era is Ötzi, the Tyrolean Iceman.

For those that haven't heard, Ötzi lost his life on a glacier in what we know today as the Otzal Alps near the Austrian-Italian border. His mummified remains were discovered by German hikers in 1991.

In an ironic twist of fate, one of those hikers later lost his own life to the same glaciers.

The South Tyrol Museum of Archaeology in Bolzano, Italy retains Ötzi for study. Carbon dating placed his time of death at about fifty-three hundred years ago, the Copper Age of the Neolithic Period.

Much about him was well-preserved. His body, the clothing he wore, the weapons and tools he carried. All these offered an unprecedented window to life in that time.

Scientists have since then pieced together a fascinating story of Ötzi's life. For example, his wounds suggest he was in a severe fight. He succumbed on the glacier, perhaps his route to escape.

Among the intriguing items found with Ötzi were two pouches. Each was crafted from rolled birch bark. The first harbored tinder and flint tools. It was a kit for starting fires.

The other was lined with maple leaves and juniper needles as insulation and contained blackened charcoal. Proof of the first known transmission of energy. Ötzi carried embers of energy as he moved from one camp to another.

Those pouches, a technology of sorts, made it safe to carry embers. And easier to restart a fire in any location. Fire for warmth and for light to settle new regions. Fire for cultivating the land for agriculture. Fire for cooking for better diets. Fire for boosting the odds of survival.

People of Neolithic times most certainly still ran from wildfire, as do we. But they did something their Stone Age predecessors did not do. They assessed the threat and reimagined what was possible.

And they figured out ways to use resources differently to make things better. They applied ingenuity to command fire to their purpose. They changed the course of life for all.

Technology as Fire

Much has changed since the Neolithic Period. What persists is our fear of uncertainties and things we don't take time to understand. Just like fire was to our Stone Age predecessors.

For example, consider the dramatic shifts in the policies and economics

Roger Woodworth, principal consultant at Mindset Matters, helps others align strategies for greater impact. Previously he was vice president and chief strategy officer of Avista Corp. He's chaired Edison Electric Institute's customer service executive advisory committee and was board president of the National Hydropower Association and the Northwest Gas Association.

Does your utility, commission, or agency run in fear of these fires?

of energy. Tally the growing number of new regulatory requirements of utilities. And pause in awe of how consumer expectations have moved.

What underpins so much change in so few years? In part, new technologies and thought leaders who reimagine and advocate ways to make energy service better.

Such tech-driven change will persist. You need not look far for new things that might alter the utility landscape. Two were in the news this past month.

The California Energy Commission is studying use of piezoelectric crystals in asphalt to get power from cars using roads. And AT&T has revealed Project AirGig, a radically better and cheaper powerline carrier technology.

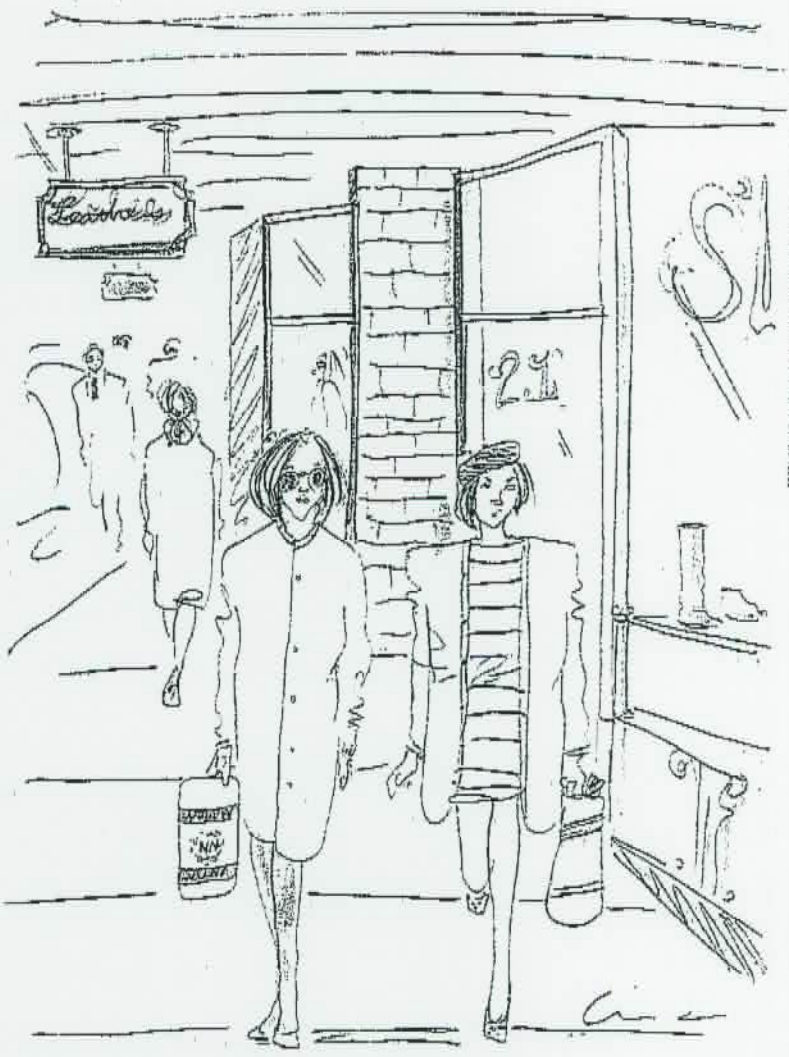
These are fires in the making.

