

ARCHITECTURE AND CONSTRUCTION

SCIENCE-BASED ECOPOLIS OR BACK TO THE FUTURE

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ABSTRACT

This article examines the basic prerequisites and essential social needs in search of new architectural and urban realization forms of scientific research. Existing scientific researches of the bases and design concepts of ecological settlements have been analyzed. The contextual form-making of the ecopolis research is scientifically proven. The search project proposal for the implementation of the basic principles of environmental scientific city research is given and described. The main provisions of the project approach in the design of ecological research ecopolis are formulated.

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*Never, in any case, the Republic will not
thrive, if it is not drawn by artists on the
divine pattern.
Plato, The Republic*

Introduction. Global experience shows the economic growth of advanced nations and their particular areas is primarily based on the high use of the academia and latest technologies, the synthesis of which serves as a decisive impetus for the progressive development of the nation and all of mankind. Perception of the scientific development, as a necessary and priority component of nation-wide headway, took place in days of old, when leading scientific schools and universities began to be actively formed. There is a wide typological spectrum of various types of research buildings, facilities, centers and structures today in the world intended for research in any scientific fields, ranging from basic subjects (biology, medicine, physics, etc.) to modern synthetic and multidisciplinary endeavors of innovative research.

Problem formulation. Current types, forms, and sizes of “architectural envelope” for conducting academic research work today also differ in a wide range of options: from space-saving laboratories, research centers, institutes, complexes to the academic centers and entire science campuses founded in the Soviet period. It should be added that in the last 50-60 years in many advanced nations an evolutionary “modified” architectural form of research purpose - the technopark - was actively implemented. The leading functionally forming the distinctive feature of the technopark from the previous types of formations of innovative scientific focus was architects` and investors` understanding of science commercialization importance and, as a result, of scientific research and sensations.

Taking into account the key period for existence and operation of technological parks as centers of scientific research, the question of further evolutionary and progressive way of development

for architectural and urban objects` organization of innovative research activity today appears again. In our opinion, a possible further step in this direction may be the scientific ecological city - ecopolis.

By all means, one should take into account the inherent issues of urban design and current trends of its cost-efficient design, considering the possible creation of a research center for innovation activity on the whole city scale. Today, the incremental pace of extensive development and urbanization of modern cities exceeds the adaptive capacity of the local natural environment, which slowly leads to the destruction of the up-to-day and future basis of human life support for mankind.

Volodymyr Vernadsky defined as “the pressure of life” the process of continuous expansion of the boundaries of the biosphere, its inhabitation of living matter. Then and there, the growing man-made impact on nature is one of the super-powerful urban factors, which determined the need to find more balanced forms of human existence in the environment, as well as the need to optimize socio-natural interaction.

Spreading common “expanding trend” of spatial development of new cities is gradually changing with the aspirations of society to rationalize the use of all resources, which in turn leads to the search for fresh forms of organization for the comfortable inhabitable environment. Improving the living standards, working conditions, including the research spectrum, is considered as a social project aimed at increasing the people capability. Today the quality is defined as the foundation of the constant development of society. So, mankind needs a strategy for sustainable development, a master plan, in which it is necessary to reveal the existing issues of the research ecological city, agglomeration and show the ways of their solution.

Research and publications analysis. In urban planning theory has been formed several generalized approaches and concepts of ecological cities: “City as a self-organizing system” (Y. Bocharov, V. Lavrov, B. Marchen, E. White, Y. Borton, V.O. Timochin); “City as an element of the biosphere development” (V. Vladimirov, V. Glazychev, B. Kommoner); “The City as the Only Complex-Urban Landscape Evolving in time” (L. Zaleskaya, E. Mykulina, I. Fomin); “City as the Object of the Homosphere Humanization” (D. Likhachev).

In the early eighties, “Ecopolis” concept became popular that was proposed by a group of experts in ecology and biology [1]. Staged environmentalization of all activities and brainwork will promote the noospheric orientation of socio-natural sustainable development, recommended by the United Nations as the only acceptable direction for the existence and world community development. A possible variant of interaction is proposed in the sense of conceptual project of the scientific research ecopolis: noosphere – man – science – city.

The purpose of the article. The purpose of the article is to highlight the further development of one of the types of scientific research groups (ecopolis) formed from the analysis of historical kinds of human settlements and best known practice in design of diverse forms of scientific research objects, as well as taking into account the contemporary ecological and urban trends of architectural and urban design.

