



Discussion on the Construction of Multi-element Geoscience Service System in Future New Urban Areas-A Case Study of Xiongan

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Abstract. With the continuous acceleration of urbanization in China, the requirements for new district planning in urban construction are getting higher and higher, which requires the establishment of a more perfect, more integrated and more systematic multi-element urban geoscience service system to support urban planning and construction. It covers five levels, including exploration and evaluation, governance and restoration, engineering construction, urban operation management and industrialization base construction and development, including 13 aspects, such as geology, environment, engineering and smart city, so as to adapt to the requirements of “intensive, intelligent, green and low-carbon” new-type urbanization.

Keywords: urbanization · multi- elements · urban geoscience · system construction

1 Introduction

With the continuous development of urban and rural construction in China, cities across the country have been spreading and expanding outward, resulting in the relative distance between cities becoming smaller and smaller, and the rural buffer zone between cities shrinking, gradually extending into a city cluster, such as Hong Kong, Macao, shenzhen, guangzhou as the center of the China Great Bay Area, with Shanghai as the center of the Yangtze river delta urban agglomeration, the Chengdu-Chongqing city cluster, led by Chengdu and Chongqing, and the Beijing-Tianjin-Hebei city cluster, led by Beijing and Tianjin, have gradually promoted the integrated development of national and regional strategies [6].

Such integrated development at the strategic level must be supported by a new concept. The new urbanization path of “intensive, intelligent, green and low-carbon” is obviously more in line with China’s new demand for urban development and construction in the future. Xiongan plays an important role in the coordinated development of The Beijing-Tianjin-Hebei region as a place to take over non-capital functions of Beijing.

The advantages of location and geography, as well as the large development space, have endowed Xiongan with the model role of renewal. Therefore, it is of vital importance to introduce a systematic multi-element urban geoscience service system in the development process, so as to build xiongan urban geoscience system and promote the organic integration of urban geoscience and urban management [2].

The introduction of systematic multi-element urban geosciences service system enables cities to better develop high-end high-tech industries, actively absorb and gather innovative element resources, and cultivate new driving forces, to enable cities to provide quality public services and build quality public facilities, make the city management become more adapted to local conditions, avoid the development pattern of one thousand cities, make major projects, new urbanization and industrial belts greener, more modern, smarter and more sustainable.

2 Problems and Current Situation

Urban geological concept into the country over the years, our country's urban geological work effective, since 2004 in Beijing, nanjing, tianjin, Shanghai, guangzhou, hangzhou to carry out the 3D geological survey since the pilot, the work gradually to the provinces, and at the same time, discusses its in the standard, specification, Such as "urban environmental geological survey evaluation standards", "urban geological survey work guide", "urban geological survey standards" and so on, to promote urban geological work [7].

From existing standard and specification, its guidance content still focused on hydrology, engineering, environment, disaster, and other aspects of basic geology, that is to say, did not jump out the category of geological, however, the city is a multidisciplinary integrated system, from the service level, is not only the geological requirements, including the planning requirements, construction needs, cultural needs, management needs, therefore, Cities built according to relatively single disciplinary standards will be slightly inadequate in the integration of urban management, and cannot meet the requirements of "intensive, intelligent, green and low-carbon" new-type urbanization.

According to the Master Plan of Hebei Xiongan New Area (2018–2035), it will be built into a high-level modern city. The urban planning and construction formed from the perspective of geology alone is far from reaching the standard of "intensive, intelligent, green and low-carbon", and a multi-element urban geoscience service system needs to be established.

3 The Overall Idea

3.1 The Basic Idea

Guided by general Secretary Xi Jinping's important speeches and instructions on the planning and construction of Xiongan New Area, following the concept of "green, humanistic, traditional and modern", focusing on relieving Beijing of non-capital functions, extending the traditional geological industrial chain, and focusing on major issues of urban planning, construction, operation and management, to carry out basic geological survey, energy, mineral resources survey and evaluation, hydrogeology survey,