As a leader, the choices you are making now will determine the fate of your organization. Does your utility, commission, or agency run in fear of these fires?

Will your leadership leave those who follow in a weakened state, perhaps lost to the ages? Or are you leading the way to first understand the implications of emerging technology and imagining how things could be better?

A vantage point in the future is no different than our look back from today. Those who honestly assess perceived threats are more apt to understand and command fires of any kind.

They'll be the ones best able to imagine ways to leverage new technologies with existing resources. And they'll be the ones who make things better for all. The lesson is clear. Those who apply ingenuity will thrive.



Cartoon drawn by Richard Chen. Permission granted by The New Yorker and Condé Nast.

"I took him for what he was worth, but it was all in utilities."

In the last issue of Public Utilities Fortnightly before Thomas Edison's death in 1931, PUF reported he lighted the Menlo Park grounds with gas lamps.

Cultivating revolutions: early farmers may have sown social upheavals from the Middle East to Europe
Bruce Bower
Science News. 167.6 (Feb. 5, 2005): p88. From *General OneFile.*

Full Text:

Nearly 80 years ago, the British archaeologist V. Gordon Childe championed a theory of what he called a revolution in food production during the Neolithic age. Childe proposed that hunting-and-gathering groups in the Middle East had been the first people to grow crops, raise animals for food, and live year-round in villages--around 10,000 years ago. In his scenario, farmers then spread into prehistoric Europe, where they spurred the equally revolutionary rise of modern civilization.

Childe's ideas triggered a scientific squabble over the roots of agriculture that has produced two polarized camps. Childe-friendly researchers hold that expanding populations of Middle Eastern farmers moved across Europe and replaced hunter-gatherers already living there. This massive migration is often portrayed ,as a wave of advance, in which farming populations inexorably annexed new chunks of land at a rate of about I kilometer annually as they cut a path northwest through Europe. In the process, they overwhelmed any hunter-gatherers who happened to be in their way.

A contrasting approach, which has arisen over the past 20 years, pegs the Neolithic transition to a movement largely of ideas, not people. In this scenario, European hunter-gatherers slowly adopted agricultural practices on their own or after brief encounters with encroaching Middle Eastern farmers. Thus, over millennia, the Europeans picked up farming techniques as they continued their nomadic ways. Proponents of this theory suspect that crops and livestock initially were eaten in Europe only on special occasions or during rituals.

This debate has now taken a novel turn. Some anthropologists are proposing that farmers spread from the Middle East into Europe via a convoluted series of prehistoric migrations. Those population pulses often covered much larger swaths (if land in much shorter periods than would have been possible with a single, slowly advancing wave of cultivators.

Rapid shifts to agriculture then revolutionized social life across Europe. As cultivators came to occupy the stomping grounds of people who had long thrived as hunter-gatherers, the choice became a stark one: Farm or die.

The seeds of agriculture's eventual dominance may have been sown surprisingly early. Evidence at a Stone Age site in Israel shows that the people who lived there began to lay the groundwork for farming at least 23,000 years ago, although crop cultivation in that region didn't begin until roughly 13,000 years later. Agriculture's ancient forerunners gathered and ate seeds from grasses and wild cereals such as wheat and barley (Sr: 7/24/04, p.61), as a substantial part of their diets. These Stone Age people didn't plant seeds, though.