The main material. Ecopolis is a conceptual scientific research city of the future, which should embody the best features and experience of existing historic settlements, meet the progressive environmental principles of its own building and life support, and serve as a research platform for mobile international cooperation. Illustration of architectural and urban planning, building mass and functional-planning display of the leading ideas of the scientific ecopolis can be seen in the search project of the ELZAS city.

The countryside near the Ukrainian city Odessa was chosen as an area for the pilot design of the ELZAS ecopolis. For centuries-long history, these lands are remembered by the tribes of Cimmerians, Scythians, Greeks, who built the ancient cities of the Black Sea, early Slavic tribes [2]. The way of the Kiev princes to Constantinople passed through them in 904-944, and in the 14th century, Ukrainian nationality was formed on these lands. These lands were allocated for the settlement of foreign colonists by the order of the Russian Empress Catherine II. 67 colonist families from the German lands of Alsace settled in the valley of the Baroque in 1808. They created the village of the same name there, in which their families lived 138 years. In 1944, when the village left the last Germans, the village was renamed Scherban [3].

The planning composition solution of the ELZAS ecopolis is based on the classical concentric system, which can be traced for the first time since the initial human settlements. The relevancy of choosing the circular form of primary settlements was related to the objective necessity of defense, as well as the subconscious sense of security and cohesion that arises in the circle. At the same time, the central part of the colonial settlement has always been recognized as the most protected and significant.

Another well-known example of the use of a concentric system is Stonehenge (“Stone Circle”), built before by the Egyptian pyramids, the oldest monument, an artifact of ancient civilizations and beliefs, which is also received a circular planet with a centric core.

The circle shape is the naturally subconscious geometric figure, which forms the basis of building for many objective structures of world perception of the material and spiritual worlds: from elementary surrounding things to the sun shape and solar system structure, the infinity perception, and even the entire universe. The cyclicity concept we observe in nature and various spheres of human activity, including in most sciences: psychology, sociology, pedagogy, economics, etc. Circulation is the basis even in market relations, which, of course, affect all spheres of society's life today.

Returning to the choosing rationale for concentric form for ecopolis from a philosophical point of view, it should be noted that intuitive quest for the ideal city began long before the well-known Plato, *The Republic Dialogue*, in which the fair and harmonious model of social life within the city unit was first applied. All primary utopias, Platonic type, "turned out to be a kind of later interpretation of the ancient pattern of "city" as "space" ... [4]. Understanding the city as a social matrix, which was evidenced by Leonardo and Durer, Campanella followed out, turning it into the space dimension (Fig.1.1). The true source of these forces is hidden not in atomic, but in the spiritual structure of reality – is the embodiment of the "central order" in the form of the solar system [5]. For an entire system of resettlement, Howard, in turn, proposed the creation of a "third magnet" opposite to the city and the countryside - economically autonomous garden-cities, which should "disassemble large bubbles" – megacities. (Fig.1.4).