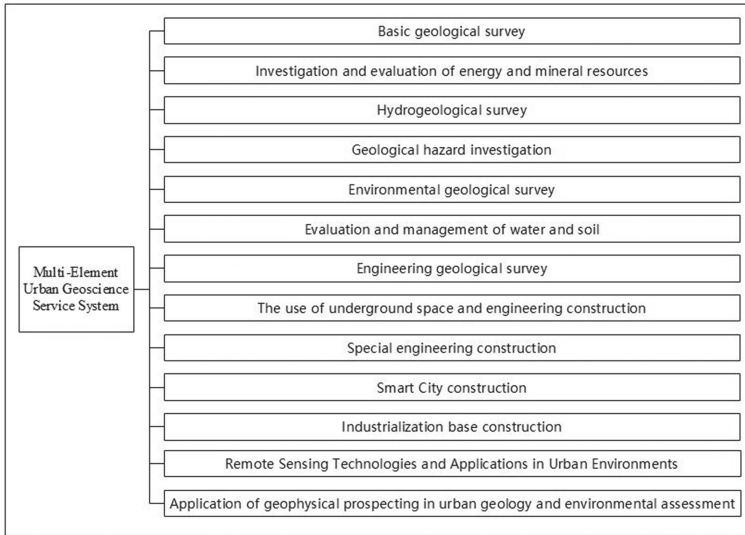


Fig. 1. The framework structure of multi-element urban geosciences service system

geological hazard and environmental geological survey, evaluation and management of water and soil, engineering geological investigation, the use of underground space and engineering construction, special engineering construction, smart City construction, Industrialization base construction and development, remote sensing technology in the application of the urban environment geological and geophysical exploration techniques in city and the environment evaluation of 13 aspects such as applied research, to build a green and smart Xiongan [3] (Fig. 1).

3.2 Architecture

According to the above ideas and according to the requirements of systematic construction, the framework structure of multi-element urban geosciences service system was compiled. According to the content of the framework, the work was carried out according to “five levels and four working areas”. Five levels are: exploration and evaluation, governance and restoration, engineering construction, urban operation and management, and industrialization base construction and development; The four workspaces are: Core start area, core, radiative zone, associated area, core start zone covers an area of 100 km², the core area of 200 km², radiative zone covers an area of 2000 km², the associated region for hundreds of kilometers, radiative zone periphery mainly male Ann district ecological geological unit associated areas, reflect male Ann driving around, the surrounding supporting male close relationship(Fig. 2).

3.2.1 Exploration and Evaluation

Based on the planning and construction requirements of Xiongan New Area, geological, hydrological, disaster, environmental and resource surveys should be carried out on

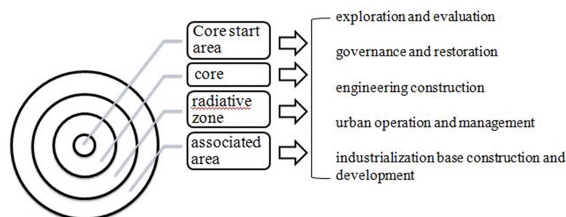


Fig. 2. Five levels and four working areas

the basis of the existing work level, so as to achieve a “transparent Xiongan” with a depth of 200 m, dynamic monitoring management of water resources and comprehensive environmental assessment [1]. Comprehensively improve the degree of investigation and research, provide reliable geological environment data for the construction of the new area, and provide support for urban planning, construction, operation and management.

3.2.2 Environmental Assessment and Restoration Management

We will carry out environmental governance and restoration planning, ecological and environmental protection planning, and environmental impact assessment for the overall plan of the Xiongan New Area. Focusing on local geological conditions and making full use of local resources to carry out restoration work. We will effectively improve the quality of the ecological environment, and provide support for building an ecological city with blue and green, fresh and bright, and integrated water city.

3.2.3 Engineering Construction

To carry out engineering geological survey, underground space engineering construction and special engineering construction. Evaluate the stability and suitability of the engineering site, make full use of underground space and provide technical and engineering construction support. And from the perspective of energy-saving city construction, the existing buildings are fully utilized and special engineering construction such as building translation is carried out to provide strong engineering and technical support for the construction of the new district.

3.2.4 City Operation Management

Building a smart city with full-space characteristics based on the idea of overground and underground comprehensive planning and utilization, providing support and services for the planning, construction, management, operation and maintenance of Xiongan New Area, and realizing the deep integration of informatization, industrialization and urbanization.

