

'WHO IS WHO' ON THE MAP?

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Abstract

There are many attempts at map's content explanation. We show one more attempt for expounded its content by semiological point of view. The map's content is divided in three groups:

Map's field is a mathematical model of the represented part of the reality. It has some properties: *a scale; plane and elevation co-ordinate systems; a surface of reference; a cartographic projection; physic sizes*. It is shown that positional reference frame, contours, and co-ordinate lines are components of the map's field. Map's field is strictly determined by a) frame on the map or b) by map's object boundaries.

Internal components are cartographical signs that represent definite objects from reality. They are situated on the map's field and they get their own *specific location*. This location connects the signs with their objects. The internal components have been received properties from map's field, specially its scale and co-ordinate systems. Out of the field the internal components are geometrical shapes, pictograms, images and so on. When they are positioned on the map's field on a specific location, they get field's properties and become cartographical signs.

External components have been characterized the map's object; the map's field and the map itself. They are sign vehicles, written or graphical, but they are not cartographic signs because they are not connected to the map's field. Different kind of maps can have various external components, but most important internal components are the *legend of the map, map title, contour interval specification and scale representation*.

A map to be usable it must consist at least one element of each component. Map's field, some cartographical signs and at least one of external components are necessary to create a simple map. Some more complex maps are consisted by several fields with different scales, co-ordinate systems and diverse legends.

1 Introduction

The maps have different contents and they contain various component parts. Some maps are very simple and are consisted by several elements. Other maps are more complex (for example topographical maps) and they contain great number of elements. It is not impossible to enumerate all of them. **All maps are composed only by graphical signs**. Some of these signs are cartographical, because they are subordinated to cartographical rules and they represent some objects from the reality. Other signs are not cartographical and they are subordinated to other rules or do not represent any objects from the reality. For example, map title and descriptions in the legend are controlled by the rules of natural language and their locations on the map are controlled by aesthetic rules. When we teach cartography, we must clearly separate the cartographical signs from other signs on the map.

What other components, except cartographical signs, have the map? This question is discussed many times by different cartographers. But each of them answers by different way. We will look at two cartographers' understandings for the components of the map.

2 Components of the map according to K. Salischev

Salischev (1990) described three main components of the map:

- **Content** – “some aggregation of information for the natural and social object (phenomena) that are shown on the map, their location, properties and sometimes – dynamics.” (p.19)
- **Mathematical base** – “determinative mathematical laws for map building and geometrical properties of the cartographical image that determine co-ordinate relation between object in reality and their images on the map.” (p.19-20)
- **Legend of the map** – “a systematical composition from the signs used on the map and the necessary explanation for them – they serve as key for map’s reading and map’s analysis.” (p. 20)