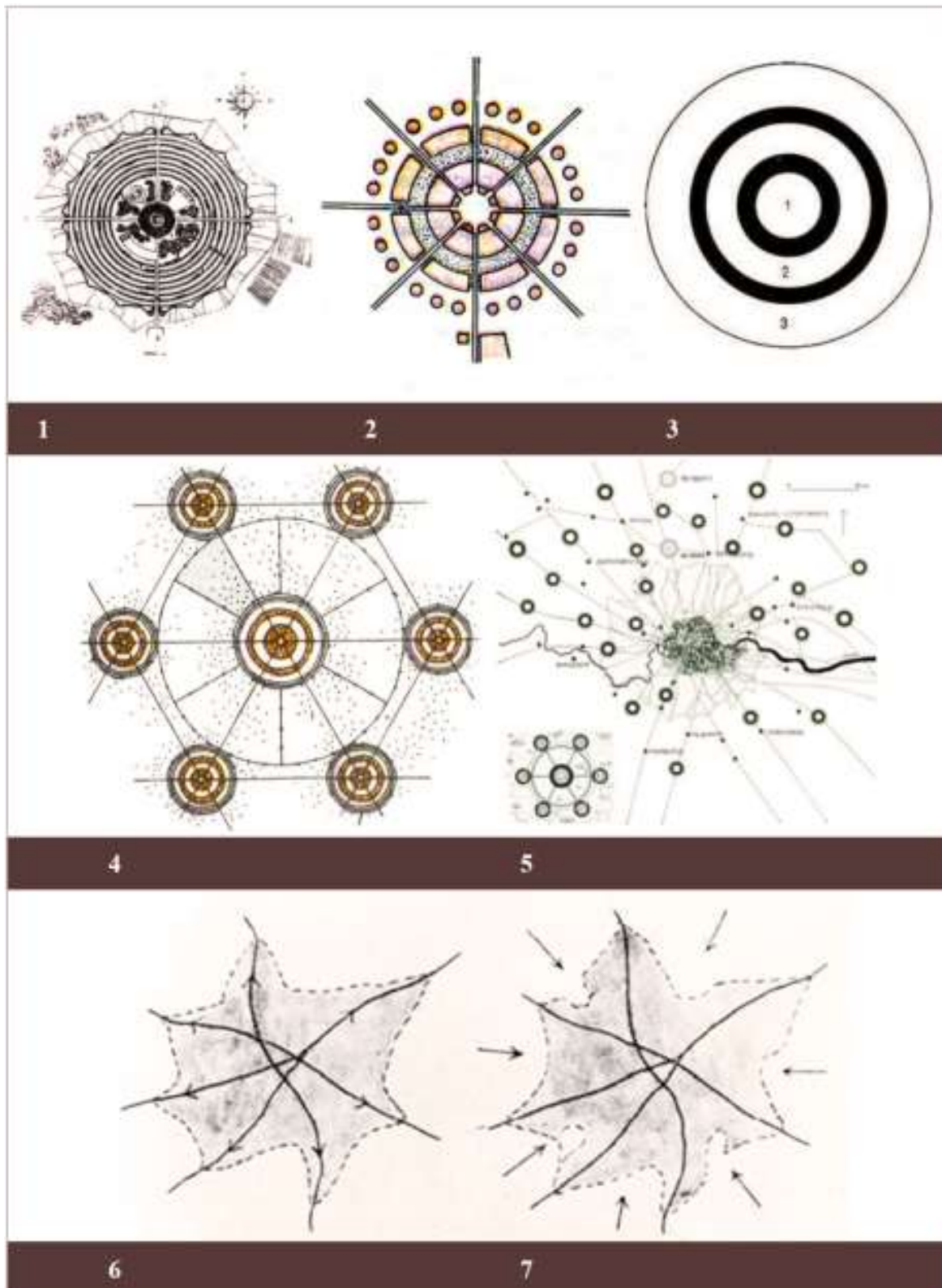
According to Patrick Geddes's elementary scheme, the principal choice of the urban development way was hiding - an attempt to see the region as an integral system whose functioning is distorted by the influence of the city-metropolis (Fig. 1.6, 1.7). In 1915 Gueddes published the book "Evolution of the City", where idealistic aspirations acquired the form of "city-region" or "conurbation". It should be noted that illustrative schemes to all of the above-mentioned concepts of creating forms of human settlements received colloquial outlines of plans.

Another fundamental idea, which is based on the formation of the scientific research ELZAS ecopolis, is based on the high use of the individual and unique context of the area, taking into account all its historical "layers". Today, the code reuse is based on the methodology of designing computer and other complex systems. The computer program, the program system module must be partially or fully composed of parts written in the past or parts of another system. So the idea of shaping the ecopolis on the example of the scientific research ELZAS city, designed for 2,5 thousand inhabitants, is based on preserving the value-psychological culture core of several stages of development of this territory – "through time".

The conceptual proposition is due to the "genetic code" as a hidden reserve for the development of an ancient settlement. The concept of the formation of a new settlement is also based on the modern reading of the structure of the ancient city of Trypillian civilization. A distinctive feature of these cities is also the concentric planning with the temple in the center.

The main communication city axes are formed taking into account the optimal orientation and the wind rose. The composite core of the landscape-ecological framework is a restored lake, around of which there are a ring-shaped scientific research and housing building with a moderate population density and perception human scale (Fig. 2.1). A circle construction feature is an internal atrium park, which in the section divides the building into a research and living area (Fig. 2.2). The underground part of the building provides a technical floor with engineering equipment, as well as an electric transport tunnel.

