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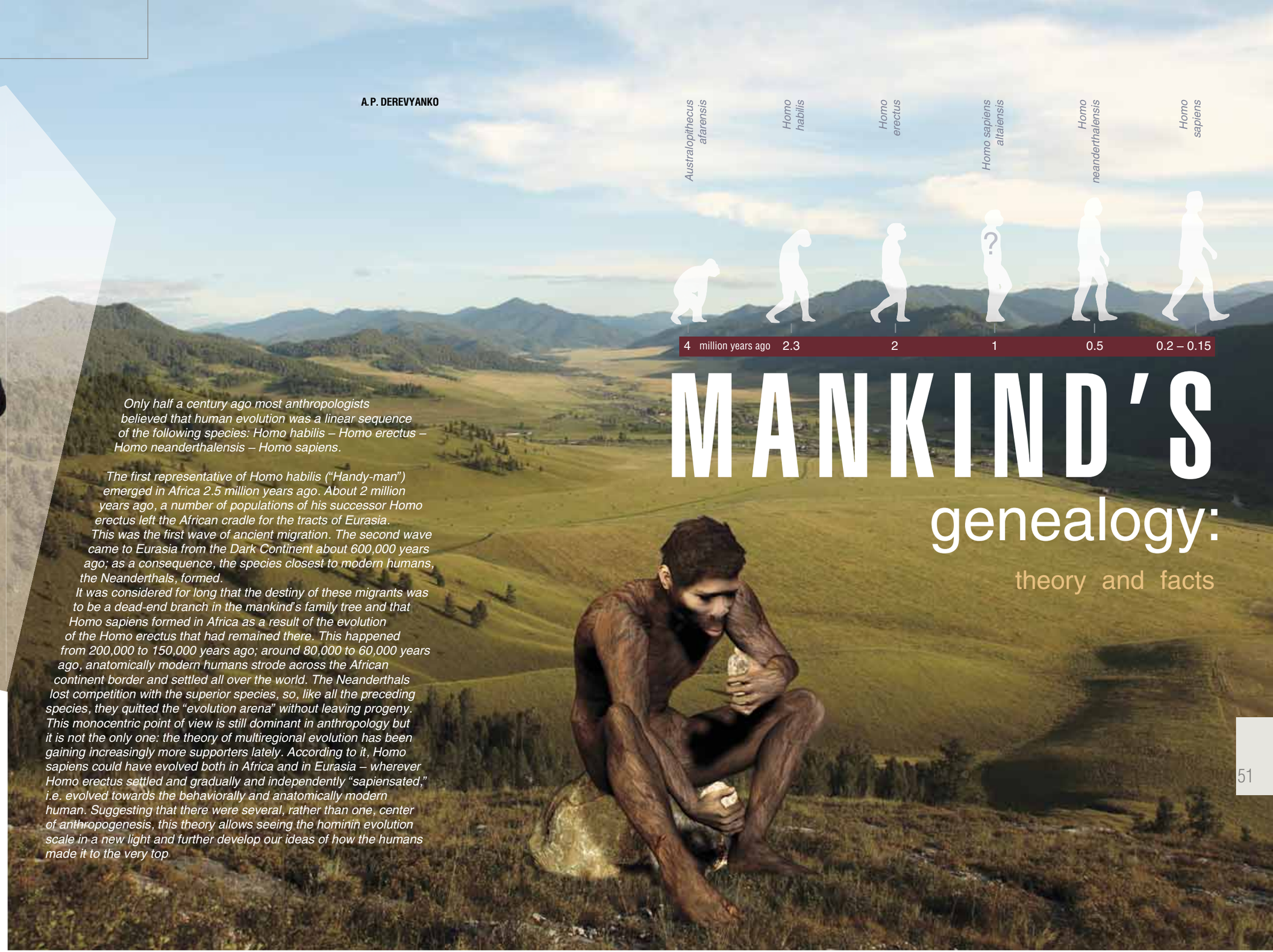

MANKIND'S genealogy:

theory and facts

Only half a century ago most anthropologists believed that human evolution was a linear sequence of the following species: Homo habilis – Homo erectus – Homo neanderthalensis – Homo sapiens.

The first representative of Homo habilis ("Handy-man") emerged in Africa 2.5 million years ago. About 2 million years ago, a number of populations of his successor Homo erectus left the African cradle for the tracts of Eurasia. This was the first wave of ancient migration. The second wave came to Eurasia from the Dark Continent about 600,000 years ago; as a consequence, the species closest to modern humans, the Neanderthals, formed.

It was considered for long that the destiny of these migrants was to be a dead-end branch in the mankind's family tree and that Homo sapiens formed in Africa as a result of the evolution of the Homo erectus that had remained there. This happened from 200,000 to 150,000 years ago; around 80,000 to 60,000 years ago, anatomically modern humans strode across the African continent border and settled all over the world. The Neanderthals lost competition with the superior species, so, like all the preceding species, they quitted the "evolution arena" without leaving progeny. This monocentric point of view is still dominant in anthropology but it is not the only one: the theory of multiregional evolution has been gaining increasingly more supporters lately. According to it, Homo sapiens could have evolved both in Africa and in Eurasia – wherever Homo erectus settled and gradually and independently "sapiensated," i.e. evolved towards the behaviorally and anatomically modern human. Suggesting that there were several, rather than one, center of anthropogenesis, this theory allows seeing the hominin evolution scale in a new light and further develop our ideas of how the humans made it to the very top

