Identification and Zoning of Landscape Characters of Mining Heritage from the Perspective of Local Identity: A Case Study of Yangquan No. 3 Coal Mine

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Abstract The transformation of resource-based cities has progressively converted abandoned mining areas into composite spaces where material remains and collective memory coexist. However, current zoning approaches predominantly rely on production functions and morphological characteristics, often neglecting the dimension of local identity and its space expressions. This oversight hampers the ability to discern meaningful differences within seemingly similar spaces. This study used the Yangquan No.3 Coal Mine as a case study, employing landscape character assessment (LCA) as the principal line. It also integrated concepts of historical stratification and the holistic interrelations inherent in historic urban landscapes (HUL), thereby incorporating spatially expressive local identity information into multi-source evidence verification. The study utilized 11 preliminary functional zones as fundamental spatial units to conduct a comprehensive analysis of the material landscape, historical stratification, and the interrelationships among production, transportation, and living spaces. Following multi-source evidence verification, 18 comprehensive landscape character zones were delineated. The findings indicate that local identity can enhance the significance of place, aid in boundary delineation, and reinforce cross-regional linkages. This approach offers a spatial foundation for the value assessment and differentiated protection and renewal of mining heritage.

Keywords Local identity, Mining heritage, Landscape character assessment (LCA), Historic urban landscape (HUL), Spatial zoning
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With the transformation of resource-based cities and the progression of stock renewal, traditional mining areas have gradually evolved from purely production spaces into complex environments where mining heritage coexist with community life and local culture[1]. Given the significant differences within mining regions in terms of their formation periods, spatial forms, and current usage, relying solely on a single production function or land use classification for spatial division risks disrupting the historical connections among excavation, transportation, and living spaces. Moreover, such an approach may fail to capture the shared perceptions of significant places held by local residents. Research on existing mining heritage has expanded beyond the preservation of individual buildings to encompass industrial landscapes, ecological restoration, and community renewal. Nevertheless, the identification of internal space continues to depend largely on the types of remains, present functions, and morphological characteristics. Collective memory, place cognition, and habitual movement routes included in local identity can supplement the social significance and spatial relationships that are often underrepresented in material landscapes. This approach offers a cognitive foundation for identifying internal differences within mining areas and for validating the boundaries of distinct zones.

This study focused on Yangquan No.3 Coal Mine as the research subject. It employed landscape character assessment (LCA) to identify the material landscape and delineate basic units, and utilized historical urban landscape (HUL) method to interpret historical stratification and systemic relationships. Subsequently, spatially expressive information related to local identity was used to validate the zoning. The objective of this research is to establish a relatively stable spatial framework to support subsequent evaluations of heritage value, land use suitability, and differentiated renewal strategies.

1 Theoretical basis and research entry point

1.1 Theoretical complementarity of LCA, HUL and local identity

LCA typically categorizes relatively consistent landscape types and spatial units by analyzing natural basiss, land use, composition of remains, spatial texture, and perceptual characteristics. Its primary advantage is its capacity to describe differences from the perspective of "characters", rendering it an effective operational framework for identifying internal spaces within mining areas[2]. However, certain facilities within the mining production chain have either disappeared or undergone functional transformations, and exclusive reliance on their current forms may result in the oversight of historical functions and cross-regional connections[3].

HUL conceptualizes the historical environment as an integrated whole, shaped by the long-term stratification of natural conditions, constructed spaces, social practices, and cultural values[4]. This article does not treat HUL merely as an alternative zoning method. Rather, it adopts the concepts of historical stratification and holistic correlation, integrating mining area chronicles, historical maps, old photographs, and oral histories to elucidate the formation processes of various assemblages of remains and to identify the historical relationships among wellheads, washing and selection facilities, storage and transportation infrastructures, gangue discharge facilities, as well as residential and public service spaces.

Local identity constitutes a crucial element of self-identity, developed by individuals and groups through prolonged environmental experiences and social interactions[5]. Within mining communities, the cessation of production activities does not equate to the loss of local significance. Instead, mining experiences, community life, and landscape transformations continue to contribute to the construction of local identity via collective memory[6]. This study does not assign abstract weights to local identity; rather, it delineates the spatial extent, common memory sites, significant pathways, and shared activity areas associated with local identity, translating these into nodes, linear connections, and general spatial ranges. Consequently, LCA

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identifies visible distinctions, HUL analysis elucidates temporal stratification and systemic relationships, and local identity enriches the shared meanings within the group. Together, these three components underpin a comprehensive zoning framework.

1.2 Research deficiencies and the entry point of this article

In the spatial identification of mining heritage, existing research predominantly emphasizes the current forms, types of remains, and functional distinctions, while insufficiently addressing the roles of vanished production facilities, historical linkages, and residents' shared perceptions in delineating spatial boundaries. Accordingly, this study identifies fundamental spatial units through LCA and validates them by integrating historical data and local identity surveys. Local identity information does not directly define boundaries; rather, given an established physical spatial foundation, it functions as supplementary evidence for zoning retention, division, and local adjustment.