The dominant element of the building is scientific business center with research, analytical, marketing, office, commercial and other related functions, which should be easily transformed and tuned for the necessary scientific purposes, to be universal. (Fig. 3). There is a sports complex, a water park, a zoo, an innovative information and library center (where all research information is stored and analyzed), a restaurant, an entertainment center, a school and kindergarten, a hospital, and a church in the central part of the landscape park. The area outside of the circle building is intended for the location of the airport, hotels, campsites and pneumatic mobile laboratories.



*Fig. 1. The concept of searching the perfect ecological city
 1 - Campanella, the perfect "City of the Sun"; 2 - Morelli, a city based on the principles of the Code of Nature; 3 - Fourier, concentric city III; 4 - Howard, a garden-city; 5 - Evin, a garden-city; 6, 7 - Geddes, urban conurbation*

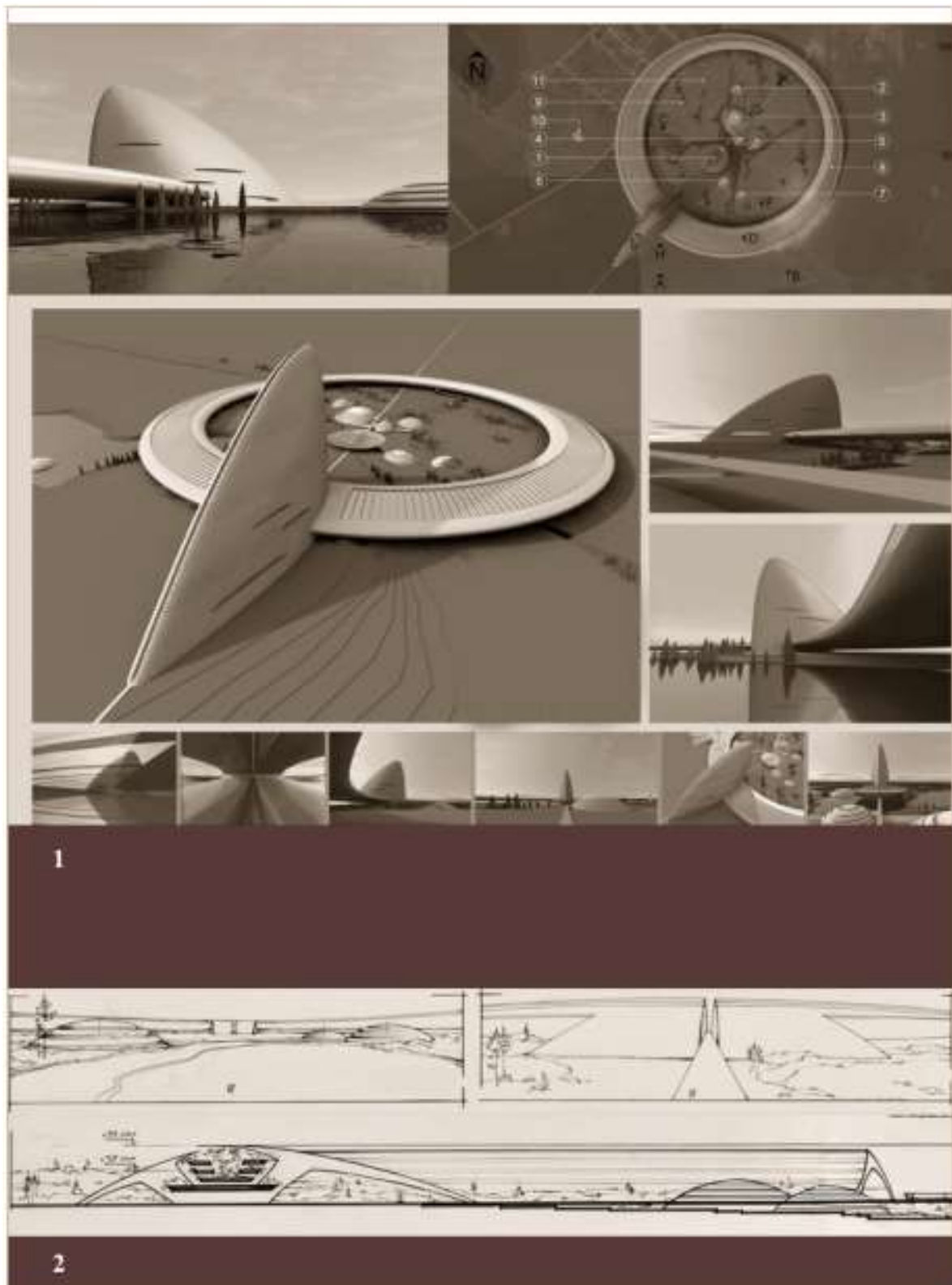


Fig.2. ELZAS ecopolis

1 - General view and lay-out (1 - sports complex, 2 - water park, zoo, 3 information and library center, 4 - restaurant, 5 - entertainment center, 6 - school, kindergarten, 7 - hospital, 8 - research and living sections, 9 - church, 10 - hotel, camping, 11 - park); 2 – “City gate” and section