Archaeological finds indicate that as conditions became colder and drier between 11,000 and 10,200 years ago, Middle Eastern groups that had founded large settlements a few millennia earlier left those outposts for a mobile, foraging lifestyle. When the weather finally turned warmer and wetter, they quickly built villages and cultivated an array of crops.

According to the new theories on agriculture's roots, this is when crop-savvy populations in the East launched a succession of small-scale treks into Europe. They often sailed vessels along the northern Mediterranean coast before reaching islands such as Cyprus or heading up major rivers such as the Danube. In some regions, farmers replaced hunter-gatherers; in other areas, natives and newcomers lived side by side.

Around 6,000 years ago, farming reached northwestern Europe and quickly reshaped the social landscape. Within a century or two, the farmers' way of life became dominant. Many hunter-gatherers who had long inhabited the region faced a wrenching change as they adopted the strange new culture of agriculture.

"The idea that foragers made a seamless, gradual transition to farming is unrealistic and has no sound evidence to support it," says Harvard University archaeologist Ofer Bar-Yosef, who contributed to a special supplement of the Aug.-Oct. 2004 Current Anthropology on the topic of agricultural revolutions of Neolithic Europe and the Middle East. Those transformations triggered the growth of complex societies and religious beliefs, Bar-Yosef contends.

GAME FOR CHANGE The immediate ancestors of the first farmers in the Middle East belonged to the Natufian culture, which lasted from about 12,800 to 10,200 years ago. The remains of game animals at four Natuflail sites in Israel provide clues to what was apparently a bumpy transition to agriculture, says anthropologist Natalie D. Munro of the University of Connecticut in Storrs.

Throughout much of their existence, Natufians avidly hunted gazelle as well as small animals such as tortoises, partridges, and hares. Natufians inhabited permanent settlements or base camps in numbers large enough to necessitate hunting a wide

variety of animals, in Munro's view.

The Natufians' hunting preferences changed around 11,000 years ago, as an 800-year stretch of cold, dry weather winnowed the populations of many animals in their home regions. Natufian numbers also fell with the temperature, Munro proposes. The region's inhabitants, who had congregated in large settlements, returned to their old ways of foraging from a series of temporary camps. Animal remains at these sites bolster that scenario, indicating that ancient residents still ate gazelle when they could find them, but that small prey had disappeared from their menu.

As many Middle Easterners had done for millennia, the Natufians continued to collect and eat wild cereals. Intimate knowledge of these plants and their growing seasons set the stage for cultivation, says Munro. "When climatic conditions improved around 10,000 years ago, cereal agriculture was adopted immediately," she contends.

Emily L. Jones of the University of Washington in Seattle calls this theory "an elegant and realistic alternative" to the assumption by many Childe-influenced researchers that people stabilized food supplies amid harsh weather by moving directly from foraging to farming.

Brian Hayden of Simon Fraser University in Burnaby, British Columbia, suspects that social and political changes, not climate change, prompted the move to agriculture in the Middle East. He notes that during the cold, dry conditions, Natufians apparently organized hunting parties to nab gazelles. This indicates that communities still needed to feed large numbers of people, Hayden says. Meat was primarily consumed at ritual feasts, in his view. Prehistoric Native Americans often hunted to stock up on meat for feasts, he notes.

As climate conditions improved, expanding Natufian societies eventually became laboratories of agriculture and animal domestication, Hayden theorizes.

WESTWARD HO After thus sprouting on the Mediterranean's eastern edge, agriculture set in motion the search for new expanses of land, according to the latest thinking. Early farmers had no master plan for migrating into Europe. Different groups simply moved into the continent in a haphazard fashion.

One new line of evidence for such migrations comes from an analysis, directed by Sue Colledge of University College London, of preserved crops and weeds at early farming sites. Colledge's team examined data from 166 sites in the Middle East and Europe, many of which have been dated to the agricultural transition period.

So-called founder crops of Neolithic farmers appeared more than 10,000 years ago in the Middle East, according to Colledge's team. These crops consisted of three domesticated cereals--emmer, einkorn, and hulled barley--together with flax and four bean varieties--lentil, pea, bitter vetch, and chickpea.

Over the next 3,000 years, local variations on this basic crop repertoire appeared in central Turkey and then in Cyprus, Crete, and Greece. Agricultural colonists of those areas must have transported grains that they then sowed in fields cleared of wild plants, Colledge asserts. Unlike the weed-strewn farming sites in the Middle East, European sites reveal remains of few weeds.