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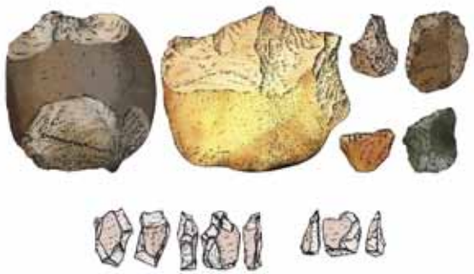
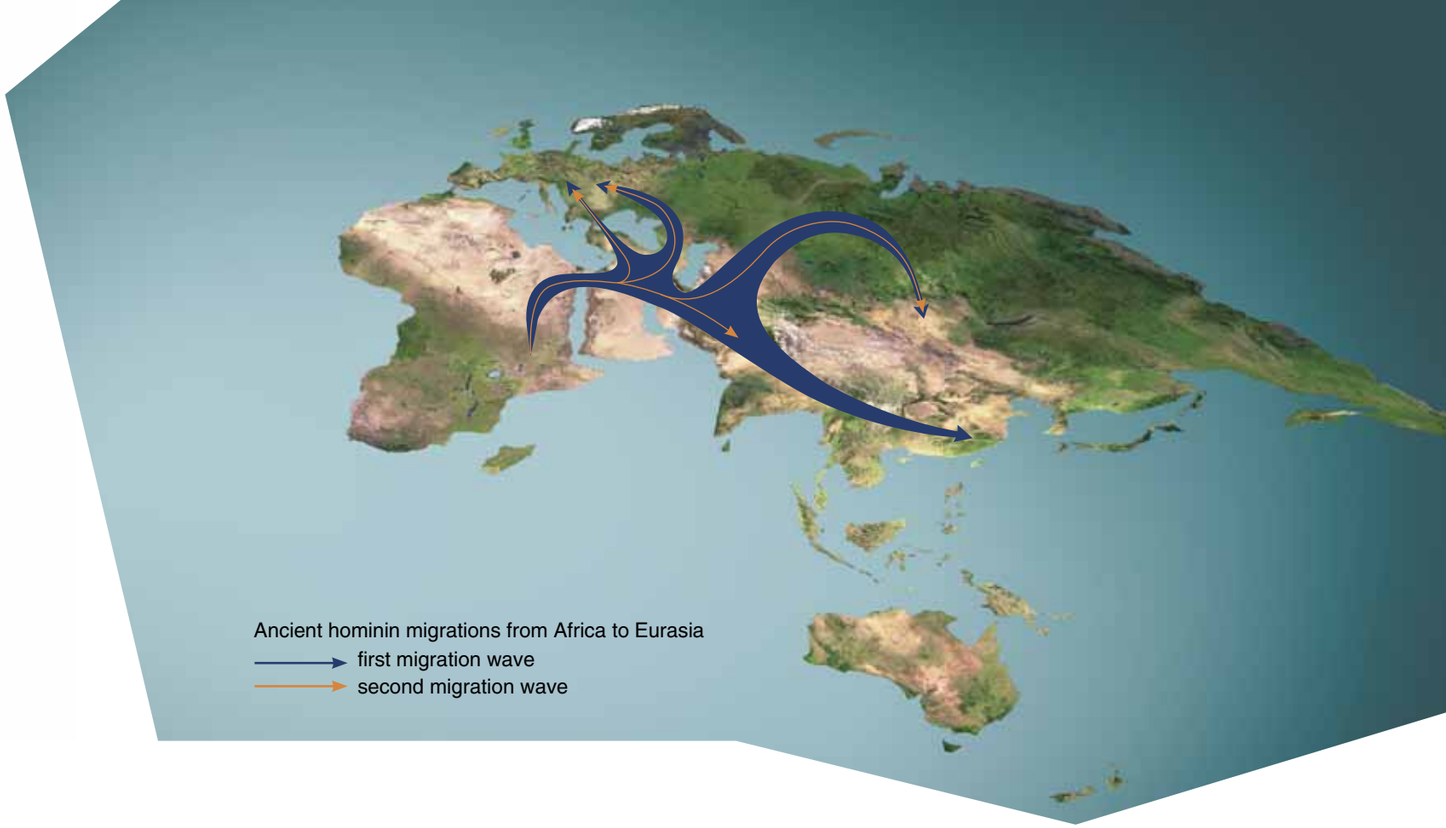


The most ancient tools are massive pebbles with a chopped off top or edge (Oldowan industry)

Tools of the “advanced” Acheulean industry (biface stone processing)

Very few bone relics of ancient hominins have been found so far. The basic materials archaeologists deal with are stone tools. Their examination allows us to trace the improvement of lithic industry and development of human intellectual abilities



It goes without saying that our ancestral home is Africa, as evidenced by archaeological, anthropological, and paleogenetic data. The oldest stone tools on the Earth were found in Africa, near the Kada Gona River. Their age is about 2.5 million years.

The branching of our distant ancestral line into *Homo sapiens* and anthropoid apes happened in Africa, from 7 to 6 million years ago. The most probable reason behind this division must have been the global climate change that occurred in the beginning of the Pleistocene: the Earth became drier and cooler, and tropical forests in Africa, especially on highlands and plateaus, gave way to savannas.

Open space made the primates to adjust their survival strategies: they had to become bipeds (learn to move on two legs) and consume more protein-containing foods. Some primates succeeded – *Australopithecus*, the ancestor of the first human, evolved.