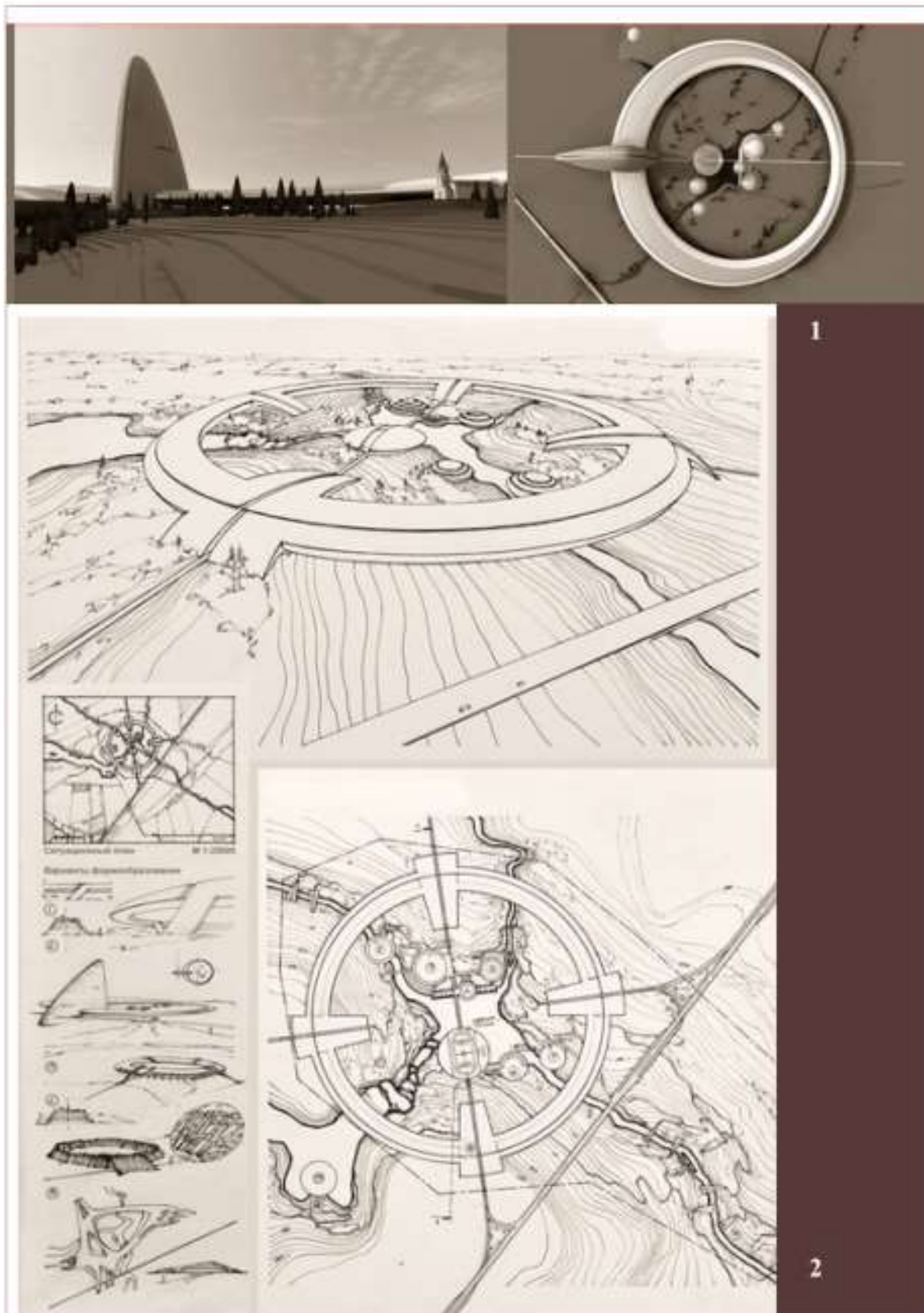


Fig. 3. Scientific research ELZAS ecopolis
1, 2 - General view, lay-out, building fragments