2 Research design and methods

2.1 Research area, data and overall framework

The research scope covered the original production, transportation, guarantee, office service, and staff living spaces of the No.3 Coal Mine. The data sources include remote sensing imagery, publicly available maps, existing planning documents, mining area chronicles, archival materials, historical maps, and old photographs. Additionally, the study involved on-site investigations, verification of physical remains, semi-structured interviews, cognitive mapping, and field identification. Geographic information systems (GIS) were employed solely for base map organization, element overlay, and the production of outcome maps, without engaging in high-precision calculations. The study systematically identified the material landscape and fundamental units, analyzed historical stratification and systemic relationships, extracted information pertaining to local identity, and ultimately determined whether to retain or subdivide units based on multi-source evidence. Furthermore, local boundaries were verified, as illustrated in Fig.1.

2.2 Identification of multi–dimensional landscape information

Identification of material landscapes involves analyzing natural basis, composition of remains, dominant functions, transportation structures, current usage, and spatial textures. Boundaries can be delineated using features such as the edges of roads, railways, terraces, and continuous building clusters. When transportation facilities serve the purpose of continuous connectivity,

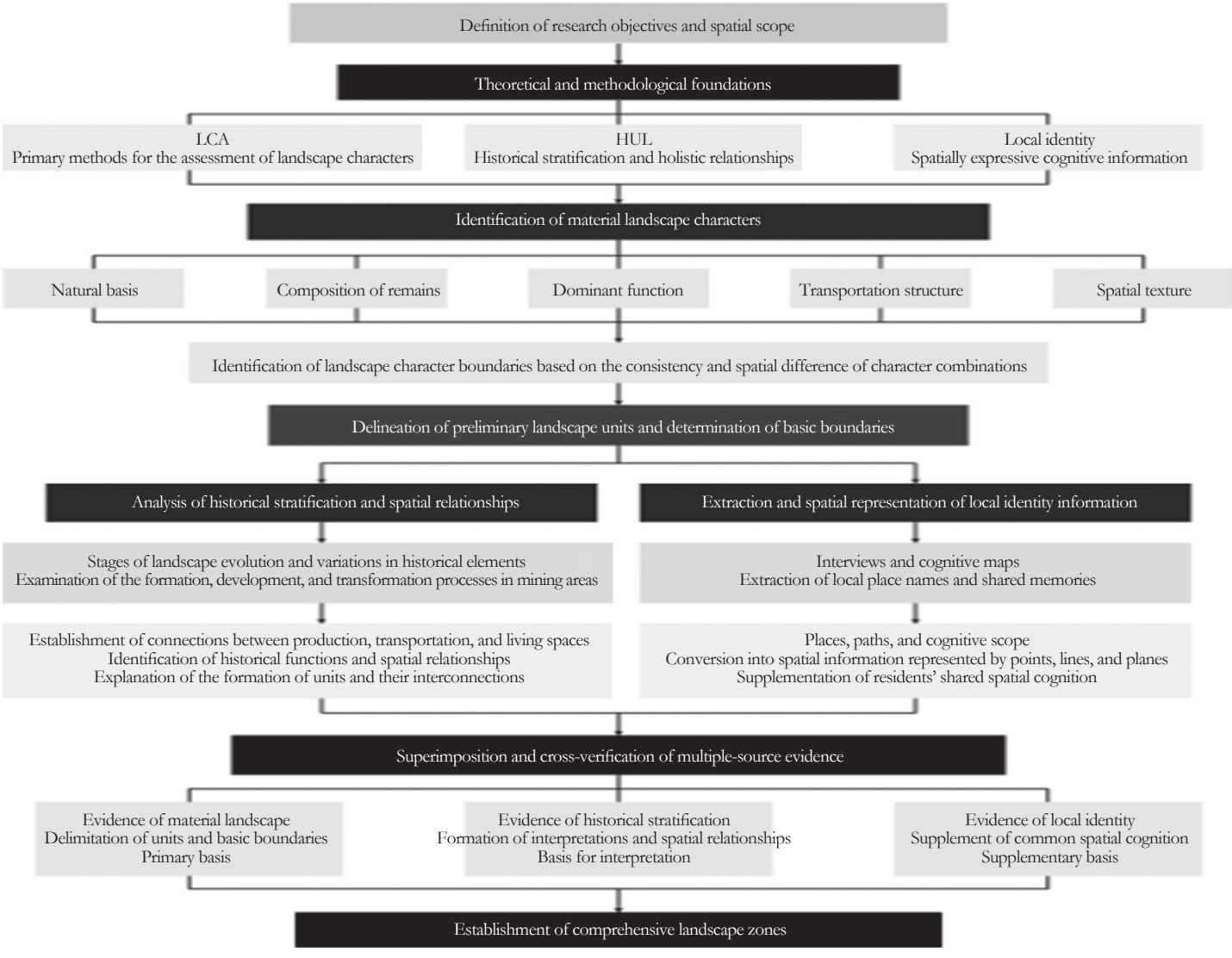

Fig.1 Research framework for landscape character identification and comprehensive zoning of mining heritage

