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# Prehistoric Yellow River Flooding Secrets Unraveled by the Middle Route of the South-to-North Water Diversion Project in the Zhengzhou Section*

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In the spring of 2011, the transfer project of the South-to-North Water Diversion Middle Route Canal in the Zhengzhou section was in full swing. Earth excavation along the main canal in the Xingyang section and the Zhengzhou urban section progressed rapidly. What people might not have anticipated was that this colossal 21st-century water conservancy project would open for us a profound archive of environmental and hydrological history of the Yellow River. It has unveiled the secrets of ancient Yellow River distributaries once traversing Greater Zhengzhou, flowing through the western and southern parts of present-day Zhengzhou.

If you set out on a journey along the excavated main canal in the southern and western suburbs of Zhengzhou after a rain, just as the skies have cleared, and head toward the construction sites in the western suburbs of Zhengzhou and the Xingyang section, you will see, following the neat line of the canal, distinct layers of soil on the slope in shades of light yellow, dark yellow, grayish-brown, ginger yellow, and reddish-brown. The boundaries between these layers appear to run parallel to the canal banks and bottom. We joked, "It looks like marbled pork!" Descending from the path down to the canal bottom along the cleared slope, at various points, you can clearly observe the exposed earth of western Zhengzhou, laid bare by the excavation: layers of soil in different colors—cultivated topsoil, silt layers, sandy clay, silt layers, silty clay, fine sand layers—alternate and overlap, extending for over ten kilometers in an orderly, continuous, and cohesive sequence. In most sections, clay or silty clay layers and fine silt or sand layers appear at least twice, revealing multiple sedimentary cycles under varying hydraulic conditions. Field observations of the texture and grain size of the sand and clay layers indicate deposits formed in different fluvial or still-water environments. Thanks to the engineering excavation, we were able to survey the shallow geological and stratigraphic cross-section of western Zhengzhou along the entire route without cost—saving the effort of drilling ten boreholes! Examining the enlarged grains of the sand layers, they show high roundness, good sorting, and uniform color, typical of sediments transported over long distances by flowing water. Occasionally containing clay particles, small calcareous concretions, or fossilized aquatic shell organisms, these deposits, when compared with the familiar Yellow River sand, are likely sediments carried by the Yellow River rather than local alluvial or proluvial deposits from the piedmont.

* This excerpt is taken from XU Hailiang's *The Yellow River and Zhengzhou from an Environmental History Perspective*, China Water & Power Press, first edition, March 2025.

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South-to-North Water Diversion Middle Route Project: Zhengzhou Section Route Map.

The Landscape of an Excavation Site—South-to-North Water Diversion Middle Route, Zhengzhou Section. (Photographed by the author)

But these are sands left by the Yellow River ten thousand, even twenty thousand years ago! In exploring the natural evolution of the Yellow River, we cannot help but feel a profound reverence for these prehistoric grains of Yellow River sand.

To understand today's topography and landforms, even professionals in water conservancy would find it hard to believe—without studying geological literature or conducting surveys and tests—that the Yellow River once flowed from the higher loess terraces of Xingyang through the western and southern suburbs of Zhengzhou. Yet this is an undeniable objective fact of the prehistoric evolution of the Yellow River in the Zhengzhou region.

The Geomorphology Laboratory of the Institute of Geography, Chinese Academy of Sciences, has long been engaged in the study of fluvial geomorphology in the lower reaches of the Yellow River (esp. in the 1980s–1990s). In the comprehensive research titled *Fluvial Geomorphology of the Lower Yellow River* (Science Press, 1990), Mr. Ye Qingchao provided an exceptionally valuable description:

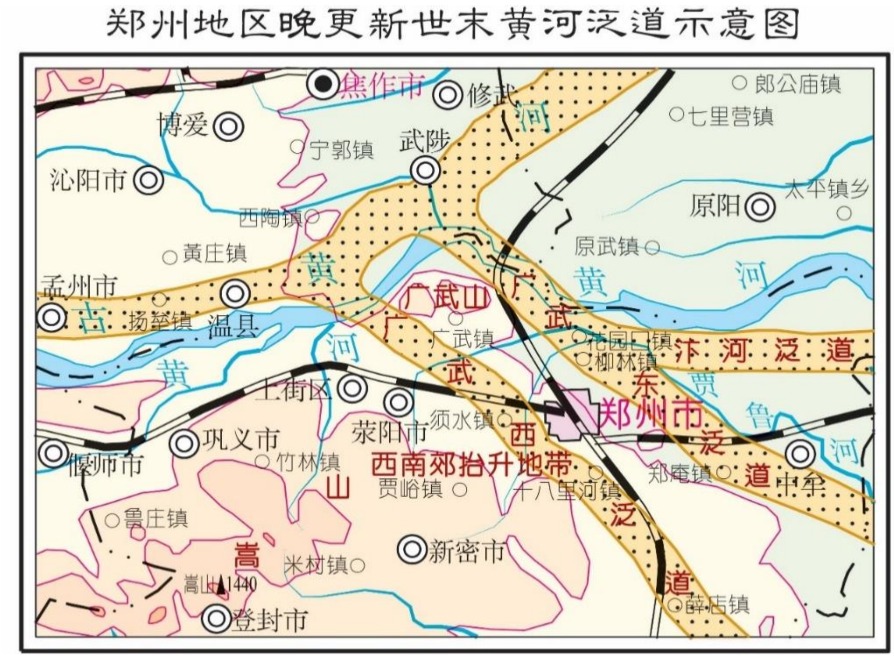
> The Xingyang and Guangwu regions feature an elongated depression within the Yellow River terrace surface, sloping from the northwest Sishui River estuary toward the southeast and connecting with the plain in the form of a platform near the outskirts of Zhengzhou. This depression is narrow in the west and widens toward the east, spanning approximately 15–30 kilometers, with an elevation of 110–150 meters. The terrain of the depression is lower than the terrace surface south of the Mangshan Mountains. Based on our field investigations, the characteristics of this depression landform likely indicate a distributary channel of the ancient Yellow River during the Late Pleistocene... From a geological cross-section perspective, the loess ($Q^1_3$) in the depression zone has been completely eroded and replaced by accumulations of secondary loess-like clayey sand. The middle part contains thick lenticular sand layers, which are actually fluvial sedimentary deposits, with a total thickness of about 10–40 meters. Their base is in direct unconformable contact with the Middle Pleistocene strata. Subsequently, driven by the uplift of the Taihang and Funiu Mountains during the late Late Pleistocene, the area was elevated, forming the present-day landform of the terrace surface with an embedded depression zone.