3.2.5 Construction and Development of Industrialization Base

Through the construction of data platform center, full-space geological, geophysical, geochemical, remote sensing, survey data acquisition, processing, processing and application platform, mineral testing and analysis experiment and comprehensive utilization base, comprehensive utilization of waste, promote the construction of industrialization base, improve the core competitiveness of Xiongan New Area, and create new economic growth point.

3.3 Content of Geosciences Service System

Around the basic geological survey, energy, mineral resources survey and evaluation, hydrogeology survey, geological hazard investigation and environmental geological survey, evaluation and management of water and soil, engineering geological investigation, the use of underground space and engineering construction, special engineering construction, Smart City construction, industrialization base construction, the application of remote sensing technology in the urban environment geological and geophysical exploration techniques in city and environmental evaluation the application of these thirteen aspects of development.

3.3.1 Basic Geological Survey

Around the male Ann in the planning of the city to the new requirement of the geological work, to carry out the male Ann district and surrounding the basis of geological survey work, improve the level of investigation and study, find out the new quaternary geological condition, engineering geological conditions and problems, build 200 m to pale male “transparent”, for the land use planning, project construction and provide technical support for the development and utilization of underground space, It provides engineering geology and water and soil quality geological information support for the planning, construction, operation and management of green modern smart city and blue-green interwoven ecological city.

3.3.2 Investigation and Evaluation of Energy and Mineral Resources

The taihang Mountain area in the west of xiongan New Area will be investigated for resources, including high-quality cultivated land, geological landscape and geological remains, rare and rare earth minerals, precious jade, graphite, lead and zinc, silver, gold and molybdenum, and non-metallic mineral resources such as construction stones and decorative materials. Find out in the northwest ecological its collapse landslide geological disaster such as mud-rock flow and characteristics of mine environmental geological problems and find out the present situation of the important mineral tailings (dam), and evaluate the tailings, harmful to the good governance through the recycling and utilization of tailings, as a male Ann to provide resources to support the new city construction, to ensure the development of characteristic agriculture, important mining and the regional economy, the Xiongan New Area will realize green and sustainable development.

3.3.3 Hydrogeological Survey

The construction and operation of the new area need enough water source for security, and the construction and operation of the new area in turn will have a certain impact on the water circulation system. According to the principle of “first seeks after the move”, for the quality of existing water resources (including groundwater, surface water), the future trend has a comprehensive grasp, and on the basis of water resources in the future to meet the production and life prediction of the degree, the ecological water, provided the scientific basis for the new city planning, provide the new city construction and operation of water security.

3.3.4 Geological Hazard Investigation

The establishment of Xiongan New Area puts forward a higher demand for the carrying capacity of geological resources and environment in the surrounding areas, especially for the three districts and counties in western China (Xushui, Mancheng and Shunping), where geological disasters are relatively common, because of the low degree of geological disaster work and the fact that the existing geological disaster data cannot meet the planning and construction requirements of the new area. In order to provide strong support for the next planning and construction of the region, a detailed investigation was carried out for the hidden danger points of geological disasters in the region, and the key hidden danger points were selected for geological disaster prevention and control engineering design.

3.3.5 Environmental Geological Survey

Taking the prospective control area of 2000 km² as the investigation area, the investigation and evaluation of the pollution status of soil, groundwater, surface water (including sediment), atmosphere, fruits and vegetables and crops were carried out, and the causes of radioactive pollution and endemic diseases were investigated and analyzed, so as to put forward suggestions and requirements for environmental remediation and management.

3.3.6 Evaluation and Management of Water and Soil

Xiongan New Area's environmental governance and restoration plan, ecological and environmental protection plan and overall planning environmental impact assessment are of great importance. Strengthen environmental monitoring, law enforcement and supervision, as well as scientific and technological support for pollution control of air, water, soil and solid waste, and improve the ecological environment quality of the New Area [8]. Giving priority to ecology and pursue green development, Strictly demarcating development boundaries and ecological red lines. It is planned to build a sponge, ecological, healthy and intelligent city with blue and green, fresh and bright, and water city in harmony.