they are considered internal structures of the unit. Historical stratification analysis segments developmental stages based on significant events, including mine construction, production expansion, and production decline, categorizing current elements into states such as continuation, replacement, or disappearance. Systematic relationship employs coal production, material transportation, and staff livelihoods as key indicators to identify the production network, which comprises wellheads, lifting, washing and selection facilities, coal storage, external transportation, and gangue discharge facilities, as well as the life network, which includes residences, roads, public facilities, and workplaces.

Local identity data are encoded based on "narrative content, spatial objects, local significance, and spatial form"[7]. This approach distinctly categorizes sites as point-like nodes, continuous activities and process routes as linear paths, and shared activity areas as planar or approximate ranges. Information that is repeatedly mentioned, consistent across different groups, and exhibits stable spatial orientation is considered consensus evidence. Areas at the periphery that show significant differences are identified as blurred edges. Individual information that cannot be corroborated through archives, existing relics, or other respondents is utilized solely for interpretative purposes and does not directly influence boundary delineation.

2.3 Multi-source evidence verification and zoning rules

Comprehensive verification focuses on the basic zoning units and initially assesses the consistency, complementarity, and conflicts among evidence derived from material, history, systematic relationship, and local identity. When the combination of remains, spatial form, historical function, and local significance within a unit is generally coherent, the original boundaries should be preserved. If stable internal differences exist and can be delineated by features such as roads, terrain, building textures, or the edges of continuous land use, further subdivision is warranted. For adjacent units, merging should only be considered when material differences are minimal, historical connections and shared understanding are strong, and no significant spatial barriers are present. If the local cognitive scopes do not align with the original boundaries, adjustments should be made in conjunction with the physical boundaries. In principle, substantive boundary adjustment must be supported by at least two independent types of evidence, including material changes or evidence from the physical space. In cases where areas are spatially separated but closely linked through production processes, commuting, or collective memory, the independence of planar zoning should be maintained, with their overall relationship supplemented by connection lines and nodes.

3 Landscape character identification and spatial representation of Yangquan No.3 Coal Mine

3.1 Overview and development context of the research area

Yangquan No.3 Coal Mine is situated within the mining region of Yangquan City, Shanxi Province (Fig.2). The scope of this study encompasses production, transportation, guarantee, office services, and staff living spaces. The site contains preserved relics including wellhead lifting equipment, washing and selection facilities, storage and transportation infrastructure, railway gangue discharge points, maintenance workshops, public buildings, and residential dwellings. The study area is developed along mountainous terrain characterized by gullies, slopes, and elevation differences, which together form a natural framework. Prolonged excavation activities and engineering construction have further modified the landscape, resulting in artificial slopes, multi-level terraces, and clustered layouts. The development of the site can be categorized into three distinct phases: from 1906 to 1946, representing the early mining formation period marked by dispersed mining sites; from 1947 to 1997, denoting the phase of modern mining area expansion during which an integrated system comprising mining and excavation, washing and selection, storage and transportation, gangue discharge, and residential services was established; and since 1998, a period characterized by decline and transformation. During this latter phase, some facilities have become idle, been demolished, or repurposed; however, the roads, terraces, and building complexes largely retain their original structures and memories.

3.2 Material landscape characters and basic zoning

The overall elevation of Yangquan No.3 Coal Mine exhibits minimal undulations. Due to limitations in scale and data accuracy, factors such as slope direction, geology, river systems, and vegetation coverage demonstrate constrained variability, resulting in indistinct internal spatial differentiation. Consequently, separate mapping of these factors was not conducted. In contrast, slope effectively captured micro-terrain features, including local inclines, artificial slopes, and plateau transitions. Therefore, this study employed the slope map as a reference tool to aid in delineating the boundaries of fundamental spatial units (Fig.3).

Based on on-site investigation and verification of remains, the material landscape of the No.3 Coal Mine can be categorized into three primary types: production and transportation, production guarantee, and office and living areas. The production and transportation space primarily comprises wellhead lifting facilities, washing and selection facilities, storage and transportation infrastructure, and gangue discharge facilities. Production guarantee spaces encompass power supply, maintenance, recycling, and associated industrial courtyards. Office and living spaces include administrative offices, public service, and staff living clusters. Variations exist among different wellheads and their auxiliary spaces: the main and auxiliary wells constitute the production core; No.1 well integrates early excavation, transportation, and subsequent utilization functions; No.2 well is situated adjacent to the mechanical and electrical maintenance plant; and Yugong well occupies a relatively independent space characterized by sinking terrain. Boundaries for roads, railways, terraces, and contiguous building clusters were identified as candidate delimitations. Linear facilities that facilitate production transportation or daily passage were considered internal structures within units or as cross-unit connections.

