CARTOSEMIOTIC ANALYSIS OF ECOLOGICAL ATLASES

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Abstract

Ecological atlases reflect the results of multifarious studies of territories. They serve for the complex presentation of spatial characteristics, and also for the knowledge of the interrelation of geographical medium and society. These atlases can be the subjects of the study and research too.
More than 3 years we conducted cartosemiotic analysis of diverse ecological atlases and maps. The work is executed within the framework of scientific project, conducted together by the Institute for Cartography, Dresden University of Technology, Germany and by the Institute for Water and Environmental Problems , Barnaul, Russia.
In the paper is presented author's theoretical- methodical experience concerning analog ecological atlases. This is also a new theoretical-applied approach to traditional atlases as semiotic time-spatial models of reality. This approach is based on the modular structuring and analysis of ecological atlas.

Cartosemiotic analysis

The cartosemiotics, within the framework of cartography is a new discipline studying features of cartosemiotic models (from the standpoint of modeling, communication and cognition) with the goal of acquisition of new spatial knowledge or revitalization of forgotten spatial information.
Cartosemiotics focuses its research and education interests, and other activities in interaction with cartography. The elaboration of research method of cartosemiotic models (not only traditional or analog models but also electronic or virtual ones) is one of the important tasks of cartosemiotics. Cartosemiotic method of research is a way to study and understand map language and language of map-like models (products) with their cultural-historical, social and comminication aspects. In this context the cartosemiotic method includes a cartographic method of research too; it is open for research with cartographic and non cartographic traditions.
Cartosemiotic study of traditional (analog) atlases as modular-semiotic spatial-temporal models of reality is based on semiotic structuring of atlas with further study of information properties of its componets (Wolodtschenko 1995). For the study of the structure of atlases can be used different approaches. Our approach is called a modular or information-module one. Figure 1 shows a module structure of analog atlas.

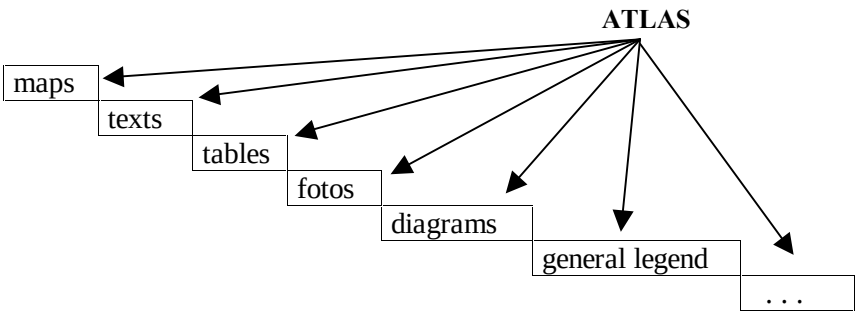

Figure 1. Module structure of analog atlas (Wolodtschenko 1999)

Within the framework of scientific project by the Institute for Cartography, Dresden University of Technology and Institute for Water and Ecological Problems, Barnaul the analysis of 22 ecological atlases was carried out (Rotanova 2001; Rotanova, Wolodtschenko 2001). This atlases are subdivided into four goups of territorial units: cities (with 3 atlases), regions (10), states (4) and world (5). The list of 22 selected ecological atlases is shown as Table 1. One atlas of this list, the ecological altas of Dnipropetrovsk region was selected for our detail examination.