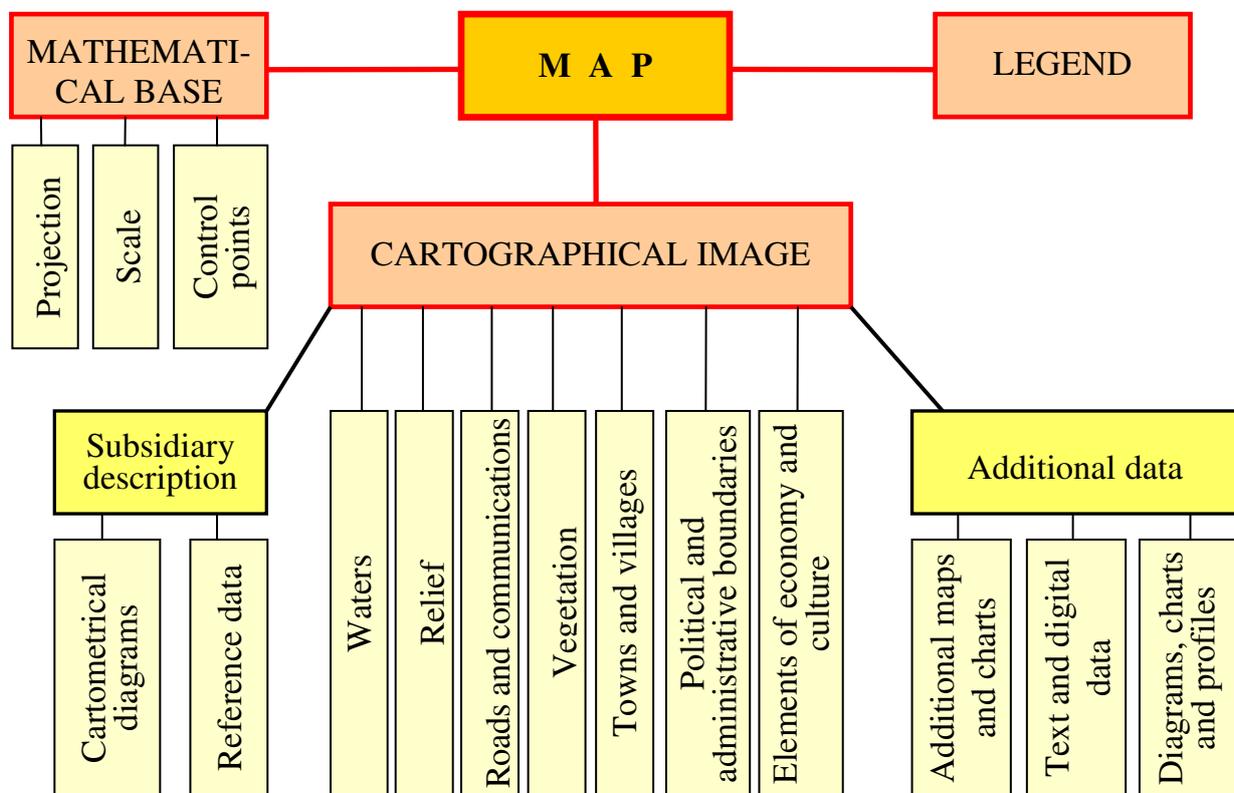


Fig.1 Scheme of geographical maps' elements

Salischev (1990) referred two special elements toward the map contents (p. 21):

- **Subsidiary descriptions** – “some formal information about map (title, creators ... map sources ...) and official elements that make more easy reading of the map.” (p. 21)
- **Additional data** that add the some information about represented on the map objects. These data are situated very often outside of the frameworks of the map.

The elements of these components are shown on the fig. 1. We will mark that *mathematical laws* and *geometrical properties* cannot be components of any map. They are used in processes of map construction but they do not present in map contents.

It is incorrect to put such elements like *diagrams, charts and profiles; reference data; text and digital data* in the cartographical image. The appearance and location of these elements are not subordinated from cartographical rules and they do not represent any objects by cartographical way.

3 Components of a Cartographic product according Raul Ramirez

Raul Ramirez (2004) divides the map content into eleven components. He do not group them, but he investigates how far necessary are these component and their elements.

3.1 Heading

*“Heading ... is composed of the **title block** and **the legend**.”* Beside map title, the title block includes *“name of the organization producing the cartographic product, name of the geographic area displayed type of cartographic product, date of publication and so forth ... The legend ... is equivalent to a bilingual dictionary. It uses graphic and natural language signs to define the equivalences between the components of both languages.”* (p.86)

3.2 Positional reference frame

“The positional reference frame links the actual terrain and the display area of a cartographic product. ... There are two kinds of positional reference frames: the graticule network and the grid network.” (p.86-87). Under *graticule network* Ramirez understands geographical network and under *grid network* he understands rectangular network.

3.3 Surfaces of reference

Ramirez includes description of *reference ellipsoid, horizontal datum* and *vertical datum* in this component. He considers it for necessary component, although many maps do not include descriptions of such elements.