This reasoned analysis was derived in the 1980s through geological and geomorphological surveys, the study of borehole data around Zhengzhou, and research on the development of the Yellow River. When I worked in Zhengzhou, I traveled extensively through its four suburban areas, studied geological and geomorphological materials, and pored over historical records documenting the evolution of the Yellow River. I became deeply convinced that distributaries of the Yellow River had once flowed through the western and southern suburbs. However, my own field investigation experience was quite limited, and the borehole data I examined were also far from comprehensive, so many questions remained unresolved. Moreover, historical documents could never accurately record events from prehistoric times.

It was only through recent surveys and explorations conducted with a group of enthusiasts in Zhengzhou that we have come to believe that a prehistoric distributary of the Yellow River did indeed exist in the western part of Zhengzhou. This channel belonged to an ancient distributary of the Yellow River's Ningzui alluvial fan during the Late Pleistocene (approximately tens of thousands to 12,000 years ago). Compared to the Late Pleistocene and Holocene distributaries of the Yellow River east of Guangwu low hills (commonly known as Mangshan) in Zhengzhou—later known as the Bianhe and Yinghe distributaries, which are widely recognized—we tentatively refer to this newly identified one as the Western Guangwu low hills distributary. It roughly entered through gaps in the loess ridges such as the ancient Sishui estuary and Niukou Valley, flowed through the Xingyang-Guangwu depression, extended to the southern and northern suburban waterways of Zhengzhou, traversed western Zhengzhou, Xinzheng, the Airport Zone, and southeastern Weishi, and eventually entered the ancient Weishui River before merging into the Yinghe distributary system. Traces of this channel are reflected in hydrogeological profiles from 1960–1980 and engineering geological data from the 1990s–2000s. In recent years, extensive urban construction and foundation work around Zhengzhou have also exposed related evidence, though precise dating remained lacking.

With the planning of the South-to-North Water Diversion Middle Route Project, the implementation of cultural heritage surveys and geological drilling, the construction of the inverted siphon under Guangwu low hills crossing the Yellow River, as well as the marking, land acquisition, and relocation for the canal project, we eagerly awaited, month after month, the day when large-scale excavation would finally unveil the prehistoric face of the Yellow River.

Finally, in 2011, that day arrived. With the commencement of the excavation for the South-to-North Water Diversion Middle Route canal, the project by May and June had fully cut across the Xingyang-Guangwu depression zone, clearly exposing the stratigraphic layers deposited by the ancient river's flow. We specifically arranged boreholes at locations including Zhen Village, Dongda Village, Damiao, Sima, and Dashigu in Xingyang, as well as Zhangwuzhai and Zhanmatun in the city's outskirts. Through drilling and analyzing the shallow sedimentary sequence within the Xingyang depression, and by sampling for dating and analysis, we aimed to gain new insights into the sedimentary environment of each layer, the characteristics of the sand and soil deposits, and the fluvial geomorphology of the prehistoric Yellow River distributary.




Distribution Map of Late Pleistocene Yellow River Distributaries in the Zhengzhou Area.

If this topic is brought up abruptly to Zhengzhou locals—including experts in the field—the first doubt that arises is this: the areas of Shangjie and Xingyang lie at a high elevation. With the towering Guangwu low hills acting as a barrier, Xingyang is significantly higher than the Yellow River and the western suburbs of Zhengzhou. How could Yellow River water possibly flow there? In Shangjie, the banks of the Sishui River stand about 20 meters above its riverbed—how could the Yellow River rise to such a level?

This is a misconception derived from applying modern topography to ancient times—a classic case of "marking the boat to find the sword." In prehistoric times, specifically before 30,000 years ago, the western part of Zhengzhou was overall lower relative to its present elevation. At that time, the Yellow River could easily pass through gaps such as the Sishui outlet and certain valleys on Guangwu low hills at higher water levels—or even at normal levels—and flow into the basin between Xingyang and Guangwu.