An increasingly varied set of crops moving from east to west, as documented by Colledge's team, suggests that the migration of early farmers "was not an organized one but more like an infiltration from all parts of the core to all parts of the new area," remarks Mehmet Ozdogan of Istanbul (Turkey) University.

A new analysis of human skulls excavated at various Neolithic settlements throws an anatomical spotlight on farmers' infiltrations into Europe. Two British researchers, Ron Pinhasi of the University of Surrey Roehampton in London and Mark Pluciennik of the University of Leicester, measured and compared the shapes of 231 adult skulls from 54 sites in the Middle East and Europe.

Initial farming groups in the Middle East and Turkey differed considerably from each other in cranial shape, Pinhasi and Pluciennik find. Signature physical traits in prehistoric communities across that region reflect the growth of largely independent agricultural populations, they assert.

A small core of cultivators from central Turkey first took agriculture westward, the researchers propose. Striking anatomical similarities link early farmers in central Turkey to people who, around 8,000 years ago, began growing crops in Greece and nearby parts of southeastern Europe.

Agriculture then gradually caught on in Mediterranean regions farther to the west, as local foragers mingled with various bands of incoming farmers, Pinhasi and Pluciennik contend. This process yielded many variations in cranial shape among these farmers as well as some commonalities between their skulls and those of hunter-gatherers who lived in the region, they say.

The new cranial findings are consistent with many simultaneous incursions of farmers into Europe, remarks Joao Zilhao of the Portuguese Institute of Archaeology in Lisbon. In 2001, Zilhao's analysis of farming settlements in western Europe indicated that the

mostsecurely dated ones were built in a period lasting just 100 years or so approximately 7,400 years ago. From that narrow window of time, he estimates that it took no more than six generations for farming to spread to Portugal from what's now central Italy. Only colonists who sailed vessels along the Mediterranean coast and up European rivers could have settled such a vast area so rapidly, in Zilhao's opinion.

In the past several years, other researchers have uncovered a geographic patchwork of genetic types among modem Europeans. These researchers have generally interpreted this evidence as reflecting the replacement of Neolithic hunter-gatherers by many different groups of farmers. Such genetic data could instead have resulted from breeding within geographically isolated populations of both hunter-gatherers and farmers, Pinhasi and Pluciennik caution. That possibility would support the gradual-change scenario.

A NEW WORLD Agriculture's spread may have ignited social revolutions from southeastern Europe to the continent's northwestern fringes. Archaeological evidence now shows that, about 6,000 years ago, a village lifestyle of farming and animal raising swept through what are now England, Ireland, and southern Scandinavia, says Peter Rowley-Conwy of the University of Durham in England.

"The rapidity of change must have been traumatic for hunter-gatherers who inhabited those regions," he says. "Agriculture's appearance in northwestern Europe represented a massive social and economic wave of disruption."

Rowly-Conwy's view clashes with a theory popular among archaeologists, many of whom regard Neolithic farm life as having gradually emerged among local hunter-gatherers throughout much of Europe. As these people grew more numerous and expanded their efforts to obtain food, social classes formed and new religious beliefs appeared, according to this view. That led to early attempts to cultivate fields as well as the construction of ceremonial structures and elaborate graves beginning around 6,000 years ago.

However, no archaeological finding indicates that hunter-gatherers in northwestern Europe gradually increased in numbers or in social complexity, Rowley-Conwy asserts. Various lines of evidence instead suggest that agricultural settlements sprang up at that time throughout northwestern Europe, he says.

Newly arrived farmers first felled trees in small patches of forest. In clearings framed by stone walls, they built wooden houses, cultivated fields, and raised animals for meat and dairy products (SN: 2/1/03, p. 67). Northwestern Europe's hunter-gatherers took up farming, fled the region, or starved, Rowley-ComEr proposes.

He notes that at least 175 wooden houses dating to between 6,000 and 4,000 years ago have now been identified in England, Ireland, Denmark, and southern Sweden. The remains of one or more houses typically are among the vestiges of stone walls, irrigation ditches, and tilled fields. Many of the prehistoric dwellings include storage areas holding cultivated cereal grains and remnants of foraged foods such as hazelnuts and wild apples.

Other finds suggest that a similarly rapid move to agriculture occurred farther south, along the coast of what's now Portugal and Spain, says Lawrence G. Straus of the University of New Mexico in Albuquerque.