№	Ecological atlases	Year of edition	Territorial units
I	Bremer Umweltatlas. Bremer,48 p.	1978	city
	Umweltatlas Berlin / Senatsverwaltiung für Stadtewicklung und Umweltschutz. Band 1. Berlin,179p.	1998	
	/Ecological Atlas of Moscow/ Экологический атлас Москвы, Москва, 96с.	2000	
II	Environmental Atlas of Alaska. University of Alaska.Fairbenks, 103 p.	1984	region
	Ekolocicka optimalizacia vyuzivania Vychodoslovenskej niziny. Bratislava, 122 p.	1986	
	Umweltatlas für den Landesteil Schleswig. Flensburg , 86 p.	1987	
	/Ecological atlas of Volga drainage-basin/. Экология ландшафтов Волжского бассейна в системе глобальных изменений климата (прогнозный Атлас-монография).– Н. Новгород. Интер-Волга.–163 с.	1995	
	/Ecological atlas of Dnipropetrovsk region/. Екологічний атлас Дніпропетровської області. Київ-Дніпропетровськ: Мапа ЛТД. – 24 с.	1995	
	/Atlas of Chernobyl exclusion zone/. Атлас Чорнобильської зоны відчуження. Київ, 26 с.	1996	
	/Dnipropetrovsk region. Medical-ecological atlas/. Екологія людини. Медико-екологічний атлас Дніпропетровської області. Київ-Дніпропетровськ: Мапа ЛТД. – 24 с.	1997	
	/Murmansk region. Ecological atlas/. Экологический атлас Мурманской области. Москва- Апатиты. – 48 с.	1999	
	Atlas niv Odry/Atlas obszarow zalewowych/Oder-Auen- Atlas. WWF Deutschland, 164 p.	2000	
	/Rostov region. Ecological atlas./ Экологический атлас Ростовской области / Под ред. В.Е. Закруткина. – Ростов н/Д. Изд-во СКНЦ ВШ, 120 с.	2000	
III	Atlas zur Trinkwasserqualität der Bundesrepublik Deutschland. Berlin 172p.	1980	state
	/Atlas of environmental and heals of Russia/. Атлас «Окружающая среда и здоровье населения России». – М., ПАИМС. 448 с.	1995	
	/Ecological atlas of Ukraine/. Екологічний атлас України. В.А.Барановський. Київ. Географіка. – 42р.	2000	
	/Ecological atlas of Russia/. Экологический атлас России. – СПб. ЗАО «Карта». 2002. – 128 с.	2002	
IV	Internationaler Umweltatlas, Jahrbuch der Welt-Ressourcen. Analysen. Band 1, 727 p.	1986	world
	Atlas of the Environment. New York, 192 p.	1900	
	Der Oeko-Atlas. (Hrsg.J.Seager). Bonn. – 128 p.	1991	
	World Atlas of Desertification. UNEP. London/New York/ Melbourne/Auchland, 78 p.	1992	
	Resources and Environment. World Atlas. Institute of Geography (IG RAS), Moscow; Ed. Hölzel, Vienna: 1998, v.1-93p, v.2-190p.	1998	

Table 1. Selected ecological atlases

Module of maps and its submodules

As a rule the module of maps (or map module) presents a major part of the ecological atlases. This module forms a new semiotic field of information for the study, research and knowledge of ecological cartographic works. A map module includes different maps (basic and additional ones), which can be characterized according to the specific classification aspects. In our studies a map module is examined in four aspects: territorial (spatial), subject, graphical and functional ones (Figure 2).

System module of maps							
Spatial submodule		Subject-substantial submodule		Graphic visualization submodule		Functional submodule	
Territorial and/or aquatic scope	Projection Succession of scales	Substantial sections of maps	Subject types of maps	Syntactic-semantic submodule	Sigmatic submodule	Function al purpose of maps	Form of perfor-mance

Figure 2. Module system with four submodules

As separate example of cartosemiotic analysis (for spatial and subject-substantial submodules only) we used the ecological atlas of Dnipropetrovsk region. The semiotic structure of atlas includes 4 information modules (Table 2): maps, texts, diagrams and general legend. The module of maps is most informative one; it includes 20,5 pages of maps or 85,4% of atlas content.

Modules	Characteristic of modules	
	in pages	in %
Maps	20,5	85,4
Texts	2	8,3
Diagrams	1	4,2
General legend	0,5	2,1

Table 2. Characteristic of modules of ecological atlas of Dnipropetrovsk region

Table 3 shows four territorial units of spatial submodule: republic, region, parts of region and cities. 28 maps or 77,8% belong to teritorial unit - region; 5 maps (13,8%) are maps of cities.