However, since around 30,000 years ago, and especially over the more than 10,000 years of the Holocene, the western Zhengzhou region has experienced intermittent uplift. The Xingyang area in western Zhengzhou has been relatively elevated by 30–40 meters. As a result, what was once a distributary that could flow freely at average water levels gradually evolved: first, it could only flow during higher flood levels, then only during exceptionally high floods, until eventually it could no longer enter at all. The once-active Yellow River distributary transformed into an overflow channel, then a seasonal watercourse, and finally shriveled into a "blind gut" disconnected from the Yellow River. The fundamental cause lies in tectonic uplift driven by the rising Songshan and Jishan uplifts.

If we deduct this uplift of 40 or 30 meters and envision the Yellow River's normal water level around that time to be equivalent to about 130–140 meters above present sea level, it becomes clear that the river could indeed have flowed through certain gaps in Guangwu low hills. From 30,000 to 12,000 years ago, the broad valley above Taohuayu and the surrounding mountains, hills, and loess landforms were uplifted tectonically, while the Yellow River channel incised downward to maintain its original longitudinal profile. As a result, high water levels could no longer enter the Xingyang-Guangwu depression.

Simultaneously, the uplift of the Songshan mountainous area in southwestern Zhengzhou also "compressed" and eventually cut off the southeastward flow path of the distributary. Around the east-west line of Zhengzhou Airport, the most recent Holocene activity of the Xinzheng uplift created a watershed. Rainfall north of the watershed in Xinzheng and the southern suburbs of Zhengzhou now flows northeast, while precipitation south of the watershed follows the Weishui River southeast into the Yinghe distributary system. The phenomenon of water from the western suburbs crossing through the Airport Zone and flowing southeast has completely disappeared.

Over the past 30,000 years, dramatic changes have taken place: surface water erosion and deposition, windblown sand burial, and human cultivation gradually buried the prehistoric Yellow River distributary deep underground—until it was brought back to light in 2011. Although we did not investigate the stratigraphic secrets exposed by the canal excavation in the Airport Zone, it undoubtedly reveals the history of the great river sweeping across southeastern Xinzheng and western Weishi, entering the Yinghe distributary zone, and undergoing cycles of deposition, erosion, and redeposition. Otherwise, how could those strikingly regular, comb-like ridge and valley landforms—so puzzling to observers—have been preserved?

People find it hard to believe that tectonic uplift could have such a significant effect, yet we engaged the School of Urban and Environmental Sciences at Peking University to apply the most advanced optical luminescence dating techniques. Their results once again confirmed that the western Zhengzhou region has undergone an overall uplift of 20–40 meters over the past 30,000 years!

This is a slow, gradual process of geological and historical evolution. Based solely on simple field surveys, it is already difficult to believe that a distributary of the Yellow River once flowed through this area. Yet, the farmers in Xingyang and the western suburbs of Zhengzhou actually trust the stories passed down through generations about the ancient Yellow River system flowing here. My own understanding wavered between historical records and the accounts of elderly locals.

I hold a deep reverence for the belief that since the Paleolithic era, the ancestors who inhabited both banks of the Yellow River—including those who lived across the vast Guangwu low hills and within the Xingyang-

Guangwu depression—witnessed this long, extraordinary yet ordinary geological process. Regardless of their migrations, shifts, rises, and declines across generations, they passed down the most commonplace hydrological and geomorphic features of the land from one era to the next.

During the construction and evolution of the Late Pleistocene Yellow River alluvial fan in Zhengzhou, the river served as the most critical hydrodynamic agent, supplying massive amounts of sediment. In addition to contributing to the formation of the region’s basal secondary loess—ranging from over ten to more than thirty meters thick—the Yellow River’s overflow also facilitated the development of a series of Late Pleistocene lakes within its interdistributary depressions, floodplains, and channels. After the Yellow River ceased to enter the western region in the Holocene, the local drainage system underwent reorganization under the influence of tectonic activity and climatic conditions, forming band-shaped seasonal shallow lake-swamp clusters.

Based on our sampling and dating of fluvio-lacustrine strata at locations such as Zhangwuzhai, Zhen Village, and Sima, the extent (and water levels) of these western lakes and swamps likely reached their maximum around 7,500–5,600 years before present. In the northern suburb of Dahecun and the eastern suburb of Putian Town, we retrieved continuous lacustrine sediment cores measuring 4–8 meters in thickness. The natural information contained within these cores is currently being extracted and may include lacustrine depositional sequences dating back to the end of the Late Pleistocene.

Such details could never have been clearly documented in historical records. Even if fragmentary mentions exist in ancient texts, they often elude the understanding of later scholars, though these texts may subtly hint at natural mysteries. Under the constraints of tectonic movement and climatic shifts, and further influenced by human cultivation and development, the lake-swamp clusters in western Zhengzhou gradually dried up and disappeared by the mid-Holocene (around 4,000 years ago). The river drainage system in western Zhengzhou, which had originally converged into seasonal lakes and swamps, began to redevelop on a new erosional base level, gradually shaping the hydrological landscape seen today.