From Africa to all over the world

About 2 million years ago, the most ancient human populations began settling all over the world. It took them a million years to occupy a large part of Eurasia, from the Middle East and Europe to the Pacific Ocean. The way of the first migrants is marked by findings of primitive stone tools, known as Oldowan. About 600,000 years ago, the second migration wave came from Africa to Eurasia. It spread a more advanced technology, the so-called Acheulean industry. The new migrants from Africa basically followed the routes of their predecessors but, unlike them, they did not penetrate to the east of Mongolia and India. Artifacts discovered at hundreds of Paleolithic sites in China testify that this area had its own tool-making industry. During the million years since the first migrations, hominins developed there continuously, without any critical changes or influences. The natural result of this development was the emergence, from 50,000 to 30,000 years ago, of the Upper Paleolithic – the culture associated with anatomically modern humans.

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From Africa to Eurasia hominids must have got by chance. Because of the general recession of the Ocean level, 2 million years ago in the place of the Bab el Mandeb there was a land corridor that joined Africa and the Arab peninsular. Animals migrated along it, and some of the *Homo erectus* populations followed their route, leaving their native land and thus penetrating to Eurasia.

The new continent was being settled very slowly. No traces of the first migration wave have yet been discovered in the Middle East or Arabia; however, the discovery of the Dmanisi site in East Georgia suggests that ancient people came to the Caucasus 1.8 million years ago.

The North Caucasus and its cross-border regions (the Taman Peninsular and Azov region) could have been transit areas during the settlement of southeastern Europe. This way was not the only one though. When the Ocean level was at its lowest, humans could have made it from Africa through Gibraltar to Spain, through Sicily to Italy, and through the Middle East and Asia Minor to the Balkans.

Recent archaeological discoveries suggest yet another way to Europe: through the western Caspian shore and the eastern shore of the Black Sea. In any event, the erectus found their way to the European part of the continent. Atapuerca (Northern Spain) findings establish that this happened about 1.2 million years ago.

With time, the migration wave advancing eastward was to come across an insurmountable obstacle – the Tibet and Himalayan Mountains. Going round them, it forked and followed two paths: the northern and the southern.

Traces of the southern path have been discovered in Pakistan, India, China, and Southeast Asia. In Pakistan (the Rivat site) stone tools were found whose age, as determined by paleomagnetic dating, is 1.9 million years. The Java findings (1.8 and 1.6 million years supposedly) indicate that ancient hominin populations reached the Pacific Ocean.

The archaic hominin sites discovered in Central Asia and southern Siberia prove that the northern migration path went there. Ancient pebble assemblages on the Mangyshlak Peninsular and in the Karatau mountains testify that this happened from 800,000 to 600,000 years ago.

The Paleolithic site of Karama uncovered in the Altai in 2001 indicated the same period: from 800,000 to 600,000 years ago.

At about the same time, the second wave of hominin migration from Africa reached Eurasia. It propagated a new, more advanced tool-making technology – the so-called Acheulean industry, or biface stone processing.

Who were these new migrants? Probably, *Homo heidelbergensis* – a new human species that formed in Africa and combined both Neanderthal and sapiens features.

The oldest bifaces (stones chopped off on both sides) in Europe found in the Carpentier quarry are dated 600,000 years ago; in Asia Minor, India, Turkmenia, and Kazakhstan, the biface age is from 300,000 to 350,000 years ago. In the east, this wave propagated only as far as Mongolia and India. Those regions had developed their own industry since the first migration

The first archaic hominin populations reached Gorny Altai no later than 800,000 years ago. Testifying to this are the stone tools uncovered on the Karama site. They belong to the early Paleolithic pebble industry – more ancient than the Denisova Cave industry. Fourteen kilometers and almost half a million years separate them. Studies of Karama occupation layers have provided evidence that this site is the most ancient not only for the Altai but also for the entire North Asia

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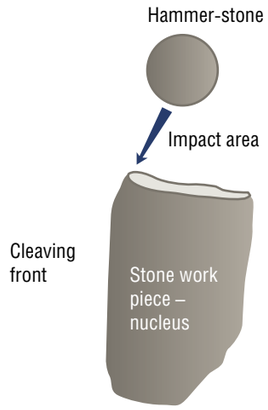


Experimental stone splitting by an ancient technique

A similar example of successive, continuous development of the material culture was discovered in southern Siberia, in Gorny Altai. The Denisova Cave Paleolithic site has demonstrated gradual development of local industry from 300,000 years back. This development continued throughout the Middle Paleolithic and ultimately generated the culture that can be classified, based on all its properties, as Upper Paleolithic.

All these data contradict the monocenrists' statement to the effect that *Homo erectus* populations who had settled in Eurasia disappeared without leaving offspring. Any theory should be based on facts, and the facts indicate that during the hundreds of thousands of years after the first Eurasian settlements Homo erectus populations continued to develop and improve their tool-making skills.

Obviously, over this vast territory the process occurred in a variety of forms depending on the given natural and climatic conditions. The environment made people work out an adaptive strategy that would provide the most comfortable existence within a certain ecological niche. Why populations inhabiting East Asia or southern Siberia could not have developed their own stone-processing techniques? They were certainly different from African, but this did not make them less advanced.

There is no question that each of the three areas – African, Eurasian, and East-Asian – had its own cultural traditions and its own models of transition from the Middle Paleolithic to Upper Paleolithic.

Multi-layered chronicle

In the thirty years of fieldwork in the Altai, researchers of the Institute of Archaeology and Ethnography SB RAS have studied over 20 multi-layered sites placed close to one another. These revealed more than 70 cultural horizons dated from the Lower, Middle and the very beginning of the Upper Paleolithic. The chronological period most important for researchers – from 100,000 to 30,000 years ago, when in different points of the planet the shift from the Middle Paleolithic to the Upper Paleolithic was taking place – is represented by 60 horizons. Virtually no other site has a comparable number of horizons referring to this period.