Based on this foundation, the functional organization prior to the production suspension, as depicted in the existing planning drawings, was superimposed and cross-verified with current imagery, the distribution of remains, and identifiable site boundaries. Areas where existing boundaries generally align with the edges of roads, terraces, or building clusters, and where the internal dominant functions and remains combinations exhibit relative continuity, were retained as fundamental spatial units. In contrast, areas exhibiting variations in the combination of remains, formation stages, or place significance were not subdivided solely on the basis of single material evidence at this stage. Instead, these areas were reserved for further verification through subsequent historical stratification and local identity evidence. Following this verification process, 11 fundamental spatial units, labeled A to K, were identified. These include the main lifting area, coal washing and selection area, coal storage yard, multi-camp recycling area, machine repair and coal maintenance area, industrial park, cultural and entertainment office, collective dormitory, No.1 well, Yugong well, and gangue

discharge area (Fig.4). These units represent the overall functional organization prior to production suspension and serve as the starting point for subsequent comprehensive zoning verification, rather than constituting the final zoning outcome.

3.3 Historical stratification and systematic relationship

Through a comparative analysis of historical maps, archival materials, old photographs, and existing remains, it has been determined that the current landscape of Yangquan No.3 Coal Mine results from the cumulative overlay of multiple phases of construction, production adjustments, shutdowns, and subsequent reuse. Distinct historical differences are evident within certain extant zones. In the main lifting area (Zone A), variations existed in the composition of remains and the production functions of the primary and auxiliary well lifting cores, as well as the power support facilities. The No.1 well area (Zone I) allowed for further differentiation between the core remains at the wellhead and the surrounding transportation and reuse spaces. The remnants of the No.2 well and the later mechanical and electrical maintenance plant within the No.3 Coal Mine Industrial Park (Zone F) exhibited significant differences in terms of their formation periods, facility types, and usage methods. Conversely, the primary assemblages of remains and their historical functional relationships in the coal storage yard (Zone C), machine repair and coal maintenance area (Zone E), and Yugong well area (Zone J) demonstrated relative continuity.

From the perspective of systematic relationship, Zones A, B, C, and K constituted a continuous production chain encompassing processes such as lifting, washing and selection, coal storage, transportation, and gangue discharge. Zones D, E, and F performed supportive functions including recycling, maintenance, and subsequent industrial utilization. Zones G and H established a living network through offices, public services, staff accommodations, and commuting routes. Roads, railways, and transportation routes that traverse different zones primarily served to illustrate historical connections between units and were not directly employed as criteria for merging or delineating boundaries. Therefore, historical stratification analysis is principally utilized to identify stage differences and functional continuity within existing zones, thereby informing preliminary directions for adjustment. The decision to further subdivide or retain specific boundaries requires validation through local identity surveys and the integration of multi-source evidence.

3.4 Questionnaire survey and representation of local identity

In this study, a total of 41 questionnaires were distributed, of which 37 valid responses were obtained. Local identity information was collected using semi-structured interviews, cognitive mapping, and on-site identification. The respondents primarily comprised former miners, retired workers, family members of workers, and long-term residents. The survey focused on significant locations, shared memories, and activity routes. The number of participants identified through the questionnaires served as an indicator of the degree of cognitive concentration. The sharing and spatial stability of local identity information were assessed through cross-verification among different groups, participatory mapping, and historical data[8].

The survey results indicated that the local identity of the No.3 Coal Mine primarily centered on the wellhead and its auxiliary spaces, production and transportation facilities, staff residences, public activity areas, and historical commuting routes. Former miners and retired workers placed greater emphasis on mining and excavation processes, vertical movement within the mine, job collaboration, and workflow. In contrast, family members of workers and long-term residents prioritized housing, neighborhood interactions, and public cultural activities. These cognitive differences among various groups suggest that the No.3 Coal Mine functions not only as an industrial production site but also as a mining settlement embodying workplace life, community interaction, and collective memory. The diverse local identity information and their spatial translation results are presented in Table 1.

In the context of spatial translation, information repeatedly cited by multiple respondents, indicating stability and subject to cross-verification, was classified as identification nodes, shared cognitive ranges, and meaningful connection paths. Specifically, centralized identification sites such as wellheads and clubs functioned as recognition nodes; residential clusters and public activity spaces constituted shared cognitive ranges; and production, transportation, and commuting routes represented meaningful connection paths. The information did not directly supplant physical boundaries; rather, it served as supplementary evidence for the retention, division, or partial adjustment of the fundamental spatial units when corroborated with existing relics, historical maps, or the boundaries of architectural clusters. Conversely, information that was ambiguous or lacked cross-verification was presented solely as historical interpretation.