3.4 Cartographic projection

Description of the cartographic projection, used during map creation is necessary, component of the map, according to Ramirez.

3.5 Representational signs

“Representational signs are those signs located in the display area. This is the area delimited by the positional reference frame of a cartographic product. Three kinds of representational signs are found: (i) graphic; (ii) natural language and (iii) numerical language signs.” (p.89)

This definition is incorrect. In some case other components (for example title or legend) are located *‘in display area’* due to saving of the sheet space. But nevertheless they not transmuting into *‘representational signs’*. *‘The graticule network and the grid network’* are also located in display area. But Ramirez correctly considers them as non representational signs (see above point 3.2).

3.6 North arrow

“There are three different kinds of north directions: (i) grid north; (ii) magnetic north or compass north; (iii) true north” (p.90). This component can include one or all three north directions.

3.7 Scale representation

Ramirez discusses three elements of this component: *“(i) representative fraction that is an expression of the form 1/M or 1:M. (ii) text expression and (iii) graphic or bar scale.”* (p.91).

3.8 Contour interval specification

Ramirez includes only prescribed elevation difference between successive contour lines in this component. Here we should add graphical scales for determine angles of the slope.

3.9 Positional diagram

Positional diagrams “shows the position of each cartographic product with respect to the whole area of interest” at maps with multiple sheets or they are “used to indicate the location of the cartographic product, or series with respect to a well-known geographic or political feature” (p. 93).

3.10 Quality of data sources

Here Ramirez includes information such as “data sources, dates and quality of information sources, ground control sources, dates and quality of those sources and so forth is very important in a cartographic product because they provide the basic information from which the quality of a cartographic product can be evaluated” (p. 93).

3.11 Credit and notes

“The cartographic component credit and notes, includes the following types of information: disclaimers, warnings, publisher’s name, copyright owner, sheet number, number of copies printed, publication date, production method, revision date and so forth” (p. 94).