The Altai Paleolithic is being examined comprehensively. Apart from archaeologists and anthropologists, these studies involve geologists, geomorphologists, paleobotanists, paleontologists, geophysicists, and geochronologists. This multidisciplinary approach has resulted in an exhaustive study of human material culture and habitat starting from 800,000 years ago.

To this time refer the first evidences of erectus, who had left the African continent 2 million years ago, appearing in the Altai. Either because of their small numbers or because of deteriorated climatic and weather conditions they left this area about 500,000 years ago. It long remained uninhabited until, 300,000 years ago, a new human community penetrated to the Altai, bringing their own tool-making industry.

The cultural horizons studied demonstrate the industry improving

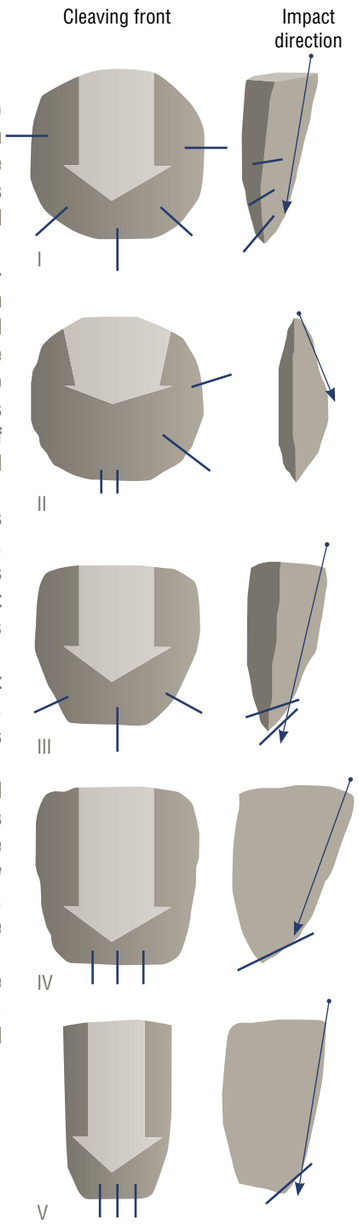
Field studies (carried out in Gorny Altai) of well-stratified sites (caves and open sites) placed relatively close to one another have allowed the researchers to trace the evolution of stone-tool making in the last 100,000 years.

The multi-layer Paleolithic site Ust-Karakol-1 is 3 kilometers from Denisova Cave. Investigation of the tools found there makes it possible, within the chronological range of 100,000 to 30,000 years, to follow the changes in the preparation and cleaving of nucleuses – parts of stone that served as rough work pieces for stone tools:

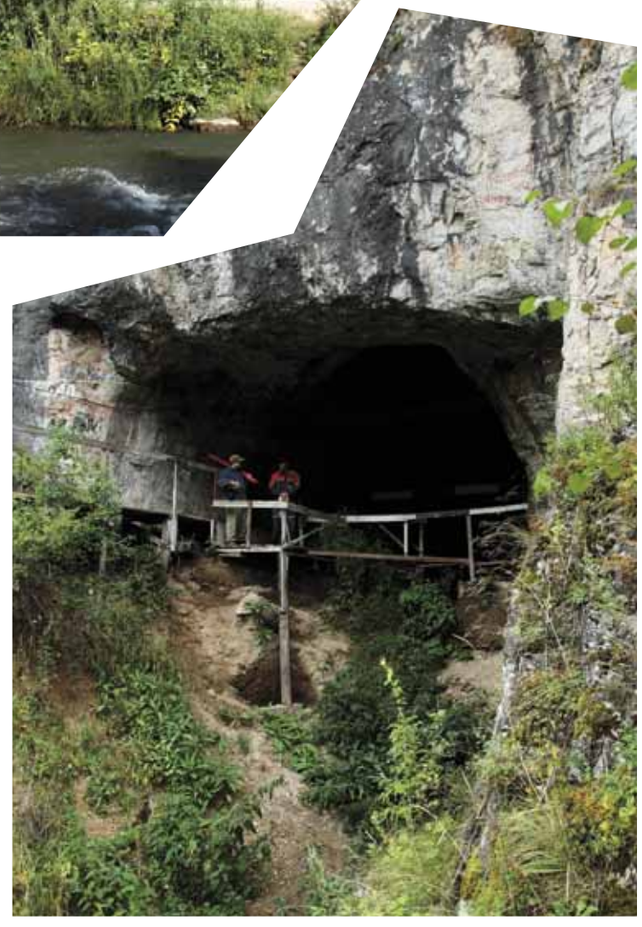
I—II stages. **The shape of the nucleus suggests getting quite a wide flake. The desired shape of the front is achieved through removing redundant material from the nucleus sides and bottom.**

III—IV stages. **The nucleus front is becoming more rectangular. The splitting gradually becomes laminated.**

V stage. **Auxiliary removals designed to maintain the shape of the nucleus main front are made only from the sides. A specially prepared auxiliary area appears at the nucleus base. The quasi-rectangular front of the nucleus is getting more elongated. Nucleuses of the two latter types were produced many times. The nucleuses, as well as the flakes cleft off acquired the shape of slabs.**



Evolution steps in nucleus preparation and cleaving (Ust-Karakol-1 site).
From: (Deverianko, Volkov, 2004)



Denisova Cave is the most ancient Paleolithic site in Siberia. The first hominin appeared there 300,000 years ago

throughout the Middle Paleolithic, which eventually produced artifacts having properties of the Upper Paleolithic culture. Among these are a more advanced technique of stone processing, use of new materials (bone, ostrich egg shell, mammoth tusks, animal teeth), and, above all, the appearance of symbolic objects and decorations that testify to the humans' spiritual evolution.