4 Multi-source evidence verification and comprehensive landscape zoning

4.1 Multi-source evidence verification and local identity

Comprehensive verification employs variations in material landscapes as the foundational boundary criteria, utilizing historical stratification and local identity to ascertain internal differences within units and to validate the local scope. The identity distinctions between administrative offices and public activity spaces in Zone G, as well as between collective buildings and sloping cave dwellings in Zone H, were corroborated through building functions, spatial configurations, and group boundaries, thereby providing supplementary evidence for unit delineation. Production transportation and commuting routes primarily illustrated cross-regional connections and did not directly alter planar boundaries.

Residents' perceptions of locations such as wellheads and clubs frequently encompassed adjacent areas used for waiting for work, transit, and public activities. When the repeatedly identified spatial range can be corroborated with the boundaries of existing relics, historical maps, or architectural clusters, it served as a means to verify local boundaries. Individual memories that lacked corroborative evidence were utilized solely as historical interpretations.

4.2 Fundamental zoning verification and adjustment

Multi-source evidence verification reveals that, among the 11 fundamental zoning areas, the dominant functions, combinations of remains, and spatial forms within Zones C, D, E, and J exhibited relative consistency and were preserved in their entirety. In contrast, Zones A, B, F, G, H, I, and K each contained two distinct sets of identifiable landscape features, which were accordingly subdivided into two zones. This subdivision resulted in the formation of 18 comprehensive landscape feature zones (Fig.5).

Adjustments are not mechanically determined by the number of elements but are grounded in consistent material distinctions and further elucidated through historical stratification, systematic relationships, or localized significance. Among these, Zones G, H, and I most effectively exemplify the role of comprehensive verification. The main office and training buildings in Zone G symbolize administrative management and organizational identity, whereas the club, bathhouse, cafeteria, and