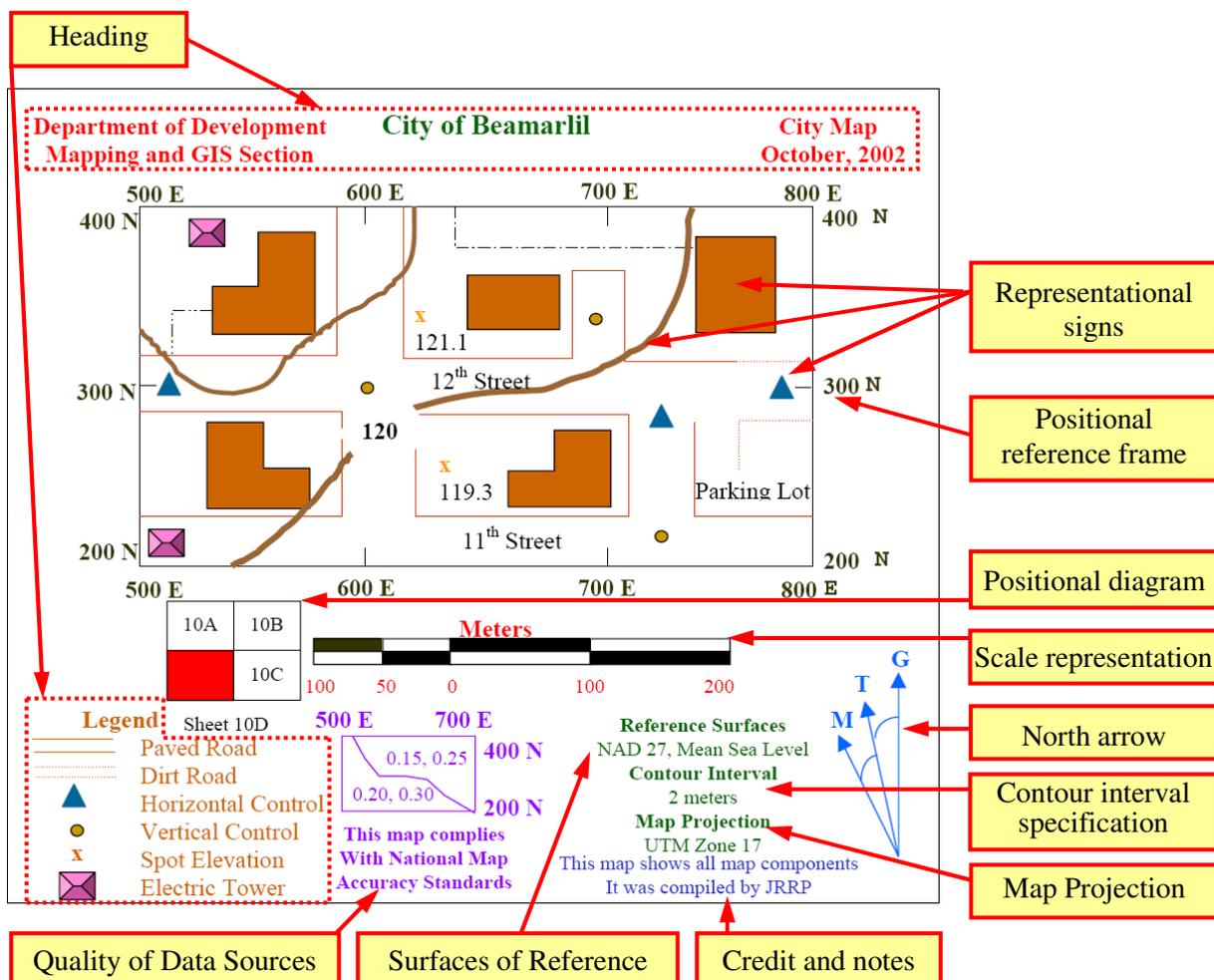


Fig. 2 Necessary components of a cartographic product, according to Ramirez (2004)

Ramirez sets the cartographical signs as one of the eleven components of the maps but this do not corresponds of the cartographical signs’ meaning and value on the map. The principle for commensurability (similar capacity) of the groups divided in the classification is not observed in this case. (See Ermack 1999)

Ramirez describes lines of the horizontal datum networks (for example meridians and parallels) as separate component. But he considers lines of vertical datum (contours) as representational signs: “*In a cartographic product, contours are part of the component representational signs*” (p. 92). All of these lines are mathematical defined and they are drawn via constant interval. They do not represent on the map any objects from the reality - they are mental lines. Therefore all of these lines should be treated equally: or as representational signs or as separate components of the maps.