The Altai "Cultural Revolution"

A unique illustration of the advanced material culture and humans' production and technical skills is the bracelet made out of dark-green chloritolite, with a smooth, almost dead-smooth, surface, found by archaeologists in Denisova Cave. The age of this finding is over 30,000 years.

The detailed trace evidence and technology analysis of the artifact has shown that the ancient artisan was well-versed in the stone processing techniques that used to be considered uncharacteristic of the Paleolithic: rapid machine drilling, boring using an instrument similar to a rasp, filing and polishing with the help of leather and hides prepared to variable extent.

The discovery of such masterpieces of the Upper Paleolithic culture in the Altai came to many scholars as a complete surprise. Not everybody could accept the evidence that in southern Siberia the transition from the Middle to the Upper Paleolithic occurred 50,000 to 45,000 years ago – earlier than in Europe.

We have held several international symposia in Gorny Altai, published the materials collected in the Russian and English languages, and started a discussion about the Middle to Upper Paleolithic transition in the journal *Archaeology, Ethnology, and Anthropology of Eurasia* – today, many scholars, foreign and Russian, agree that the Altai findings are the earliest evidence in Eurasia of the Middle to Upper Paleolithic transition and of an exceptionally early Upper Paleolithic.

The culture of this period happened to be not only highly expressive but also quite compact: 10 to 15 sites in southern Siberia (Gorny Altai, Gornaya Shoria, Cis-Baikal and Trans-Baikal regions) and nothing similar 5,000 kilometers around or within the transit areas. It looks as though this art sprang up out of the blue, like a bright flash. And who was the author? *Homo sapiens* would be a logical assumption, but...

DNA interrogated

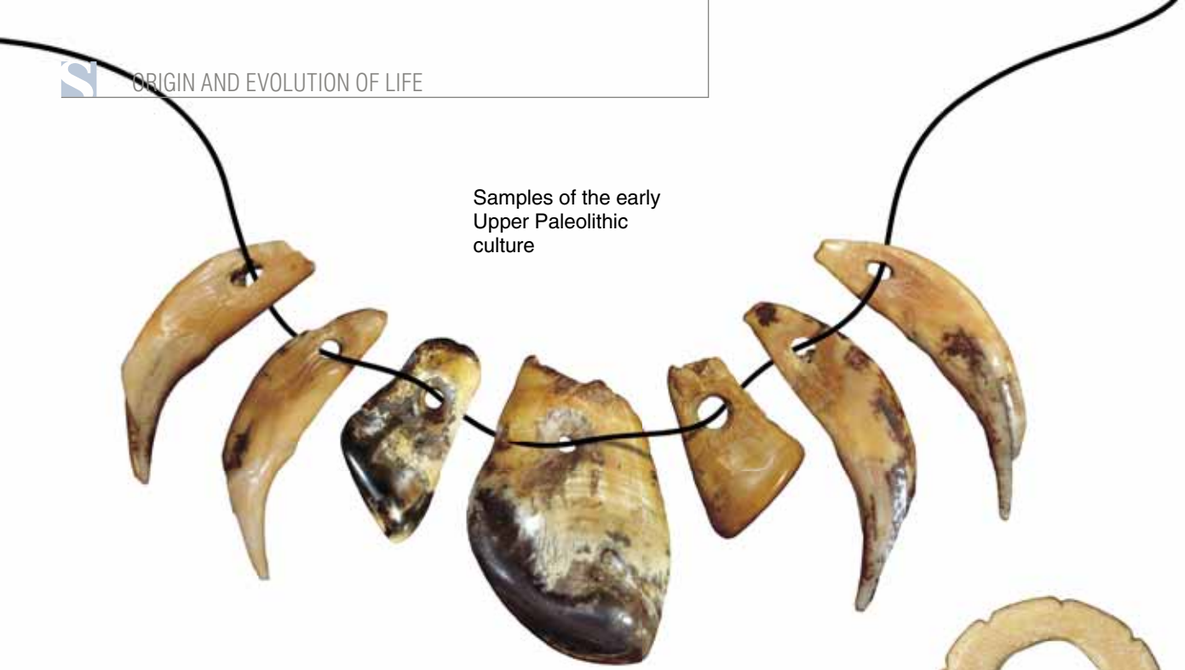
For a long time, excavations produced no anthropologic material. Generally speaking, the human fossil bone remains found in the world are scarce. Every such find is a great event for archaeologists.

For Siberian scholars it occurred in 2008, when in the 11th stratum of Denisova Cave, where a fragment of the bracelet and other Upper Paleolithic artifacts were discovered, a nail-phalanx of a human, presumably belonging to a 5- to 8-year-old girl, was found.

The find was sent for genetic analysis to the Max Planck Institute of Evolutionary Anthropology (Leipzig), whose research team headed by Dr. Svante Pääbo had gained considerable experience in paleogenetic studies; in particular, they have sequenced the Neanderthal nuclear genome.