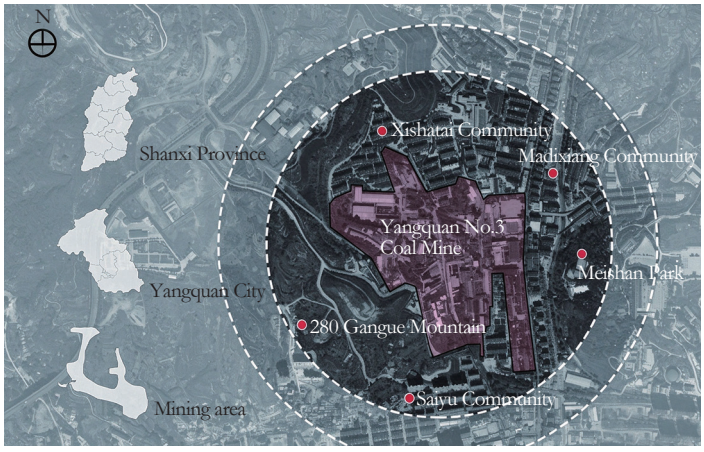

Fig.2 Location and research scope of Yangquan No.3 Coal Mine

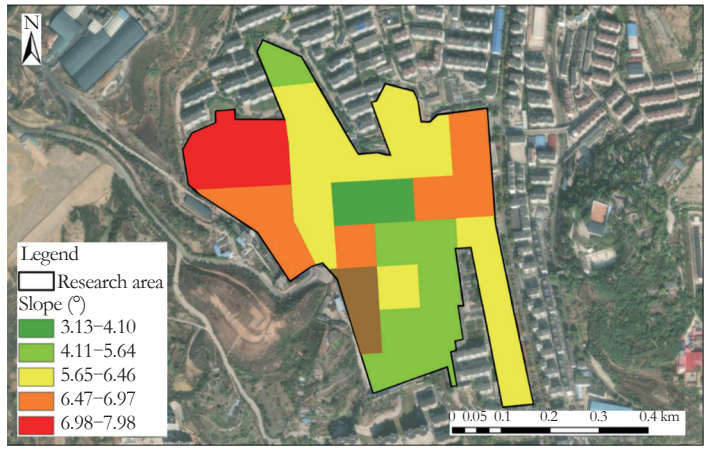

Fig.3 Slope of Yangquan No.3 Coal Mine

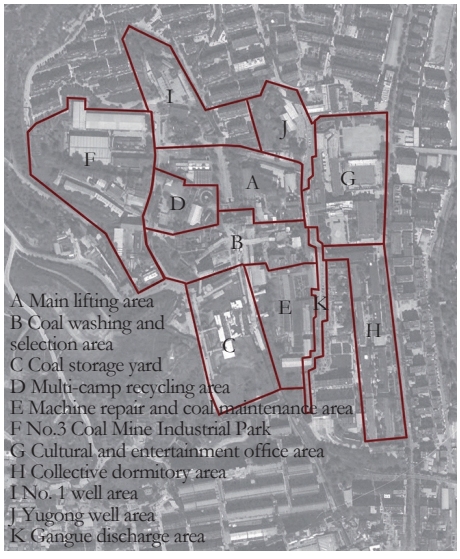

Fig.4 Fundamental spatial unit of Yang–quan No.3 Coal Mine

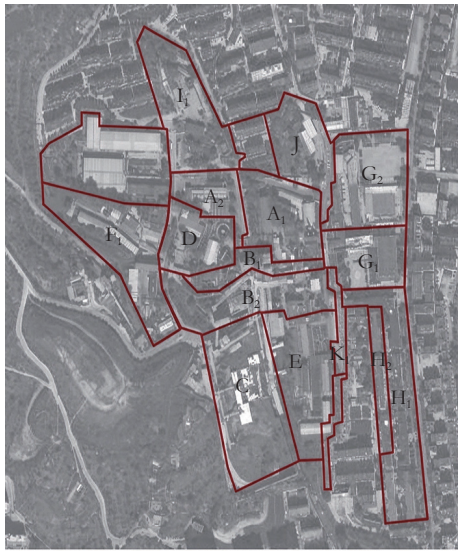

Fig.5 Comprehensive landscape charac–ter zoning of Yangquan No.3 Coal Mine after verification

cultural square are associated with the staff's public life and collective activities. Consequently, Zone G is subdivided into the administrative office landscape area (G_1) and the cultural and recreational public service landscape area (G_2). Although Zone H includes residential functions, its collective buildings embody the regular unit system of habitation, while the sloping cave dwellings reflect traditional hillside construction methods and diverse living experiences, resulting n the delineation of Zones H_1 and H_2. In Zone I, the wellhead of No.1 well and early mining heritage differ markedly from the bottom unloading silo, transportation plant, and subsequent enterprise buildings in terms of their period of formation and functional stratification, leading to the division into Zones I_1 and I_2. The criteria for adjustments in other zones are presented in Table 2.

4.3 Comprehensive landscape character zoning and overall structure

The 18 comprehensive zones, following verification, were categorized into four groups: mining and lifting; washing, selection, storage, and transportation; production support; and office and living areas. The specific composition and dominant characteristics of these categories are presented in Table 3. The production processes, historical transportation routes, and commuting paths were incorporated and represented as cross-regional connections; consequently, no distinct landscape types were designated.

From a holistic structural perspective, Zones A_1, B_1, B_2, and C constitute the core coal production chain of the No.3 Coal Mine, whereas Zones K_1 and K_2 are responsible for the subsequent processes of loading, transportation, and gangue discharge. Zones I_1, I_2, F_1, and J document the historical development of various wellheads and their auxiliary spaces. Zones A_2, D, E, and F_2 collectively provide power, maintenance, and material services. Zones G_1, G_2, H_1, and H_2 comprise a network of living spaces characterized by commuting, public services, and daily interactions. This comprehensive zoning not only highlights internal distinctions but also preserves the overall integration of production, transportation, and living spaces within the No.3 Coal Mine.

5 Conclusions

This study used Yangquan No.3 Coal Mine as a case study to develop an analytical framework primarily based on LCA, complemented by the stratification and correlation concepts of HUL, and validated through the involvement of local identity. Given the constraints of limited data accuracy, the research delineated the boundary using the on-site identifiable material landscape, interpreted spatial evolution through archival documents, historical photographs, and oral histories, and converts memory sites and activity routes into nodes, linear connections, and approximate spatial ranges, thereby constructing a verifiable multi-source evidence chain.

The study refined 11 basic zones into 18 comprehensive landscape feature zones, retaining four zones and dividing seven zones into two distinct units. These 18 zones were categorized into four types of physical landscapes: mining and lifting; washing, selection, storage, and transportation; production support; and office and residential areas. Cross-regional connections were delineated based on production processes, historical transportation routes, and residential pathways. The findings indicate that local identity can enhance the understanding of place

Table 1 Local identity investigation and spatial identification of Yangquan No. 3 Coal Mine