4 A new scheme of the components of the map

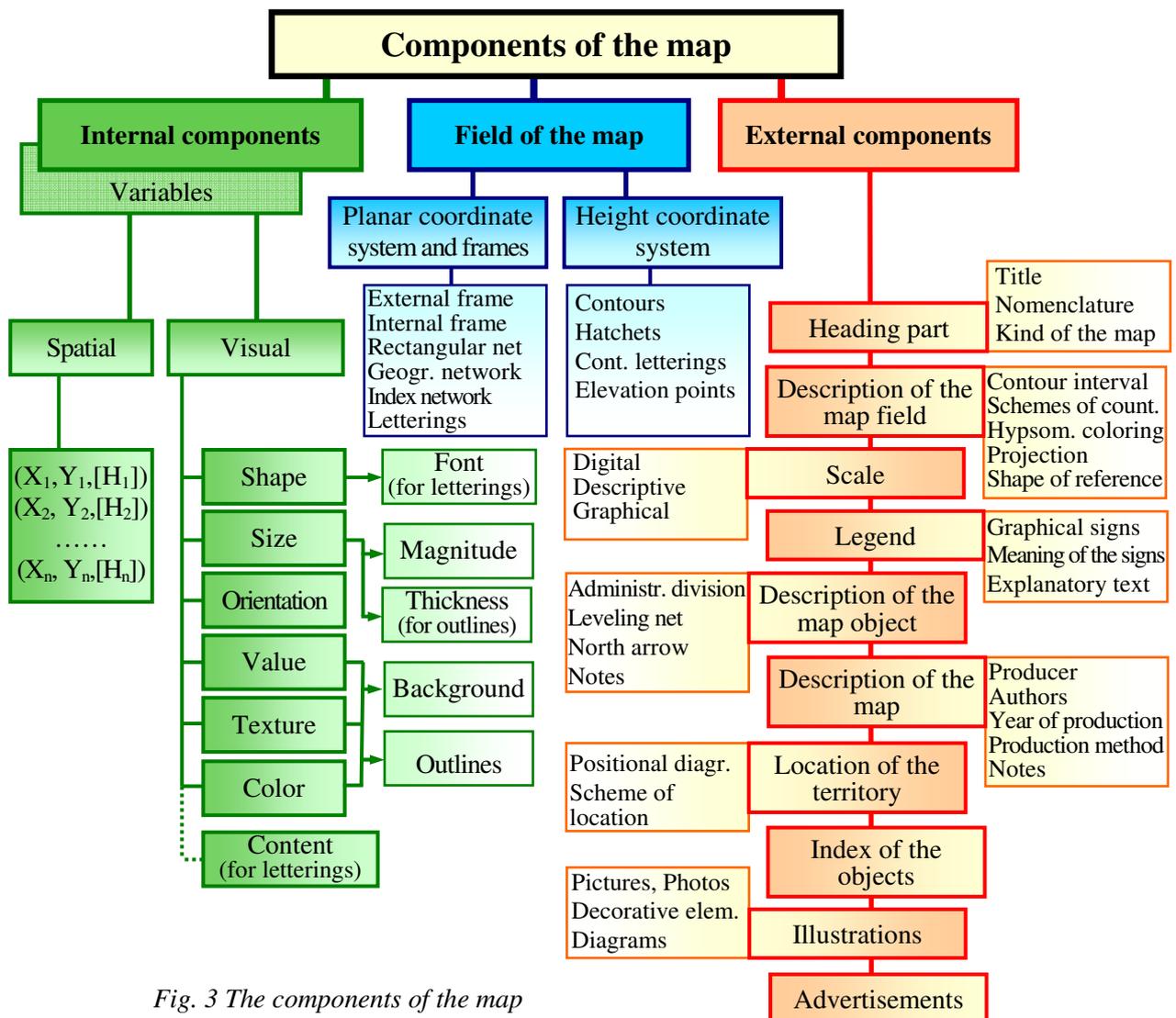


Fig. 3 The components of the map

The cartographical language is consisted by two elements: *graphical signs* (alphabet) and *cartographical rules* (grammar). When the graphical signs are placed in concrete location on the map in accordance of cartographical rules, they become *cartographical signs*. In this case they have abilities to represent some objects from the reality by cartographical way and they compose a space-similar model by the reality. Other graphical signs on the map, which are independent from cartographical rules, do not have these abilities. They are controlled by non-cartographic rules (geometrical, grammatical or aesthetical).

We called the cartographical signs *internal components of the map* because they implement the main function of the map – to represent a definite part form the reality. These signs represent concrete objects from the reality.

The internal components do not functioned in an empty space. They needs of a stage to play their roles, like the actors. The stage in the theatre reproduces the epoch of the play. It is a window to different dimension, shown in the staging. The map is needs of such stage that to connect map area with space of represented part of the reality. This component we called *field of the map*. It is a window to the reality. When the graphical signs are laid in this stage according to cartographical rules, they gain a connection with represented objects from the reality and they become cartographical signs.

In the map there are some other signs that describe *the internal components; the field of the map; the represented part of the reality; or itself the map*. These signs we called *external components of the map*. They functioned out of the field of the map and do not submit to cartographical rules.