Our Leipzig colleagues extracted from the finger bone piece the mitochondrial DNA, sequenced it, and came

Excavations in the east gallery of Denisova Cave



Samples of the early Upper Paleolithic culture

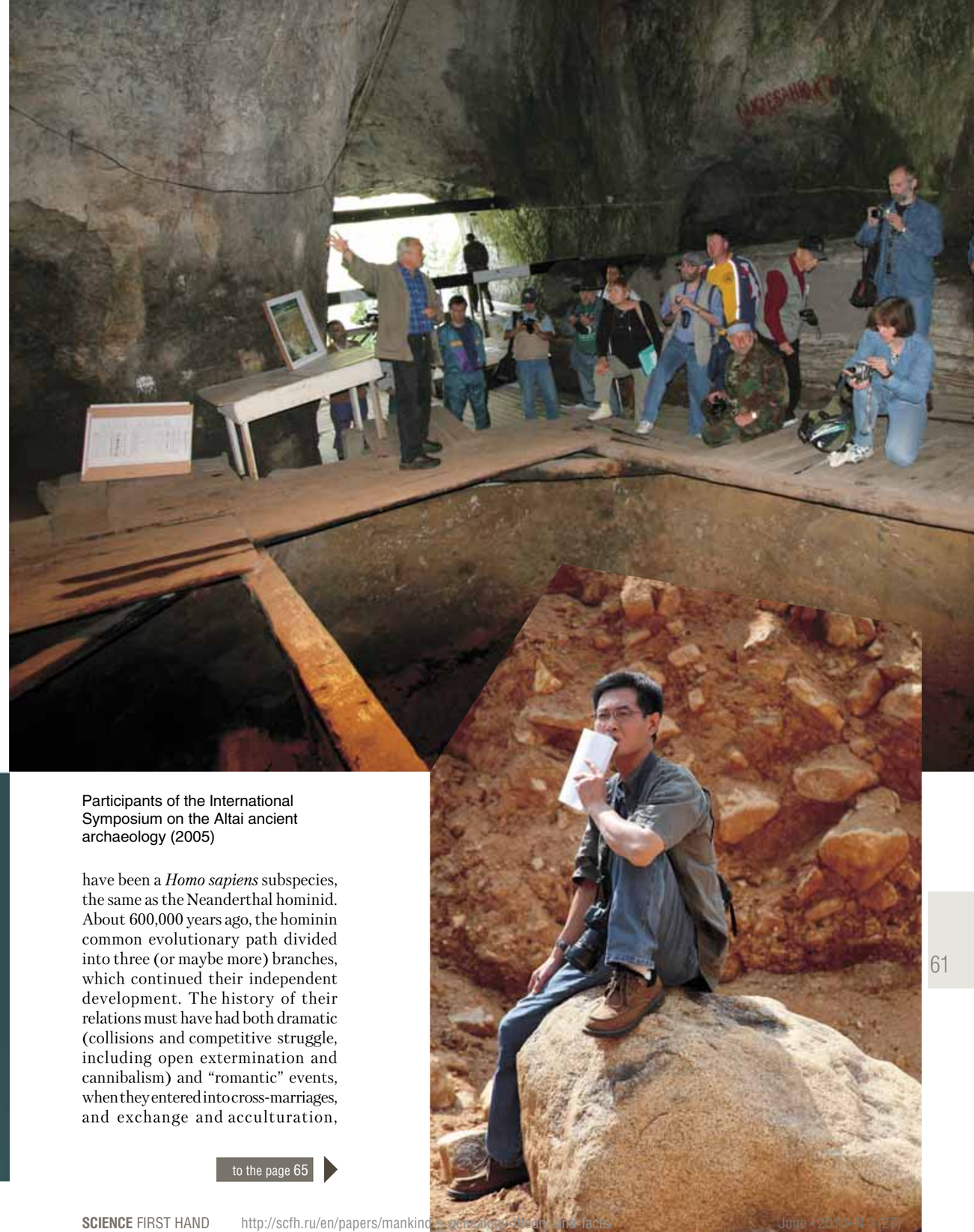
to an unexpected conclusion: its structure was distinct both from the modern human and Neanderthal DNA. Publication of this result in *Nature* created a furor in the academic community – a whisper went round that textbooks on paleoanthropology should be revised.

In order to support or invalidate the conclusions obtained by the mitochondrial DNA analysis, Svante Pääbo's laboratory began sequencing the nuclear DNA, which is known to produce more accurate results. The geneticists have completed their work – their previous conclusions were supported.

Sapiens altaiensis

So what can we say about the Denisova Cave hominid? It is most likely to be not a new human species but a new subspecies. Scholars have long been arguing whether *Homo sapiens* and *Homo neanderthalensis* were different species or different subspecies. If the former is true, they must have had distinct evolutionary paths because they could not have produced viable offspring. For example, the cross of a horse and a donkey is a mule; however, the mule cannot procreate. If they are different subspecies, miscegenation could have taken place between the anatomically modern humans and Neanderthals, i.e. they could have produced genetically mixed progeny.

In our opinion, the latter hypothesis is true. The Denisova cave man, who we called *Homo sapiens altaiensis*, could



Participants of the International Symposium on the Altai ancient archaeology (2005)

have been a *Homo sapiens* subspecies, the same as the Neanderthal hominid. About 600,000 years ago, the hominin common evolutionary path divided into three (or maybe more) branches, which continued their independent development. The history of their relations must have had both dramatic (collisions and competitive struggle, including open extermination and cannibalism) and "romantic" events, when they entered into cross-marriages, and exchange and acculturation,

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The artifact reconstructed.
Drawing by A. V. Abdulmanova

A piece of the Paleolithic bracelet and a modern sample with a slot *(bottom)*

THE ART OF AN ARCHAIC JEWELLER

In the Denisova Cave east gallery, a unique sample of the Upper Paleolithic art – a chloritolite bracelet – was uncovered.

Two pieces, 2.7 cm wide and 0.9 cm thick – were found. The diameter of the whole artifact was supposedly 7 cm. Next to one of the fractures is a drilled hole 0.8 cm in diameter.

Judging by the traces, the speed of rotation of the drilling tool was fairly high, oscillations were minimal, and the rotation of the drilling tool around its axis was multiple – in a word, machine drilling, the technology characteristic of later times, was employed.