At the same time, do a good job in environmental monitoring and data integration information construction, focusing on the design of atmospheric, surface water, groundwater, soil environment regular monitoring scheme; Carry out dynamic environment data

information construction, set up emergency response plan and information management system for sudden major environmental pollution.

It is also necessary to improve the design and ecological construction of sponge city, coordinate the actual construction of existing built-up areas and new areas, and realize the construction of sponge city with natural storage, natural infiltration and natural purification functions. Strictly delimit the development boundary and ecological red line, repair and protect the ecological barrier of Baiyangdian Lake, and plan to build ribbonlike forest green barrier and ecological corridor, so as to build an ecological city of blue and green, fresh and bright, and water city.

3.3.7 Engineering Geological Survey

To coordinate the actual construction of existing built-up areas and new areas, and realize the construction of sponge cities with natural storage, natural infiltration and natural purification functions. Strictly delimit the development boundary and ecological red line, repair and protect the ecological barrier of Baiyangdian Lake, and plan to build ribbonlike forest green barrier and ecological corridor, so as to build an ecological city of blue and green, fresh and bright, and water city.

3.3.8 The Use of Underground Space and Engineering Construction

Xiongan New Area will take regional underground space development and utilization as the premise, making underground space become an indispensable part of urban production and life. However, there is a serious shortage of ground space for development in Xiongan area, and it is urgent to plan and develop the shallow underground space (0 to 26 m buried depth) and the middle and deep underground space (less than 40 m buried depth). The upper part of the shallow underground space in Xiongan area can be used as the construction space for shopping, living and entertainment, parking lot and civil defense projects, while the lower part can be used as the construction space for comprehensive pipelines and underground transportation. The upper part of the middle and deep underground space can be used as underground transportation, logistics channels and other construction space, while the lower part can be used as water storage pipe gallery, special projects and other strategic infrastructure construction space. The implementation of underground space engineering construction provides support for shallow, medium and deep underground space.

3.3.9 Special Engineering Construction

During the construction of the new district, there will inevitably be conflicts between the new planning and the existing buildings and road facilities in the old city. From the perspective of energy-saving urban construction, the existing buildings should be fully utilized. To carry out the construction and consultation of building reinforcement, structural transformation and strengthening, building translation and deviation correction, concrete facade and bridge deck and airport runway breaking (without damaging steel), girder and column underlaying, bridge deck and dam and other reinforced concrete structure nondestructive cutting projects.

3.3.10 Smart City Construction

Centering on the planning, construction and key tasks of Xiongan New Area, and based on the actual characteristics of Xiongan New Area, the advantages and roles of China Metallurgical and Geological Administration as a central enterprise are displayed and brought into play, and the thematic work of intelligent management with characteristics of the whole space above and underground is highlighted as the entry point, so as to participate in promoting the construction of a new intelligent Xiongan with a high starting point and high standard. Through the operation and maintenance of thematic intelligent applications, support and services are provided for the planning, construction, management, operation and maintenance of Xiongan New Area, and reliable guarantee for the improvement of urban functions and safe operation of xiongan New Area.

3.3.11 Industrialization Base Construction

Put forward comprehensive utilization and industrialization construction plan for mud and other wastes generated during the construction of new area during the implementation of underground pipe corridors and underground space projects; To meet the needs of urban construction, the pilot test base of mineral testing, analysis, experiment and comprehensive utilization will be built. To build a full-space data acquisition, processing, processing and application platform for land, physical, chemical, remote and surveying. Centering on special application, aiming at the research and development and industrialization of iot sensing equipment, an industrial base for the operation and maintenance of iot sensing equipment with underground facilities will be built. Establish sensor industrial base to develop advanced sensor materials, design, micro and nano manufacturing technology and packaging technology with independent intellectual property rights, and vigorously develop all kinds of low energy consumption, high performance, low cost and intelligent, networked and integrated new sensor products suitable for sensor network applications; Centering on the development of the new sensing device industry chain, it focuses on creating three industrial clusters of “integrated circuit, intelligent chip and digital products”. Track the industrial transformation of technological achievements and accelerate the agglomeration of sensor industry to the base [4]. Exert the influence of smart city pipe network Industry Alliance, Integrate the technology, team and platform advantages of high-quality enterprises in the base, tap the potential, integrate resources, form a system, and strive to cultivate a group of technology process outsourcing enterprises, forming new characteristics of the sensor industry.