According to scheme, shown on the fig. 3, the map has three groups of components: map field, internal components and external components. Some signs, included in differing components, appear the same visually, but can have different meaning on the map. A graphical sign in legend shows a common concept to a kind of object in the reality. When this object is laid on the field of the map, it represents a concrete object with its individual characteristics.

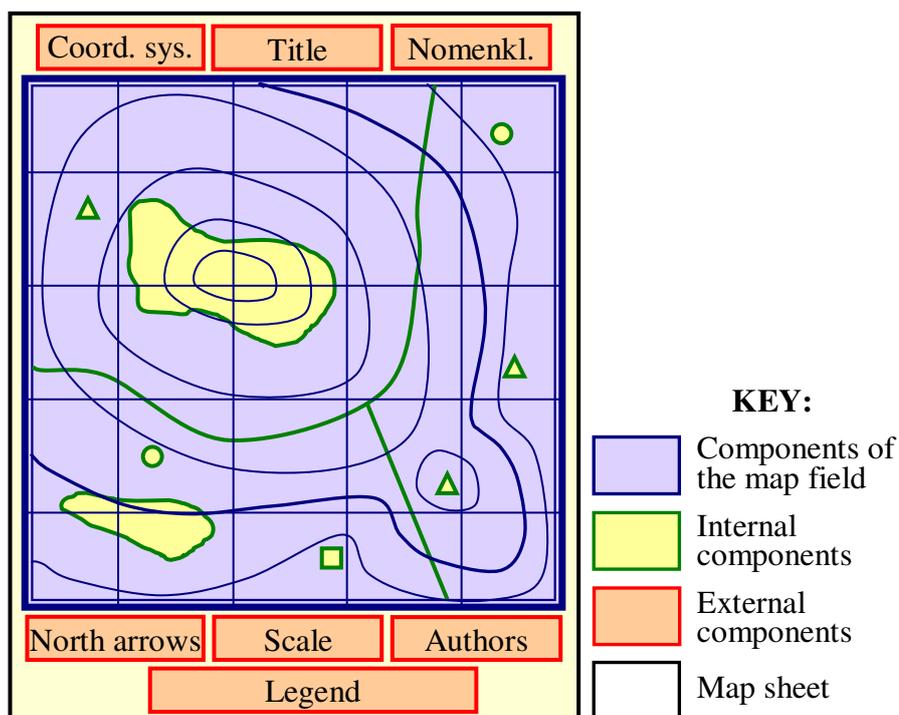


Fig. 4 An example for components of the map

On the fig. 4 is shown an example for the new scheme of components of the map. The three different types of components are displayed in varied colors. It is presented the difference between the map sheet and the map field.

4.1 Field of the map

The field of the map is a mathematical model of represented on the map part from the reality. It has own properties and components that are represented on the map sheet.

The properties of the field are scale, projection, shape of reference, type of coordinate systems, scope of the field in the reality and its physical sizes on the map. Many cartographers consider these properties as characteristics of the map. But on the map there are components that do not have

any relations with these properties (for example title, notes and description of the authors) and in some cases maps contain schemes, diagrams and other maps (a map sheet can have several fields) that have different properties. Therefore, these properties are characteristics of the map field but not of the whole map.

The components of the field, presented of the map, are:

- *Frameworks*. Most maps have one or two frames that limit the boundaries of the field. Some maps do not have any frameworks. In these cases the scope of the field is limited by object boundaries and outlines.
- *Planar coordinate network*. It is presented on the map field a) by rectangular network of lines or crests or b) by a system of meridians and parallels. It allows us to measure planar coordinates of every point of the field.
- *Height coordinate system*. It is presented on the map field by contours and elevation points. Height coordinate system allows us to measure the height of every point of the map field.

The including of the contours into the components of the fields may provoke some objections. Traditionally the contours are considered as cartographical signs (see above Salischev's and Ramirez's schemes). But they as lines from planar coordinate networks are mental lines that connect points with equal value of some quantitative characteristics and they do not represent any object from reality.