Spatial category	Corresponding space of local identity	Number of participants in the questionnaire	Results of questionnaire survey	Main memory theme	Cognitive maps and on-site identification results
A Main lifting area	Main and auxiliary wells and surrounding space for power guarantee	20	It is generally considered to represent the production history of the No.3 Coal Mine	Improving operations, vertical movement within the mine, and job collaboration	Enhancement of spatial differentiation for core and power guarantee
B Coal washing and selection area	Coal washing, selection and transportation space	22	The area primarily pertains to the processing and transportation of coal	Washing, selection, loading and technical process	Differentiation of core facilities from peripheral sites
C Coal storage yard	Coal storage yard and loading space	14	The area primarily pertains to the storage and transportation of coal in open-pit mining operations	Coal storage, loading and unloading, and open-air operations	Continuity of coal storage and loading range
D Multi-camp recycling area	Multi-camp recycling and reuse space	11	Participants focus more intently on the transformation of production and operations, as well as on changes in employment	Recycling and utilization, production transformation and operation, and employment changes	Relative concentration of recycling plants and courtyards
E Machine repair and coal maintenance area	Machine repair, coal repair and maintenance plant	17	The selectors are mainly former miners and technicians	Equipment maintenance, job collaboration and production support	Maintenance of factory buildings and continuity of courtyards
F No. 3 Coal Mine Industrial Park	No. 2 well and electromechanical maintenance space in the industrial park	18	Participants focus more on the transformation of production, employment, and functional changes	Production, equipment maintenance, employment transformation and functional changes of No.2 well	Respective concentration of No.2 well and electromechanical maintenance area
G Cultural and entertainment office area	Clubs, office buildings and public spaces	27	Clubs and public events are mentioned with greater frequency	Public culture, administrative management and collective activities	Respective concentration of office area and cultural and entertainment public space
H Collective dormitory area	Staff residences and internal streets and alleys	31	Neighbors, family, and experiences of personal growth are prominent	Residential life, neighborhood interaction and family memories	Relatively clear boundaries of residential clusters
I No. 1 well area	No.1 well and surrounding space	26	The production history and place symbols are prominent	Mining and excavation, vertical movement within the mine, waiting for work and job memory	Differentiation between wellhead core and peripheral locations
J Yugong well area	Yugong well and surrounding space	18	The original miners possess a relatively high level of cognitive ability	Mining production, vertical movement within the mine and site changes	Relatively independence of wellhead and sinking site
K Gangue discharge area	Gangue discharge facilities and transportation space	16	Participants pay more attention to the gangue discharge operation and environmental impression	Gangue discharge operations, transportation organization and job memory	Two section distribution of transportation and gangue discharge spaces
Cross-regional area	Historical commuting routes	24	The majority of participants are able to identify historical commuting routes	Commuting to and from work and daily travel	Superposition of main commuting routes
Cross-regional area	Disappeared or functionally replaced places	15	Some participants are able to recall the pertinent locations	Mine closure, demolition, relocation and spatial changes	Superposition of core positions and blurred periphery

Table 2 Verification and adjustment results of the existing functional zoning

Existing zoning	Main verification results	Main evidence	Comprehensive zoning
A Main lifting area	There is a significant difference in the improvement of core facilities compared to power guarantee facilities	Production function+boundary of building clusters	Subdividing into A_1 and A_2
B Coal washing and selection area	The areas for washing, crushing, coal slime treatment, and coal bunker transportation are distinct	Factory building forms+facility distribution	Subdividing into B_1 and B_2
C Coal storage yard	The storage and transportation functions are consistent with the characteristics of an open site	Land use+site forms+historical function continuity	Retaining as C
D Multi-camp recycling area	The recycling and storage functions are centralized, and their scope is relatively autonomous	Current functions+courtyard boundaries+cognitive ranges	Retaining as D
E Machine repair and coal maintenance area	The maintenance plant collectively constitutes the production guarantee system	Historical functions+production correlations	Retaining as E
F No.3 Coal Mine Industrial Park	The remains of No.2 well differ in nature from the maintenance facilities located within the industrial park	Historical maps+types of remains+questionnaires and spatial identification	Subdividing into F_1 and F_2
G Cultural and entertainment office area	Administrative management and public cultural life represent distinct concepts	Building functions+group boundaries+questionnaires and cognitive maps	Subdividing into G_1 and G_2
H Collective dormitory area	The architectural forms and lived experiences associated with collective buildings and sloping cave dwellings differ significantly	Architectural forms+terrain relationships +residential memories	Subdividing into H_1 and H_2
I No. 1 well area	The spatial stratification of the wellhead remains, along with the surrounding transportation and reuse activities, is clearly evident	Current remains + on-site identification	Subdividing into I_1 and I_2
J Yugong well area	The wellhead remains and the sinking terrain form a relatively independent space	Combination of remains+terrain relationships+historical functions	Retaining as J
K Gangue discharge area	Belt transportation is different in form from the gangue silo cableway system	Facility forms+process connections+path identification	Subdividing into K_1 and K_2

Table 3 Comprehensive landscape character zoning composition of Yangquan No. 3 Coal Mine