The organic circle structure of the ecopolis contributes to the compact distribution of workspaces and resettlement, the convenience of communications and the creation of a protective barrier against steppe winds. The microclimate of the interior space allows intensely greening the territory, taking into account the climatic conditions of southern Ukraine. It is intended to create a differentiated system of transport communications, with the organization of transit traffic outside of recreational and residential formations. ELZAS modeling strategy is aimed at creating a sustainable favorable environment for scientific research and development at the example of the small city of Odessa region. The proposed solution was preceded by a variant search (Fig. 4). The formation of a scientific research ecopolis is based on the creation of optimal conditions for the development, research and self-realization of not only present but also all subsequent generations of inhabitants and is determined by three groups of interrelated factors: ecological, socio-economic and cultural.

Environmental quality is based on maximizing the potential of natural and recreational resources; a respectful attitude to the historical heritage or historical identity; implementation of closed cycle technology, non-waste consumption; self-sufficiency and autonomy of functioning; valuable agricultural land preservation of the region; activating the life, creativity, social and professional potential of each person and the community as a whole in harmony with nature. Gradual ecologization of all activities, both inhabitants of the city and the urban organism, will inevitably lead to a new ecological philosophy of world perception and thinking. Land reclamation, landscape reconstruction and the reproduction of valuable water resources of the settlement with an inalienable recognition of the rule of the environment contribute to the formation of a new format of scientific-research ecopolis, which corresponds to the “city park”. An integral part of the ecopolis is determined by the closed cycle of energy consumption: the active use of the solar system on all fencing surfaces of buildings, rainwater and its cycling with constant filtration, ground energy, and heat pumps and other advanced technology. The ecological orientation of the ecopolis should also include the introduction of exclusively electric transport, the routes of which are foreseen in the underground tunnel (mainly under construction).

Social quality. Improving the life quality is seen as a social project aimed at empowering people. Quality is the sustainable development foundation of society – “the city lives of the happiness of its people”. ELZAS is designed as a regional scientific research center with an advanced cultural and economic business center that will promote the sustainable development of the territory, attract external and the formation of its own intellectual resources, the possibility of conducting a wide range of cultural events, festivals, olympiads; from the outlook of society, through the prism of each person's personality and its city perception as a cultural product of intellectual activity [6]. Past, present and successful future all of this must be combined within the city with its own history.

Cultural quality. Under the cultural regeneration of the historical settlement refers to the valorization is the process of changing the potential of limited resources, turning cheap into priceless. And, as a consequence, there is a qualitative change in the place of social existence - the cultural (partly mental) and physical environment. Special focus in ELZAS ecopolis is given to education: the city has a preschool institution, primary and secondary school of development of creative abilities under the Japanese method of training. It is believed that it is expedient to receive further qualitative education in the best world colleges and universities. Within the ELZAS research campus, is possible to study in the magistracy and graduate school, as the ecopolis.

Conclusions.

The modular construction of biological systems is accepted as the basis - the optimal natural balanced solution, which can be applied in new research ecological cities, technologies of functional organization and innovative projects on the basis of resource saving, with minimal basic modification. The image of ELZAS city is formed by the bionic ring structure of research and residential space development with the dominant volume of the public center - the natural form acts as a visual reference point; functional division of the territory into four organizational modules (labor, residential space, education, leisure); development of adjoining territory in the form of point injections of scientific and business activity.