Still, the evidence cited of agricultural revolutions in Europe draws criticism. For instance, Julian Thomas of the University of Manchester in England doubts that anyone lived in the ancient structures labeled as houses by Rowley-Conwy. Many burned down, probably as part of a Neolithic practice of torching ceremonial buildings that held special foods such as cereal grains and cattle meat, Thomas theorizes. That fits with the theory, of agriculture being slowly incorporated into hunter-gatherer culture.

Despite the wealth of new data, Childe's agricultural revolution continues to stand on contested ground.

Bower, Bruce

Last hours of the Iceman: in 1991 the frozen body of a man who lived 5,300 years ago emerged from a melting glacier in the Alps. New forensic evidence reveals that he was killed by an arrow to the back, possibly during an ambush
Stephen S. Hall
National Geographic. 212.1 (July 2007): p68. From *General OneFile.*

Full Text:

It was late spring or early summer, when a modest tree called the hop hornbeam unfurls bright yellow clusters of flowers in the steep valleys that run north into the mountains now known as the Italian Alps. The man hurried through a forest he knew well, wincing from the pain in his injured right hand and pausing occasionally to listen for sounds that he was being pursued. As he fled up the slope, the yellow pollen of the hornbeam blossoms fell like an invisible rain, salting the water and food he consumed when he stopped to rest. Five thousand years later, the Neolithic hunter we call the Iceman would still bear traces of this ancient dusting inside his body--a microscopic record of the time of year it was when he passed through this forest and into the nearby mountains, where fate would finally catch up with him.

Since hikers discovered his mummified corpse in 1991 in a rocky hollow high in the Otztal Alps on Italy's border with Austria, scientists have used ever more sophisticated tools and intellectual cunning to reconstruct the life and times of the Iceman (or "Otzi"), the oldest intact member of the human family. We know that he was a small, sinewy, and, for his times, rather elderly man in his mid-40s. Judging from the precious, copper-bladed ax found with him, we suspect that he was a person of considerable social significance. He set off on his journey wearing three layers of garments and sturdy shoes with bearskin soles. He was well equipped with a flint-tipped dagger, a little fire-starting kit, and a birchbark container holding embers wrapped in maple leaves. Yet he also headed into a harsh wilderness curiously under-armed: The arrows in his deerskin quiver were only half finished, as if he had recently fired all his munitions and was in the process of hastily replenishing them. And he was traveling with a long, roughly shaped stalk of yew--an unfinished longbow, yet to be notched and strung. Why? (Continued on page 76)

The world's best studied mummy holds clues to life in the Stone Age-and maybe a lethal rivalry.

When it comes to the Iceman, there has never been a shortage of questions, or theories to answer them. During the 16 years that scientists have poked, prodded, incised, and x-rayed his body, they have dressed him up ill speculations that have not worn nearly as

well as his rustic garments. At one time or another, he has been mistakenly described as a lost shepherd, a shaman, a victim of ritual sacrifice, and even a vegan. But all these theories fade in the face of the most startling new fact scientists have learned about the Iceman. Although we still don't know exactly what happened up there on that alpine ridge, we now know that he was murdered, and died very quickly, in the rocky hollow where his body was found.

"Even five years ago, the story was that he fled up there and walked around in the snow and probably died of exposure," said Klaus Oeggl, an archaeobotanist at the University of Innsbruck. "Now it's all changed. It's more like a paleo crime scene."

THE OBJECT OF ALL THIS intense scientific attention is a freeze-dried slab of human jerky, which since 1998 has resided in a refrigerated, high-tech chamber in the South Tyrol Museum of Archaeology in Bolzano, Italy. The temptation to conduct fresh experiments on the body rises with every new twist of technology, each revealing uncannily precise details about his life. Using a sophisticated analysis of isotopes in one of the Iceman's teeth, for example, scientists led by Wolfgang Muller (now at the Royal Holloway, University of London) have shown that he probably grew up in the Valle Isarco, an extensive north-south valley that includes the modern-day town of Bressanone. Isotope levels in his bones, meanwhile, match those in the soil and water of two alpine valleys farther west, the Val Senales and the Val Venosta. Muller's team has also analyzed microscopic chips of mica recovered from the Iceman's intestines, which were probably ingested accidentally in food made from stone-ground grain; geologic ages of the mica best match a small area limited to the lower Val Venosta. The Iceman probably set off on his final journey from this very area, near where the modern-day Adige and Senales Rivers meet.