Due to the regional and persistent subsidence of the Kaifeng Depression, as well as the hydrological connectivity provided by the Yellow River system, lakes and marshes in the eastern Zhengzhou area continued to receive water supply into the middle to late historical periods (such as the Song and Yuan dynasties). Though in a state of fragmentation, some of these water bodies persisted, occasionally appearing in the form of artificially modified or managed ponds and reservoirs. As late as the 1950s, traces of ancient lakes and marshes could still be observed on the surface in eastern and southern Zhengzhou. In the 1970s, the “Wuqi Cadre Schools” and Educated Youth Farms were established in towns like Putian, situated within former lacustrine and wetland areas.

Fortunately, engineering geological surveys carried out for the development of eastern Zhengzhou’s new urban zones have also extensively revealed features of the Holocene landforming processes and sedimentary environments associated with the Yellow River’s influence.

Based on extensive geological drilling data, the distribution of Yellow River distributaries and lake-marsh zones shows significant correlations in terms of developmental mechanisms, spatial extent, and temporal continuity.

In both eastern and western Zhengzhou, we have established standard boreholes in an attempt to obtain detailed natural information—such as fluvial and lacustrine systems, vegetation, climate, and sedimentation since the Late Pleistocene—through refined testing and research. The goal is to investigate and reconstruct the paleoenvironmental sequence of the Zhengzhou area. We believe this work holds meaningful implications for understanding Zhengzhou's past—both natural and human—as well as for planning its future development.

Guangwu low hills acted as a pivotal "midstream pillar" amidst the vast, overflowing waters of the Yellow River at the apex of its alluvial fan. It provided a protective barrier for the future human developmental space of the Zhengzhou region, a contribution of unparalleled significance. From Guangwu low hills (stretching from the Sishui River estuary to the Yellow River Scenic Area) to the urban area of Zhengzhou lies an ancient cultural corridor with an exceptionally high density of Paleolithic and Neolithic cultural sites. This corridor is situated on a "loess terrace between rivers," flanked by the eastern and western distributaries of the ancient Yellow River, traversed by the ancient Jishui River and other local waterways, and interconnected by rivers and lakes.

Precisely due to the continuous uplift of the western and southern mountainous areas, the terrain in southwestern Zhengzhou and the urban district remained relatively elevated. The western route of Yellow River flow had already been cut off for nearly ten thousand years, leaving waters from the Songzhu hill and Mang hill ranges to only follow the ancient Jishui channel eastward. Meanwhile, the eastern route of Yellow River overflow hugged the ancient river-bend terraces, connecting the Xing Marsh and Putian Marsh, yet it posed little threat to the later dense clusters of Neolithic settlements and the royal Shang city site. This setting proved highly suitable for long-term settlement and developmental construction.

A geological contemporary of Guangwu low hills may well be Maling Ridge, located between Xinzheng, Zhongmu, and Weishi. Thanks to the favor of nature, the people of Zhengzhou have been left with both a key geological landmark and the remarkable comb-like landform spectacle in the southeastern region.

However, apart from droughts and floods, Zhengzhou also experienced ancient major earthquakes (unrecorded in historical documents). Prior to the construction of the Yellow River crossing project, archaeological surveys and protective excavations were conducted, revealing that Xue Village in Xingyang may have been struck by a destructive earthquake over 3,000 years ago. According to archaeological departments, suspected traces of ancient earthquakes have also been found in Dahecun on the southern bank of the Yellow River, Shuanghuaishu in Gongyi, and Lianghu in the High-Tech Development Zone. All of these findings await further exploration and verification.

Naturally, even devastating natural disasters were unable to extinguish the flame of civilization in the Central Plains. It was precisely in this region, centered around Zhengzhou, that Huaxia civilization rose to prominence.

Looking at the environmental evolution of ancient water systems in Zhengzhou, it can be said with certainty: the ancient culture of Zhengzhou during the dawn of civilization was a typical river–lake culture, nurtured by numerous waterways. The archaeology and environment of Zhengzhou bring together "pure" natural evolution, cultural transformation, and human abstract thought into one intertwined narrative.

Experts and scholars from the Nanjing Institute of Geography and Limnology conducting fieldwork and testing. (Photographed by the author)

## About the Author

The author (center), photographed at the source of the Yellow River.

Xu Hailiang, born in 1944 in Wuxi, Jiangsu Province, is a professor-level senior engineer. He has served as a member of the Water History Research Committee of the Chinese Hydraulic Engineering Society, Secretary-General of the Disaster History Professional Committee of the China Disaster Prevention Association, and Deputy Secretary-General of the Natural Disaster Prediction Professional Committee of the Chinese Geophysical Society. His professional experience includes roles at the Disaster Reduction Center of the Ministry of Water Resources (as a guest researcher), the Flood, Drought and Typhoon Prevention Headquarters of the Shunde Municipal Government in Guangdong Province, North China University of Water Resources and Electric Power, Zhengzhou Water Resources School in Henan Province, and the Water Resources Bureau of Shenqiu County, Henan Province.

He has long been engaged in research on Chinese water history, Yellow River history, flood and drought disasters, and disaster history. He has contributed to several major national research projects, including conducting analyses of typical hydro-meteorological disasters for the National Social Science Fund's key project "The Impact of Natural Disasters on the National Economy", and completing the historical research component for the National Natural Science Foundation's major project "Environmental Evolution and Water-Sediment Dynamics in the Yellow River Basin" (which received the First Prize of Natural Science from the Chinese Academy of Sciences). He was also responsible for compiling the maps of Yellow River breaches during the Ming and Qing dynasties for the National Social Science Fund's major project "The National Historical Atlas Series".