3.3.12 Remote Sensing Technologies and Applications in Urban Environments

In Xiongan new area, demonstration projects will be carried out for rapid application of aviation hyperspectral evaluation of resources, ecology and environment [5], the content covers the integrated application of aviation hyperspectral data acquisition and processing techniques, as well as the hyperspectral identification of geological disaster and environmental pollution, the hyperspectral evaluation of baiyangdian wetland environmental factors, urban hyperspectral investigation, and agricultural soil hyperspectral

remote sensing investigation. Improving the awareness of the resources and ecological environment in Xiongan New Area, further consolidating the pattern of territorial development and improving the basis for macro policy making.

3.3.13 Application of Geophysical Prospecting in Urban Geology and Environmental Assessment

Xiongan new area basic geology, resources, energy, and many other exploration work all needs to geophysical technology to support, taking “classification step by step implementation, by successive refinement to shallow narrow space by widespread, from qualitative to quantitative on the accuracy of” principle of geophysical prospecting work deployment, focus gradually from the outer space to the new city core focus, step by step to strengthen exploration degree, To study regional geological structure, basement undulation, deep structure characteristics, etc., to understand the general situation of geothermal resources and terrestrial heat flow, and to understand deep geothermal heat sources and heat transfer channels, etc. The target exploration depth is 0~10km, so as to achieve scientific, efficient, comprehensive and accurate geological exploration and evaluation goals, and provide strong geological support for the planning and construction of the new area.

4 Conclusion

- (1) Compared with the requirements of “intensive, intelligent, green and low-carbon” new-type urbanization, the current urban geological specifications and standards overemphasize geological color, resulting in a slightly insufficient integration with urban management.
- (2) In the future, the multi-element geoscience service system of new urban areas should focus on five aspects: exploration and evaluation, governance and restoration, engineering construction, urban operation and management, and industrialization base construction and development. Xiongan should be the model of this system.
- (3) In the future, the multi-element geoscience service system of new urban areas should include the basic geological survey, the energy and mineral resources survey and evaluation, hydrologic geology survey, geological hazards and environmental geological survey, evaluation and management of water and soil, engineering geological investigation, the use of underground space and engineering construction, special engineering construction, Smart City construction, industrialization base construction, remote sensing technology in the application of the urban environment, and the application of geophysical prospecting technology in urban geology and environmental assessment.

References

1. Guo S.J, Yu L, Ren Z. W, et al. (2021) Application of high-density resistivity method in fine division of Quaternary geological structure in the starting area of Xiongan New Area[J]. North China Geology, 44(1):45-51.

2. Lin L.J, Han B, Ma Z, et al. (2021) A study of the multi-factor urban geology standard system in Xiongan New Area [J]. *Hydro Geology & Engineering Geology*, 48(2):152-156.
3. Lin L.J, Li Y.M, Ge W.Y, et al. (2017) General ideas for urban geological survey in China and key theory and techniques[J]. *Geology in China*, 44(6):1086 – 1101.
4. Ma Z, Xia Y.B, Li H.T, et al. (2021) Analysis of natural resources and environment ecological conditions in the Xiong'an New Area[J]. *Geology inChina*, 48(3):678-696.
5. Sun B. D, Chen Y. (2017) Xiong'an New Area Strategy is a Sally Port of Solving the "Poverty Belt around Beijing and Tianjin" Problem[J]. *Regional Economic Review*, 44:67-71.
6. Wang T. (2016) Study on planning strategy of Urban New District A case of Southern New Town in Changshou City [D]. ShanDong, ShanDong University,1-5.
7. Yan H, Zhang X. T, Liu F. F, et al. (2020) Discussion on urban geological work under the framework of geological planning [J]. *Geology and Exploration*, 56(4):852-861.
8. Zhang Y.D. (2021) Research on Satisfaction of Farmer's Vocational Skills Training in Xiong'an New Area[D]. Hei University of Econimics and Business:7-18.

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