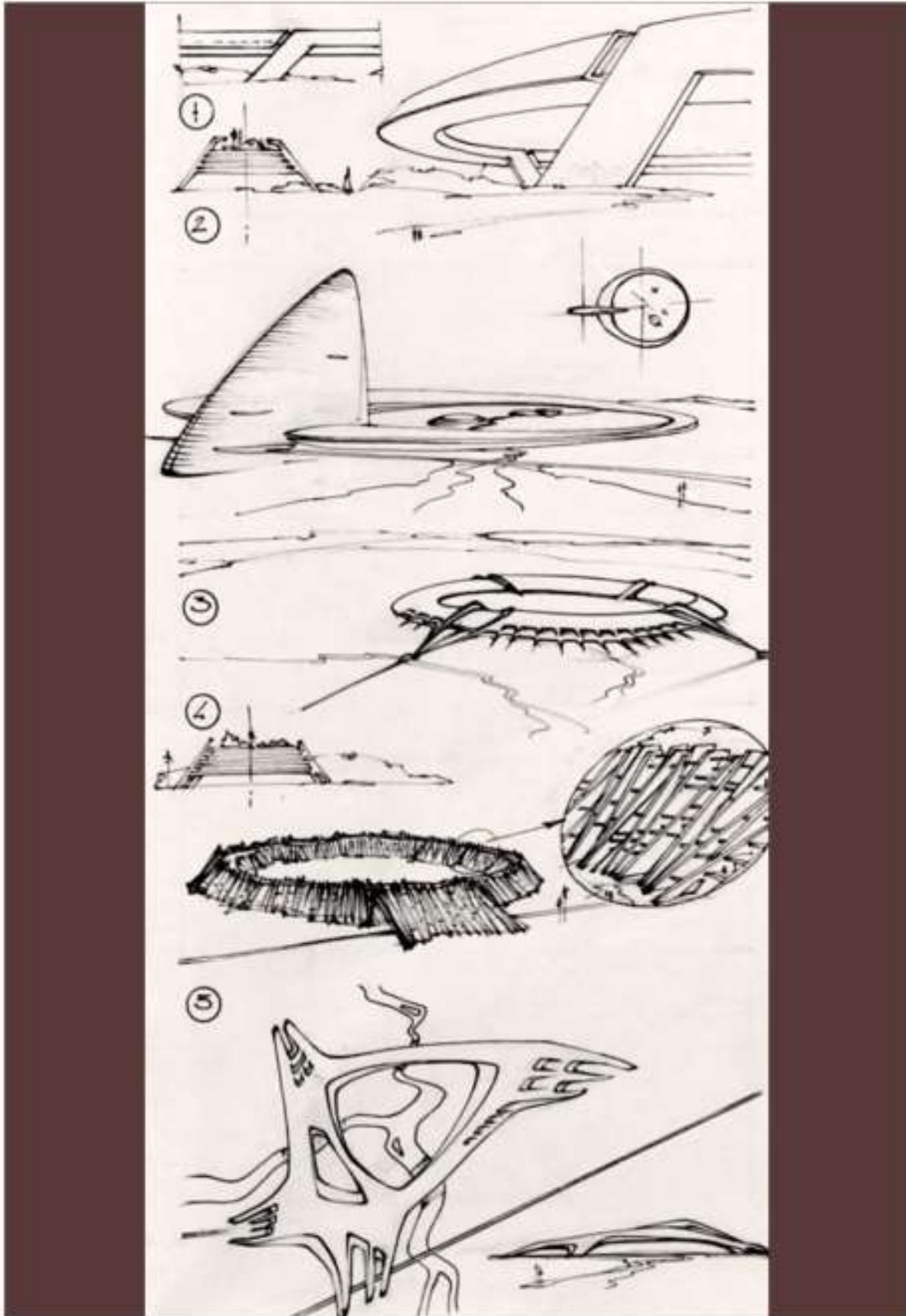


Fig. 4. Variable search or the shape and ELZAS research ecopolis mode

Creation of complete complex conditions for conducting research and international research cooperation is due to the introduction of the service industries of the highest level - hotel industry,

education, airport, trade and catering, domestic and cultural services.

The conceptual project proposal of the ELZAS ecopolis is aimed at:

- formation of new research-based cities on progressive ecological bases (ecopoliss);
- creation of new environmental agglomerations for the purpose of development of research activities and use of the potential of regional opportunities;
- association of research objects, educational, cultural, entertaining, information, residential, experimental production, transport, service spheres of life in a compact city-park;
- creation of innovative education based on “successful urban place” with competitive advantages for implementation of new ideas and projects;
- international cooperation on joint scientific and educational projects;
- renovation of the city according to research and development goals;
- universality and transformation of research laboratories, use of mobile and pneumatic temporary facilities;
- attracting high-quality human potential, intellectual resources, capable of creating innovations, realizing their initiatives and ambitions.

Then and there, the ELZAS ecopolis is designed based on the basic principle of the universe, according to which time, space, energy, and information are continuous. Man of the future must be inextricably linked and evolve together with the environment within the framework of general noospherogenesis – the noosphere – man – science – city.

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