He has authored and published numerous papers and monographs in his field.

# 郑州段南水北调中线干渠揭示的史前黄泛奥秘*

徐海亮
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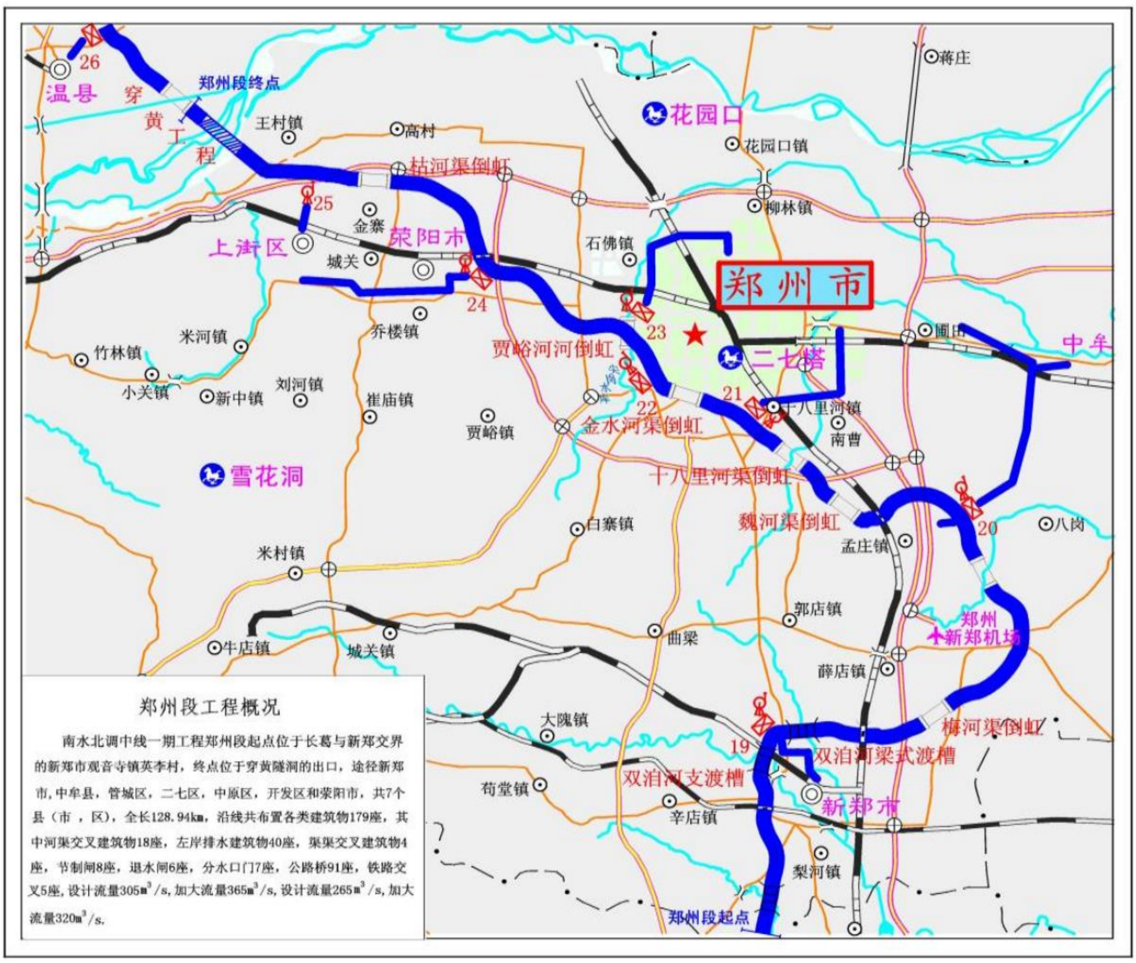
2011年春，南水北调中线引水渠工程郑州段全面施工，总干渠荥阳段和郑州市区段的土方开挖，进展迅速，人们可能没有想到的是，这21世纪的巨型水利工程，给我们打开了一本厚重的黄河环境史的地文书、水文书，揭示了远古黄河汉道贯穿大郑州，流经郑州西部、南部的奥秘。

南水北调中线工程郑州段线路图




如果在雨后初晴时分，沿着郑州市南郊、西郊已被开挖的干渠行进，到郑州西郊段、荥阳段工地，

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* 本文摘自徐海亮《环境史视野下的黄河与郑州》，中国水利水电出版社，2025 年 3 月第一版。