We also know that he was not in good health when he headed up into the mountains. The one surviving fingernail recovered from his remains suggests that he suffered three episodes of significant disease during the last six months of life, the last bout only two months prior to his death. Doctors inspecting the contents of his intestines have found eggs of the whipworm parasite, so he may well have suffered from stomach distress. But he was not too sick to eat.

In 2002, Franco Rollo and colleagues at the University of Camerino in Italy analyzed tiny amounts of food residue from the mummy's intestines. A day or two before his death, the Iceman had eaten a piece of wild goat and some plant food. The same analysis revealed that his very last meal was red deer and some cereals. The archaeobotanist Klaus Oeggl has concluded from bran-like food residues that the Iceman's diet also included the primitive form of wheat known as einkorn as well as barley, found on his garments, indicating that the Neolithic settlements south of the/kips where he lived cultivated these grains. Oeggl has even found that the small size of the wheat fragments in the gut, along with tiny flecks of charcoal, suggest that the grains

were ground and then baked as primitive bread in open fires.

Archaeobotanists have used equally clever analyses of pollen and plant fragments to plot the Iceman's last movements. James Dickson of the University of Glasgow has identified no less than 80 distinct species of mosses and liverworts in, on, or near the Iceman's body. The most prominent moss, Neckera complanata, still grows at several sites in the valleys to the south, in some cases quite near known prehistoric sites. According to Dickson, a clot of stems found in the Iceman's possession suggests he was probably using the moss to wrap food, although other ancient peoples used similar mosses as toilet paper.

Taken together, the evidence strongly indicates that the Iceman's last journey began in the low-altitude deciduous forests to the south, in the springtime when the hop hornbeams were in bloom. But it may not have been a straight hike into the mountains. Oeggl has also found traces of pine pollen in the Iceman's digestive tract, both above and below the hornbeam pollen. This suggests that he may have climbed to a higher altitude where pine trees grow in mixed coniferous forests, then descended to the lower altitude of the hop hornbeams, and finally ascended again into the pine forests in his last day or two. Why? No one knows. But perhaps he wanted to avoid the steep, thickly wooded gorge of the lower Val Senales—especially if he was in a hurry.

When he reached a mountain pass now known as Tisenjoch, he likely paused to rest. He had completed a vertical climb of 6,500 feet from the valley below, and to the north faced a desolate, glacier-riven landscape. Perhaps the rocky hollow where he found himself offered some shelter from the wind. We do not know if his enemies caught up with him at that spot, or were waiting there in ambush for him to arrive. What we do know is that he never left that hollow alive.

IN JUNE 2001, Paul Gostner, director of the Department of Radiology at the Central Hospital in Bolzano, brought a portable x-ray machine to the Iceman's chamber. His intent was to prepare for a routine analysis of some broken ribs. The following day he dropped by the office of Eduard Egarter Vigl, director of the Institute of Pathology at the hospital and principal caretaker of the mummy, to report that the rib fractures were old and of limited interest.

"But I've found another thing that I can't explain," he said. "There is this strange extraneous object in the left shoulder." When he compared his recent x-rays (and CT scans taken three months earlier) of the Iceman's torso with earlier films taken by scientists in Innsbruck, Gostner managed to detect what his Austrian colleagues had missed: a dense triangular shadow smaller than a quarter and lodged beneath the Iceman's left shoulder blade. It turned out to be a stone arrowhead. This "casual discovery," as Egarter Vigl put it, instantly turned an inexplicable death more than 5,000

years ago into archaeology's most fascinating cold case. The forensic evidence became even more intriguing in 2005, shortly after the hospital in Bolzano acquired a new high-resolution multi-slice CT scanning machine. Gostner, Egarter Vigl, Patrizia Pernter, a physician in the Department of Radiology, and Frank Ruhli, a doctor and senior lecturer in anatomy at the University of Zurich, decided to take a closer look at the body with the new CT machine. In August 2005, doctors placed the Iceman on a custom-built foam mattress, covered him with an insulated blanket and heaps of ice, and rushed him by ambulance (with a police escort) on the ten-minute ride from the museum to the hospital. There, with the kind of urgency usually reserved for humans in critical condition, they whisked the mummy into the scanning suite and quickly took a series of scans. "You had to do it before he thawed," Ruhli noted, "so you had to hurry."