Spatial submodule		
Terirtorial units	Number of maps	%
Republic: Ukraine (1)	1	2,8
Region: Dnipropetrovsk (28)	28	77,8
Parts of region: West Donbass (1), Nikopol manganese area (1)	2	5,6
Cities: Dnipropetrovsk (1), Dniprodzerzshinsk (3), Kryvi Rig (1)	5	13,8
sum:	36	100

Table 3. Spatial submodule (for territorial units)

The scale row includes three groups of maps (large, midle and small scales). Such division into scale groups was typical for territory of the former USSR where small- scale maps covered separate parts of republic, regions, and republic. Three groups of scales and accordingly number of maps into groups are shown as Table 4 and Table 5.

large scale of maps	midle scale of maps	small scale of maps
1: 100 000 (5 maps)	1: 200 000 (2 maps) 1: 1 000 000 (1 map)	1: 1 500 000 (13 maps) 1: 3 000 000 (14 maps) 1: 15 000 000 (1 map)
5 maps	3 maps	28 maps

Table 4. Three scale groups of maps

large scale of maps		
1: 100 000 (5 maps)	city	13,8%
midle scale of maps		
1: 200 000 (2 maps)	part of region	8,4%
1: 1 000 000 (1 map)	region	
small scale of maps		
1: 1 500 000 (13 maps) 1: 3 000 000 (14 maps)	region	77,8%
1: 15 000 000 (1 map)	republic	

Table 5. Three scale groups of maps with five territorial units

For characteristic of subject-substantial submodule we have selected two tables. Tables 6 shows three substantial sections and types of maps (as rule, thematic maps). With 19 maps (or 52,7%) the natural-social section is dominant one of the atlas.
The types of thematic maps are grouping into the analytic, the complex and the synthetic maps. Complex and synthetic maps (31maps) include 88,6% of the all atlas maps.

Subject-substantial submodule					
Substantial sections of maps			Subject types of maps		
Nature theme	Social theme	Natural-social theme	analytic maps	complex maps	synthetic maps
11maps	6 maps	19 maps	4	16	15
29,0%	18,3%	52,7%	11,4%	45,8%	42,8%

Table 6. Substantial sections and types of maps

The synthetic maps one can subdivide into simple synthetic, analytic -synthetic and complex -synthetic maps (Table 7). The complex -synthetic maps include 46,% of all synthetic maps.

Subject-substantial submodule (Synthetic types of maps)			
Synthetic maps	Number of maps	%	
simple synthetic maps	4	11,4	26,6
analytic -synthetic maps	4	11,4	26,6
complex - synthetic maps	7	20,0	46,8
sum	15	42,8	100

Table 7. Three groups of synthetic maps

Conclusion

Based on the example of the ecological atlas of Dnipropetrovsk region the structural-semiotic analysis of module of maps and its two submodules, spatial and subject-substantial ones was carried out. The maps of region and its parts (30 maps or 84,4%), the small scale maps (28 maps or 77,8%) and maps of natural-social thematics or strictly ecological maps (19 maps or 52,7%) occupy a key place in the atlas. The system of types of the maps is characterized by the predominance of complex maps (16 maps or 45,8%) and synthetic ones (15maps or 42,8%).
Within the framework of the cartosemiotic method of reaserch our paper represents also the construction of different structural models from the territorial- spacial and thematical parameters or characteristics. The cartosemiotic method of reaserch as a new method in the cartography must be further developed.

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Biographical sketch
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1987 - promotion in Institute for Cartography, Dresden University of Technology
1995-1999 member of the ICA Commission "Theoretical Fields and Definitions in Cartography" and Working Group "Map Semiotics"
1999-2003 and 2003-2007 chairman of the ICA Commission on Theoretical Cartography
1991-1995 co-editor of the issue "Kartosemiotik/Kartosemiotika"
Since 1998 co-editot of the issue "Diskussionsbeitraege zur Kartosemiotik und zur Theorie der Kartographie"
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