本探索研究由河南省博士后研发基地—郑州文物考古研究院项目《郑州地区晚更新世以来古环境序列重建与古聚落变化的预研究》资助。

顺整齐的渠边线放眼向前望去，渠坡上色泽呈浅黄、深黄，或灰褐、姜黄、红褐的各色土层，一目了然，土层界线似乎与渠帮、渠底线平行。我们开玩笑说”像五花肉啊”！顺着业已清理的渠坡，从道上下到渠底，在不同的位置，可以清晰地观察被开挖剖析的郑州西部大地：不同色泽的土层——耕作层、粉砂层、砂质粘土、粉砂层、粉质粘土、细砂层等，交互叠合，延伸十余公里，井然有序，前后衔接，浑然一体。而多数工段的粘土亚粘土层、粉细砂层，至少都有两层，呈现出多次不同水力条件下沉积旋回。野外观察砂层、粘层的状态、颗粒，分别为不同河流冲积或静水环境下的沉积物。因为工程开挖，让我们免费全线查看了郑州西部浅层地质、地层大剖面，省去了打十个钻孔！端详砂层放大了的沙粒，磨圆度大、分选型好，色泽均匀，系流水长途搬运沉积所为，其中偶含粘粒或小礓石，或水生介壳动物化石，与我们熟悉的黄河河沙比较，就可能是黄河来沙，而非本地山前洪积冲积物。

南水北调中线工程渠道开挖现场景观（徐海亮拍摄）

但这是一万年、两万年前留下的黄河沙！探索黄河自然演变，我们不能不对这史前的粒粒黄河沙肃然起敬。

要看今天地势地貌，不研读地质文献，不勘探测试，即使水利的专业人员也难以相信黄河曾经从地势较高的荥阳黄土阶地流过郑州西郊、南郊。但是，这却是史前郑州地区黄河演变的一个不可否认的客观事实。通过释光技术测年，通过重金属矿物和物源分析，我们得知这些沉积物确实是黄河的，也得知了它们沉积的年代，就在距今1万到3万年前。

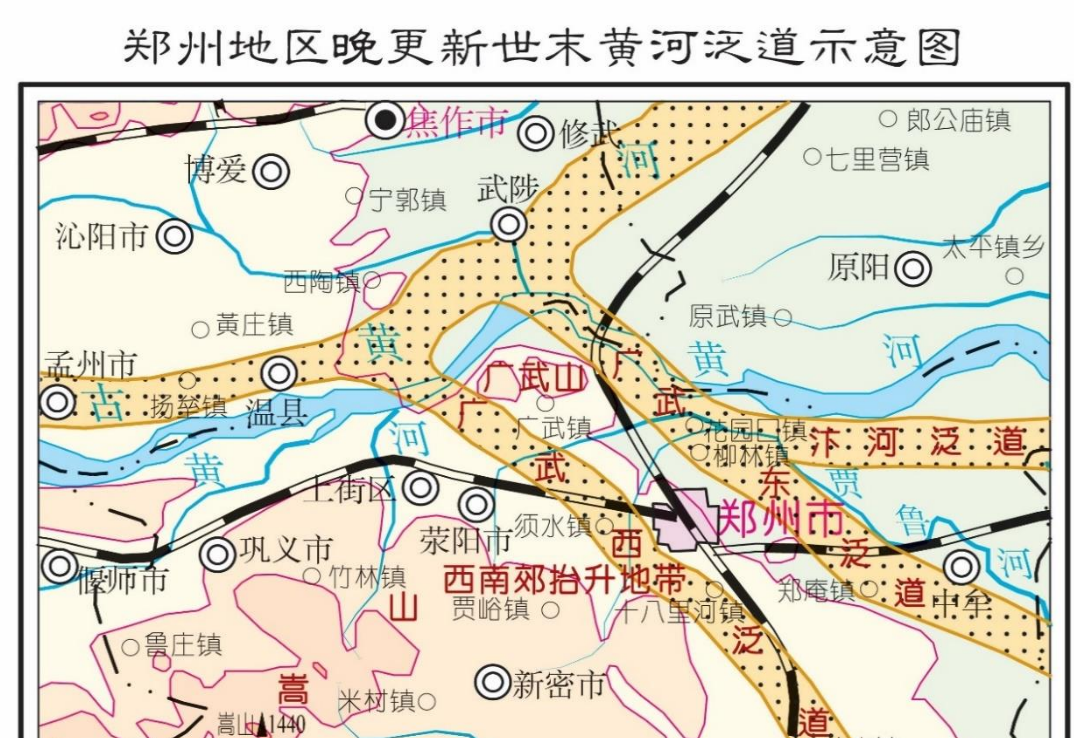
中国科学院地理研究所地貌室长期研究黄河下游河流地貌，1980-90年代，在他们的综合研究成果《黄河下游河流地貌》一书中（科学出版社，1990年），叶青超先生有一段十分宝贵的描述：

“荥阳、广武地区为黄河阶地面上长条状的夹槽，由西北汜水河口向东南方向倾斜，至郑州郊区附近以台地形式与平原接触，夹槽西窄东宽，宽约15-30公里，海拔110-150米，夹槽地势比邙山南部阶地面低洼。据我们考察所知，这种夹槽地貌形态的特点可能是晚更新世时期的古黄河汊道……从地质剖面来看，夹槽地带的黄土（$Q_3^1$）已被侵蚀殆尽，而代之堆积的物质为次生黄土类粘砂土，中部夹有厚层的砂层透镜体，实为河流相沉积物，总厚度约为10-40米，其底部直接与中更新世的假整合接触。以后随着晚更新世末期太行山和伏牛山上升的带动而抬高，形成现在这种阶面夹槽带的地貌景观。”