The results were astonishing. The sharpened piece of stone, probably flint, had made a half-inch gash in the Iceman's left subclavian artery. This is the main circulatory pipeline carrying fresh oxygenated blood from the pumping chamber of the heart to the left arm. Such a serious tear in a major thoracic artery would almost certainly lead to uncontrolled bleeding and rapid death. "This is a lethal wound," Ruhli says. "It was pretty quick. With this kind of bleeding, you don't go walking uphill for hours."

This new medical evidence suggests that an attacker, positioned behind and below his victim, fired a single arrow that struck the Iceman's left shoulder blade—precisely the area at which prehistoric hunters aimed to bring down game with one shot. The arrow went clean through the bone and pierced the artery. Blood instantly began to gush out, filling the space between the shoulder blade and the ribs. In his few remaining minutes of life, the Iceman became a textbook case of what is now known as hemorrhagic shock. His heart started to race. Sweat drenched his garments, even at an altitude two miles above sea level. He felt increasingly faint because not enough oxygen was reaching his brain. In a matter of a few minutes, the Iceman collapsed, lost consciousness, and bled out.

Then, in a fantastically fortunate cascade of circumstance, the brutal weather of the Otztal Alps conspired with chance to perform one of the greatest embalming jobs in the history of human remains. The frigid glacial environment eventually tucked him in like a cold, wet blanket, immobilizing and preserving his body in snow, ice, and glacial meltwater. The little ravine protected his lifeless form from the bone-grinding action of the Niederjoch Glacier, which passed just a few feet overhead for the next 5,300 years.

WHO KILLED THE ICEMAN, and why? Was this a Neolithic version of highwaymen ambushing a hunter and snatching his catch? Or was he stalked and killed by a person, or persons, who knew him? Experts now believe that the mystery may hinge on a bizarre detail of the crime scene. The shaft of the fatal arrow was nowhere to be found. Someone must have pulled it out, leaving behind the stone arrowhead lodged in his

body.

"I believe--in fact, I am convinced--that the person who shot the Iceman with the arrow is the same person who pulled it out," says Egarter Vigl. In an article that appeared this May in the German archaeology magazine Germania, Egarter Vigl and his colleagues noted that telltale markings in the construction of prehistoric arrows could be used to identify the archer much in the way that modern-day ballistics can link a bullet to a gun. They argue that the Iceman's killer yanked out the arrow shaft precisely to cover his tracks. For similar motives, Egarter Vigl reasons, the attacker did not run off with any of the precious artifacts that remained at the scene, especially the distinct copper-bladed ax; the appearance of such a remarkable object in the possession of a villager would automatically implicate its owner in the crime.

Other, more controversial research has suggested that this final mortal blow may have been preceded by fierce, hand-to-hand combat. The late Tom Loy, a molecular archaeologist at the University of Queensland in Australia, claimed in 2003 that human blood from no less than four separate individuals had been identified on the Iceman's garments and weapons. But Loy's research has been aired only in media accounts, and skeptics in the academic community say the claims are impossible to assess until they are published in the scientific literature.

Nonetheless, the idea that the Iceman was attacked by more than one person complements the "theory of the crime" proposed by Walter Leitner, an archaeologist at the University of Innsbruck who is an expert in both archery and Stone Age culture. He believes the bloody mountaintop confrontation was the denouement of a political dispute that began down in the valley, where rivals within the Iceman's own tribe tried to assassinate him. A microscopic analysis of the Iceman's hand wound, and the fact that it had begun to close and heal, suggests that it occurred well before the final mortal blow. "So there must have been some fight, some kind of battle, at least one day--and perhaps even two or three days--earlier," said Egarter Vigl. "The time had come where his opponents had become stronger," Leitner speculates, "but he didn't recognize that his reign was coming to an end and was holding on to his position." Leitner says that after the fight in the village, "It looks as if the Iceman was planning to flee and that his trip was brought to an end by his opponents."

The previous, erroneous theories about the Iceman's demise remind us that much of the current speculation, while plausible, must stand up in the face of continuing research. Above all, this tale of an enigmatic and bloody death atop a desolate alpine ridge is a story about remarkable scientific insight brought to bear on the skimpiest of clues--a fingernail here, a milligram of food residue there, a few grains of pollen--in order to reconstruct a riveting scene of Neolithic noir. Although not a single grunt or cry has passed through the Iceman's mummified lips in more than 5,000 years, the ongoing investigation continues to tell us new and startling things about life--and death--in the

Stone Age.

Inside the Iceman Get an update on the life and death of this Neolithic hunter in an interactive exploration of his remains at ngm.com/0707.