4.2 Internal components

Internal components (cartographical signs) have abilities to take away the thought to their objects due to their *locations* in the map field and their *visual properties*.

Raul Ramirez (2004) called these signs '*representational signs*'. This term leads the attention on its appearance. Signs that appear identical to cartographical signs (for example, the signs in legend) or others that are not less representational (for example, some pictures located out of frameworks) are not included in this component. We called the signs that represent object from reality in the field of the map '*cartographical signs*' to emphasize its role as *cartographical models* of these objects.

Every cartographical sign is composed by one or more graphical signs. The graphical signs have two component parts *sign vehicle* and *meaning*. By the sign vehicle we distinguish the graphical sign from other graphical signs. The meaning of the graphical sign is a common concept that connects the sign to a group of objects from the reality. When the graphical sign is putted in the map field and it is converted to a cartographical sign, it gains two more parts: *specific location* and *properties* of the map field. By the location, the cartographical sign is connected to its object from the reality. By the field properties the cartographical sign become measurable and we can to measure it and assign this measuring to its object. Therefore every cartographical sign is a model of its object - it allows getting some additional information for the object by examination of the sign.

We can put a sign from any sign system in the field of the map and it will not change its essence. Written words will remain a part from the natural language, the digits will remain a part from the mathematical language and geometrical shapes will remain a part from the language of geometry. If we put these signs in the field of the map, they will get up a part from cartographical language due to its location and gained properties from the map field. In some time these signs remain a part from their sign system.

4.3 External components

External components are signs from some non cartographical sign system. They describe the cartographical signs, the map field, the map object and itself the map. Their role is descriptive and they are an important part of every map.

We grouped the external components into ten groups (Vasilev 2006):

- *Heading part* of the map;
- *Legend* that included some graphical signs, their meanings and texts that explain the data in the legend;
- *Description of the scale* (by digits, by a graphic and by an expression);
- *Description of the map field* (contour intervals, projection, shape of reference and so on);
- *Description of the map object*;
- *Description of the map* (authors, producer, method of production, date of production);
- *Location of represented territory* (positional diagram of map sheets or scheme of location);
- *Illustrations* (pictures, photos, diagrams of some parts of map object that represent them by non cartographic vehicles and some decorative elements that make the maps more attractive);
- *Index of the objects* represented on the map;
- *Advertisements*.

We separate description of the scale from description of the map field because description of the scale is a necessary component of every map and other description on the field are showed rarely on the map.

Sometimes, external components are arranged within field of the map. But they do not derive properties of the field. The reader of the map must recognize them as external components. Therefore these components must be clearly described in cartographical literature.

5 Conclusions

The map is constructed by some graphical signs. But not all of them are cartographical. A graphical sign on the map become a cartographical sign when: a) It is located in field on the map; b) It accepting the properties of the field; c) It is controlled by cartographical rules; d) It represent a concrete object from reality. Only the signs that comply with these requirements are cartographical signs. Then the sign becoming a model of its object and allowing us to discover some properties of the object that are not manifestly putted on the map.

The cartographical signs except the two component parts by other signs (*sign vehicle* and *meaning*) have more two component parts (*specific location* and *properties of the map field*) that transform the graphical signs into cartographical. The components of map field (for example the coordinate lines and the contours) also have these four component parts but they do not represent any object from the reality – they give mathematical description of the space, represented on the map.

The field of the map is not a sheet of paper or a section of the computer monitor. The field of the map is a space. This space exists in two dimensions: in map space and in space of the object of the map. The main function of the field is to connect these two dimensions. The field is a model on object space that is represent on the map space. Therefore, when we measure the sings on the map, we can transfer these measurements on their objects in reality.

Other signs on the map describe the map, the field of the map, the object of the map or some represented objects but by non cartographic manner. Some of them are important for using of the map, for example map title, legend, description of the scale.

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