这一段理性分析，是1980年代通过地质地貌考察，通过郑州周围地质钻孔资料分析和黄河发育的研究得出的。我在郑州工作时，跑过郑州四郊，读过地质地貌资料，研读过记载历史黄河演变的典籍，对黄河汉道曾流经西郊、南郊，深信不疑。但自己毕竟在野外考察经验十分有限，查阅的地质钻孔资料也十分有限，所以问题一直并不清楚。况且，历史文献不可能准确记载史前的事情。

只是通过近年与郑州一群好事者的考察、勘探，我们认为黄河在郑州市西部的史前泛道确实存在，它属于晚更新世时期（大约数万年到1.2万年以前）黄河宁咀冲积扇的一条古老泛道，相对于晚更新世和全新世黄河在郑州广武山（俗称邙山）东的泛道（后世称汴河泛道与颍河泛道，人所共知）而言，我们暂时称其为广武山西泛道。它大致从古汜水口、牛口峪等黄土岭缺口入注，流经荥阳-广武夹槽，下至郑州南郊和北郊水路，穿越郑州西部、新郑、航空港区、尉氏东南而下，进入古洧水，从而汇入颍河泛道。这些，在1967-80年代的水文地质剖面、1990-2000年代的工程地质资料中有所显示，近年郑州市周围大量城市建设地基施工，也有揭露；只是缺乏年代测定。南水北调中线规划、文物保护普查钻探和地质钻探实施，广武岭下穿黄倒虹吸工程施工，中线渠道工程划线、征地，搬迁开始，我们也一月又一月地，急迫期待着大开挖大揭露这一天来临，盼望一睹史前黄河真面目。

2011年这一天终于来到，南水北调中线引水渠开挖工程动工，到5月、6月，工程全面斜穿荥阳-广武夹槽地带，清晰地揭露了大河流经沉积的地层。我们在荥阳真村、东大村、大庙、司马、大师姑和市郊的张五寨、站马屯专门布设钻孔，钻探、分析了荥阳夹槽浅层的沉积序列，取样进行测年和分析，试图对各地层的沉积环境、各层沙土的性状、史前黄河汉道的河流地貌，作出一些新的探索。




要和郑州人猛一讲这事情，包括业内专家，人们首先怀疑的是，上街、荥阳地势高仰，高昂的广武山阻挡，荥阳就比黄河和郑州西郊高得多，黄河水怎么流得过来？上街那儿汜水河岸高出汜水河床20多米左右，黄河怎么流上来？

这是基于现代地貌"刻舟求剑"得出的误判。在史前，具体说在三万年以前，郑州西部整体相对于现代要低，那时候的黄河水，可以在较高水位——甚至正常水位时轻易穿过汜水口和广武岭上的某些沟峪，进入荥阳、广武之间的盆地。由于距今3万年以来，特别是全新世一万多年以来，郑州西部整体发生间歇性抬升，郑州西部的荥阳地区，相对抬升了30-40米，从年均水位时可以自由流淌，到洪水期较高水位才能流经，再到非常洪水时期高水位才能进入——乃至再也进入不了，原来正常的黄河汊道，演变成泛道、季节性河道，最后荥阳–广武河槽萎缩成一段不能行黄的" 盲肠"，原因皆在嵩箕隆升驱动的构造抬升之上。如扣除这个抬升值40、30米，设想黄河在此上下的正常水位相当于今海拔130-140米以上，黄水当然可以由广武山的某些缺口流入。3.0-1.2万年以来，桃花峪以上宽广的河谷随同两岸大山、丘陵、黄土构造抬升，黄河河道相对下切，以保持原有的河道纵剖面，高水位就再也不可能进入荥阳-广武夹槽了。同时，郑州西南部嵩山山地抬升，也"挤压"结束了泛道东南而下的流路，在郑州机场东西一线，新郑隆起在全新世的最新活动，也造就了一道分水岭，新郑和郑州南郊坡水俱东北而去，分水岭以南降水均随洧水东南而下颍河泛道。再也看不见西郊来水穿航空港区东南而下的局面。三万年以来，沧桑巨变，地表流水搬运塑造，风沙掩埋，人类垦殖，史前黄河泛道被深埋地下，直到2011年重见天日。我们没有去考察干渠开挖披露的航空港区的地层奥秘，但它一定会揭露大河横流洗荡新郑东南部—尉氏西部，进入颍河泛道带，沉积、剥蚀，再堆积再冲蚀，又堆积的历史，不然为何遗留下来那令人生疑的规范的梳齿状岗丘地貌？

人们不相信构造抬升的威力这么大，但我们请北大城市环境学院用最先进的光释光测试手段，再次证明郑州西部在3万年以来整体的抬升数值，就是20-40米！

这是一个缓慢变化的地质历史演化过程，单凭简单的野外查勘，已经很难置信黄河的汊道曾经从此处流经，但荥阳和郑州市西郊的农民老乡，居然相信祖祖辈辈传承下来的远古黄河水系流经的说法。我的认识在故文献和老农民之间摇摆。我非常敬畏地相信，从旧石器时代以来就在黄河两岸栖息的先民，包括在漫漫的广武岭上、荥阳-广武夹槽栖息的各代先民们，早就目睹了这个漫长——奇特却又平凡的地质过程，不管他们曾有过怎样的迁徙替换、生灭兴衰，但却一代又一代地把当地最普通的水文和地文现象，传承了下来。