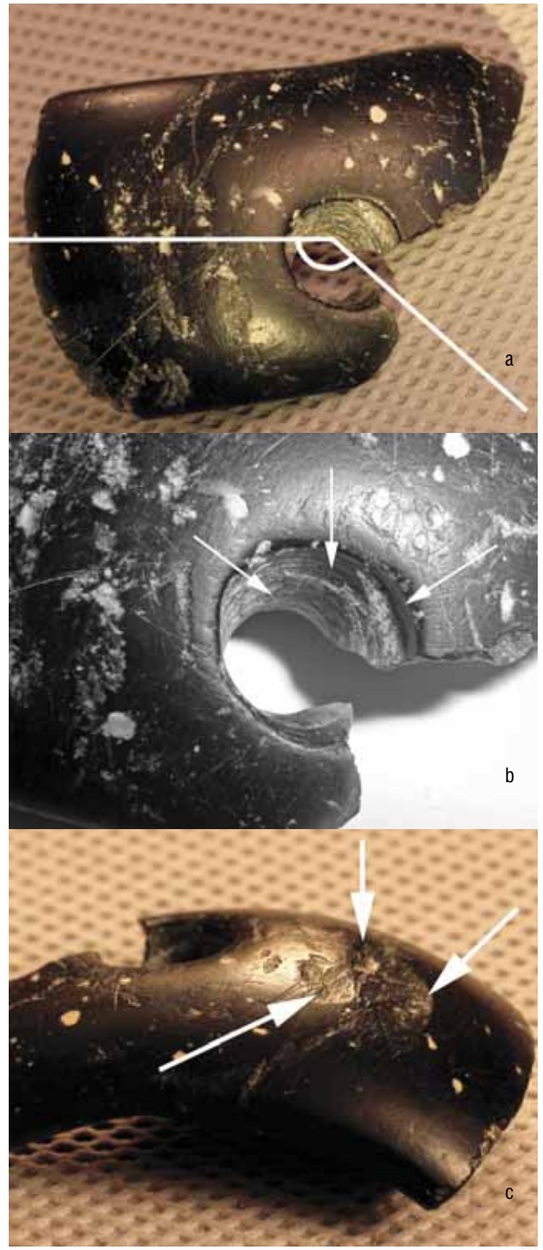
Chloritolite out of which the bracelet is made in not found anywhere close to the cave. The nearest outcrops occur in Rudny (Mining) Altai. Similarly to other Denisova Cave ornaments, the bracelet is made from the material brought from no less than 200 km away. No doubt, such artifacts were highly valuable for archaic people.

When worn, the bracelet suffered mechanical damage. Its exterior shows scratches and traces of hits. Attempts to polish some of the depressions were made, using a coarse-grained abrasive.

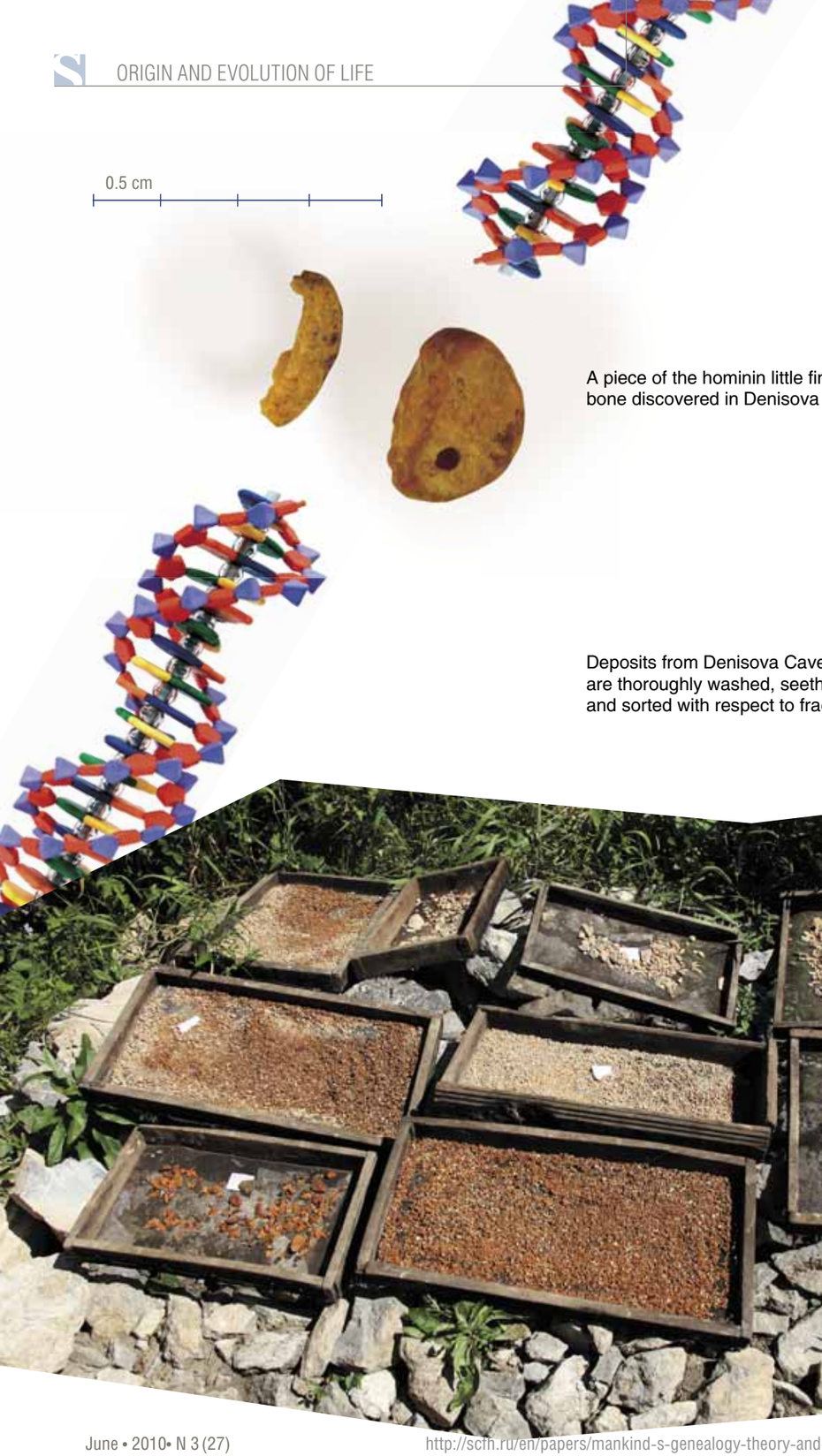
Next to the hole on the bracelet exterior, a strictly delineated area of intensive contact with a soft organic material can be seen. The researchers suggest that it could have been a leather belt to which a pendant was attached; the pendant must have been quite heavy since it set a well-defined amplitude of oscillations. The polished area helped to determine where the artifact's top and bottom was and to establish that the bracelet was worn on the right hand.