No.	Name of comprehensive zoning	Main spatial object	Dominant landscape character
A_1	Main and auxiliary shaft enhancement core landscape area	Main and auxiliary shaft headframe and winch house	The vertical wells and lifting facilities are centralized, constituting the core of production operations
A_2	Power guarantee and production service landscape area	Boiler room, pump room, mechanical and electrical factory building, supply point	Power facilities are arranged in clusters surrounding the lifting core
B_1	Washing, selection and crushing production landscape area	Coal selection buildings, crushing machine rooms	Large-scale plant facilities encompass the processes of washing, selection, and crushing
B_2	Coal slime treatment and coal bunker transportation landscape area	Concentration tanks, filter press workshops, coal bunker, conveying facilities	The tank body, coal bunker, and conveying facilities are continuously interconnected
C	Coal storage yard landscape area	Coal storage yards, weighbridge houses, warehouses, and maintenance facilities	The open storage yard is the main body, with auxiliary buildings positioned along its perimeter
D	Multi-camp recycling landscape area	Office building and storage room in the recycling area	Recycling buildings are enclosed to create courtyards, which are subsequently used for storage purposes
E	Machine repair and coal maintenance landscape area	Repair plants, machine repair and coal maintenance plants, gantry cranes	The maintenance plant and the gantry crane form a maintenance courtyard
F_1	No.2 well production remains landscape area	Wellhead and auxiliary space of No. 2 well	The wellhead and its auxiliary facilities constitute independent nodes for mining and excavation operations
F_2	Industrial park electromechanical maintenance landscape area	Hydraulic workshop, machine repair workshop, gantry crane, office building	Maintenance plants are continuously distributed, facilitating ongoing industrial utilization
G_1	Administrative office landscape area	Main office building, training building and auxiliary spaces	Office buildings form administrative clusters characterized by a well-defined organizational structure
G_2	Cultural and entertainment public service landscape area	Clubs, bathhouses, canteens, cultural squares	Public buildings are concentrated and arranged around the cultural square
H_1	Collective building dormitory landscape area	Collective building and internal living spaces	The arrangement of the collective buildings is systematic and orderly, maintaining the established residential pattern of the units
H_2	Sloping cave dwelling residential landscape area	Sloping cave dwellings, sloping roads and courtyards	The cave dwellings are situated along the slope, with the courtyards interconnected by ramps
I_1	No.1 well production remain landscape area	Wellhead of No. 1 well and remains of early mining	The early wellhead remains are concentrated and exhibit distinct historical characteristics
I_2	No.1 well transportation and reuse landscape area	Bottom unloading silos, transportation workshops, and later enterprise buildings	Transportation infrastructure and subsequent architectural developments are intricately interconnected
J	Yugong well sinking remain landscape area	Wellhead and sinking space of Yugong well	The wellhead forms an independent cluster according to the sinking site
K_1	Ore loading and belt transportation landscape area	Ore loading station, belt corridor	The ore loading station and the belt corridor are arranged in a linear configuration
K_2	Gangue silo cableway and gangue discharge landscape area	Gangue silos, cableways, and office buildings for the cableway team	The gangue silos and cableways are arranged in a continuous sequence along the direction of gangue discharge

significance, distinguish variations in meaning within the same spatial context, and facilitate boundary delineation when supported by physical and historical evidence. This paper presents a method for the identification and zoning of mining heritage landscapes, grounded in the identification of material landscapes and integrating historical evolution analysis and local identity information to validate zoning outcomes. This approach offers a spatial foundation to support the value assessment, protection, and renewal of comparable mining heritage sites. However, a limitation of the method is that the current evidence of local identity remains predominantly qualitative. Future research should further assess the stability of zoning boundaries by incorporating factors such as the structure of the interview sample, frequency of mentions, and the overlap in participatory mapping.

References

[1] Song, S. H., Shen, Y. & Chen, Y. (2020). Research on the practice of landscape renewal of Chengdu industrial heritage in the context of industrial culture inheritance. *Landscape Architecture*, *27*(7), 36-41.

[2] Liu, Q., Zainal Abidin, N. A. & Maliki, N. Z. et al. (2024). Landscape character assessment (LCA) in historic coal mining settings for landscape conservation: A systematic review. *Land*, *13*(9), 1396.

[3] Alba Dorado, M. I., Cano Sanchiz, J. M. (2024). Improvements and methodological innovations in the application of the historic landscape characterisation methodology to industrial heritage landscapes. *City*, *Territory and Architecture*, *11*, 1.

[4] Zhang, J. Y., Xu, Y. & Zhu, Y. F. (2025). Concept and characteristic of urban landscape layering, and design approach towards urban regeneration. *Landscape Architecture*, *32*(3), 32-40.

[5] Proshansky, H. M., Fabian, A. K. & Kaminoff, R. (1983). Place-identity: Physical world socialization of the self. *Journal of Environmental Psychology*, *3*(1), 57-83.

[6] Wheeler, R. (2014). Mining memories in a rural community: Landscape, temporality and place identity. *Journal of Rural Studies*, *36*, 22-32.

[7] Qiu, S. J., Bao, L. G. & Xu, J. et al. (2025). Research on the influence mechanism of "scenery-relics" landscape on public spatio-temporal behavior and perception preference in industrial wasteland: A case study of Shougang industrial heritage park. *Landscape Architecture*, *32*(3), 41-48.

[8] Ferrero, M., Friel, M. & Meneghin, E. et al. (2024). Industrial heritage and citizen participation: The UNESCO World Heritage Site of Ivrea, Italy. *Urban Planning*, *9*, 8220.