晚更新世黄河在郑州冲积扇建造和发育的过程中，是最为重要的河流动力因素，提供了巨量物质，除对于构建郑州地区基底次生黄土的贡献之外（十余米到三十余米），就是在黄河泛流的河间洼地、河流漫滩地或河槽中，发育了一系列晚更新世湖泊；全新世黄河不再进入西部之后，该地的水系在地质构造和气候条件下重新调整，形成条带状的季节性浅湖沼群。从我们对张五寨、真村、司马等处河湖相地层的取样和测年看，这些西部湖沼范围（和水位）可能在距今7500-5600年达到过最大（和最高）。在北郊大河村、东郊圃田镇，我们分别获取了4-8米的连续湖相沉积岩芯，其中蕴含的自然信息正在提取之中，可能包含的湖相沉积段（时间）还要上溯至晚更新世末。这是历史典籍不可能记载清楚，或者记载的有只言片语，而后来一般学者已难以理解的典籍则隐约包含着自然奥秘。在构造运动和气候变化的制约下，也在人类垦殖开发的参与下，郑州西部的湖沼群在全新世中期（大约距今4千多年前后）相继干缩消亡，郑州西部的河流水系，原来集聚于季节性湖沼，遂在新的侵蚀基准上重新发育，逐渐形成现今状况。

由于开封凹陷区域性的持续下沉，黄河水系的沟通，得到来水补给，所以到历史时期的中晚期（如宋代元代），郑州东部地区湖沼处于裂解中，仍保存有一些，有的以人工改造治理的陂塘形式出现，直至1950年代，郑州东部、南部地表，仍可以见到古代湖沼的痕迹，1970年代的五七干校、知青农场，就在圃田等乡镇原来的湖沼里。庆幸的是，郑州东部新城市的工程地质探测，也大量揭示了全新世在黄河参与下的造貌过程与沉积环境的某些特征。

从众多的地质钻探资料看，黄河河流泛道与湖沼带的分布，在发育机理上与空间展布、时间续连上存在重要的关联。

我们在郑州东、西两部，分别布设了标准钻孔，试图通过精细测试研究，获得晚更新世以来河流、湖泊水系，植被、气候、沉积的某些自然信息，探讨与重建郑州地区的古环境序列。相信这些对于认识郑州的过去（自然与人文），以及建设未来的郑州，都是有意义的。

广武岭，是黄河冲积扇顶部在黄水汪洋与泛流里的中流砥柱，对未来郑州地区的人文发育空间，起到了庇护作用，功大莫比。从广武岭（汜水口—黄河游览区）到郑州市区，是旧石器、新石器文化遗址密度特别大的古文化走廊，它处于郑州的东西广武泛道之间的”夹河黄土台地”上，其间有古济水和当地诸水穿越，河湖贯通。正由于西、南山地的持续抬升，郑州西南部和市区地势相对较高，西路黄水到近一万年已经断绝，嵩、邙来水只有顺古济水通道东下；东路来泛黄水偎依古老河湾台地，联通荥泽、圃田泽，难以威胁后来的新石器文化聚落密集区和王都商城地区，适宜于长期定居，建设开发。广武岭同地质时代的伙伴，可能就是新郑、中牟、尉氏之间的马岭岗，感谢大自然的眷顾，给郑州人留下了关键的地质典范，也留下了东南部梳齿状的地貌奇观。

不过，除旱涝灾害外，郑州还经历过远古的大地震（文献无记），穿黄工程进行前开展文物勘察和保护性发掘，发现荥阳薛村在三千多年前可能发生过破坏性地震，考古部门说，在黄河南岸的大河村，在巩义的双槐树，在高新开发区的梁湖，都发现过疑似古地震迹象。这些，都留待今后进一步探索、查证。当然，毁灭性自然灾害没有能扑灭中州文明的火光，华夏文明正是在以郑州为核心的中州崛起。

纵观郑州古水系的环境演化历程，完全可以说：文明起源时期的郑州古文化，是依傍众多河流的典型的河湖文化。郑州的考古和环境，把”纯粹的”自然演化，人文嬗变，人类的抽象思维，在这里交融到一起。

南京地理与湖泊研究所的专家学者在野外测试（徐海亮拍摄）

## 关于作者：

作者（中）在黄河源

**徐海亮**，生于1944年，江苏无锡人，教授级高级工程师。曾任中国水利学会水利史研究会委员，中国灾害防御协会灾害史专业委员会秘书长，中国地球物理学会天灾预测专业委员会副秘书长。曾任职水利部减灾中心（客座研究员）、广东省顺德市政府三防指挥部、华北水利水电学院、河南省郑州水利学校、河南省沈丘县水利局。长期从事中国水利史、黄河史、水旱灾害和灾害史研究。曾承担国家社会科学基金重大研究项目“自然灾害对国民经济的影响”中典型水旱气象灾害分析工作、国家自然科学基金重大项目“黄河流域环境演变与水沙运行规律”中的历史部分工作（该项目获中国科学院自然科学一等奖），承担国家社会科学基金重大项目“国家历史大地图集”中明清黄河决溢图幅编绘。撰写和发表有关论文和专著多部。