Chloritolite is relatively fragile – no wonder hence that it broke at least twice. The first break proved to be comparatively smooth so the craftsman tried to glue the pieces together. The surfaces of the fractures were thoroughly prepared for the operation: first filed by an abrasive, then the edges were canted, and finally smoothed down using a reasonably soft material. Even though the surfaces were prepared scrupulously, the bracelet was not sufficiently strong after it was glued and broke again. Repairing it again proved impossible.

The small diameter suggests that it was a split bracelet and had a slot for the hand. Its end surfaces are carefully ground and polished. When worn on the hand, it tightly embraced the wrist. Who was its owner? The rare material from which the bracelet is made and meticulous work suggest a sufficiently high status of its owner. Apart from this, the bracelet was very beautiful. In bright light it spectacularly reflected the sun, and when lit by a fire, it was of an iridescent deep dark-green color. It is unlikely to have been intended for everyday use. In all probability, this beautiful and fragile thing was worn on exceptional occasions.



The trace evidence and technology analysis of the bracelet has revealed marks of the artifact's production, wear and possible repair:
a – polished area, trace of intensive contact with a soft organic material;
b – traces of a machine drill use;
c – traces of depressions repair;
d – break surfaces prepared for gluing



A piece of the hominin little finger bone discovered in Denisova Cave

Deposits from Denisova Cave are thoroughly washed, seethed, and sorted with respect to fractions

Minute remains of human activities and bone remains of animals are being sorted in a chamber laboratory

i.e. rapprochement of cultures, took place. These three varieties are apt to have mixed with time to generate the human species which evolved further in a more or less unique form.

Testifying in support of these proposals are the remains of ancient humans found in Obi-Rachmat Cave (Uzbekistan). Some morphological characteristics of the skull and teeth fragments speak in favor of their Neanderthal origin, some are similar to these of anatomically modern humans, and the others have no paleoanthropologic analogues at all.

A small population of Neanderthals lived in the Altai during the same period as the "Denisovans," as evidenced by the Mousterian stone toolkits discovered in Okladnikov Cave and bone piece from which the Neanderthal mitochondrial DNA was extracted at Svante Pääbo's laboratory.

In all likelihood, 60,000 to 50,000 years ago the *Homo sapiens* migration made some Neanderthals leave South-West Asia first for Central Asia, and then for southern Siberia. We are still in the dark about what happened to this population. Yet, it can be said with confidence that there were Neanderthals in southern Siberia though previously it was thought that they only penetrated as far as to the east as Central Asia.

Summing up, we can say that in this argument between monocentrists and polycentrists concerning the formation of anatomically modern humans we seem to have found facts indicating that the latter are right. Indeed, there were several areas on the globe where the ancient *Homo erectus* populations and tool-making industries evolved independently. The indisputable proof of this is the Middle to Upper Paleolithic transition and emergence of the Upper Paleolithic culture discovered in the Altai.

The artifacts of this culture suggest quite a high level of the physical and mental abilities of their makers. However, were they made by *Homo sapiens*? If no, this means that the species occupying lower rungs of the evolutionary

ladder were not so primitive after all. If yes, how does it agree with the bone remains found in Denisova Cave?

So the thirty years of work made by research workers, graduates and undergraduates and heaps of processed physical material have produced the result we cannot fully comprehend. The farther in, the deeper... This is what is exciting about research though. The things that don't seem to fit in the adopted models and patterns give impetus to a search and new investigations. Sooner or later, people will find out how the highest rungs of the evolutionary ladder were reached. What has become clear so far is that the ascent was not a straight line, contrary to what they used to believe.

Tomorrow holds new anthropological findings. You can never tell, a living *Homo altaiensis* may be discovered in five years or so. There is an old joke about the discovery of yet another Pharaoh tomb in Egypt. The researchers tried to date it but failed. Decided to ask the Soviet Union for help. Tree men arrived: black suits, black shoes, and black cases. They went down to the tomb. An hour passed – no news, two hours passed – no news. In three hours, they were back, sweating, exhausted. "Well, what about it?" "Ancient kingdom, third dynasty, from so-and-so year to so-and-so. The reason of death has not been established but there are hypotheses." "How did you manage to find out?" "He cracked."

So if we find our ancestor alive, he himself will tell us everything.

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