Art by Kazuhiko Sano

Hall, Stephen S.

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What the excavations reveal
Emily Abbink
Dig Into History. 16.7 (Sept. 2014): p11. From *General OneFile*.

Full Text:

When most of us think of ancient Egypt, pyramids, sphinxes, and powerful kings come to mind. But Egypt's history reaches back much further into the Neolithic, or New Stone Age, which is long before mighty rulers and gigantic public buildings. The Neolithic was a period of worldwide development in human technology and society. It marked the beginnings of farming, herding, permanent settlements, and the gradual shift from stone to metal (copper, bronze, and iron) tools. It began in Mesopotamia, the area we know today as the Middle East, around 10,000 B.C. However, the Neolithic did not appear in Egypt until much later--around 6,000 B.C. This was some 3,000 years before the time of kings and pharaohs.

LOOKING FOR EVIDENCE

The earliest archaeological V evidence of Egyptian Neolithic activity is farming, and it was found in the Faiyum Oasis. In 1926, archaeologist Gertrude Caton-Thomas and geologist Elinor Gardner discovered more than 50 well-preserved, basket-lined storage pits or granaries that had been used to store barley, wheat, and flax. The granaries range in size from 59 to 12 inches in diameter by 35 to 12 inches deep. These were found between faint traces of two Neolithic settlements called Kom K and Kom W. The ancient granaries, dating from around 5600 B.C., represent the earliest-known indication of Egyptian production of grain. And it was this ability to grow and market grain that would lay the foundations for Egypt's wealth and power on an international scale.

[ILLUSTRATION OMITTED]

In the 1970s and 1980s, archaeological investigations near the Neolithic granaries located many more pits and hearths. Digs also uncovered many remains of lithic (stone) tools, pottery shards, and grinding tools. Such finds offer further evidence of settlement activity for Kom K and Kom W. No burials or evidence of houses or other permanent buildings were found. Both Kom K and Kom W were located on the lakeside, which offered access to a great variety of plant and animal food. The hearths did contain plant seeds and pollen, as well as the bones of sheep, goats, cattle, turtles, fish, water birds, and crocodiles.

WHAT THE STORAGE PITS SAY

In recent years, archaeologists from the URU Faiyum Project have discovered that many of the granaries had sturdy, sealable lids made of concrete-like clay. Evidence of permanent mud-brick dwellings, such as those found in earlier Neolithic Mesopotamian farming settlements, has yet to be found. Instead, the many well-sealed, hidden storage pits suggest that the Faiyum's Neolithic peoples were far less sedentary than the earlier people in the Tigris and Euphrates valley. This is to say that they stored and hid their harvested crops while still moving seasonally to take advantage of local wild plants and animals. Instead of stone or mud-brick houses, they probably lived in easily assembled, tent-like structures made of woven linen or rushes that allowed mobility.

The inhabitants of the Faiyum produced large numbers of quickly made and highly functional, all-purpose, flaked-stone tools. Bone, ivory, and wood—all easy to carry and easily worked--were also used for hunting points and fishing harpoons.

The lack of permanent architecture, along with the presence of serviceable, lightweight, easily made and replaceable tools and ceramics, offers evidence that the Faiyum's agricultural settlements were semi-permanent. If so, they could not be the foundations of major settled cities, as seen in Mesopotamia. The Faiyum's artifacts indicate small, mobile communities that focused on farming, herding, hunting, and fishing to survive. They do not suggest settlements whose people concerned themselves with social status, marketable products, or advanced farming skills, all of which accompanied Neolithic agriculture in the Middle East.

THE WEATHER FACTOR

After 4000 B.C., toward the end of Egypt's Neolithic, The Faiyum experienced a dry period. As a result, many residents moved east to the Nile. The fertile, well-watered soil that bordered the Nile River soon formed the basis for Egypt's powerful royal kingdoms, armies, and cities. While later rulers built temples, pyramids, and other acclaimed structures, it seems that the Faiyum had no permanent settlements until the arrival of the Greeks around 300 B.C. It was then that Greek officials re-settled the Faiyum, building permanent houses and cities and expanding agriculture. In the centuries that followed, the Faiyum Oasis continued to provide food, up through the later Roman Empire. Today, it remains an important agricultural area, producing cereals, cotton, figs, grapes, and olives.

URU is an acronym for university of California Los Angeles, Rijksuniversiteit Groningen in the Netherlands, and University of Auckland in Australia.