

Geographical and Cartometric Analysis of the State Border in a High-Mountain Region (from a case study of the Georgian-Russian state border – the Abkhazian section of the Caucasus)

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Abstract:

The Abkhazian land section of Georgia's state border runs entirely along the Russian Federation and includes both riverine and orographic boundaries, together with their aerial and subsurface components. Of the total 249.82 km length of this border section, the object of our study is its 196.05 km orographic part (the main ridge of the Greater Caucasus).

The formation of the Georgian-Russian state border in the Abkhazian section has a long history and has undergone significant transformations. Running along the ridge of the Caucasus Mountains, the border does not extend beyond the main watershed. Consequently, the main characteristics of the border zone are determined by the physical and geographical effects of the natural conditions.

Our research aims to examine the existing cartographic materials within the specified border zone and to develop a geoinformation system (electronic map series and electronic atlas) based on the geographical and cartometric analysis of the border's orographic section.

The establishment (delimitation and demarcation) and maintenance of the state border in mountainous regions require a specific approach. In this regard, particular attention should be given to geodetic, topographic, and cartographic work, including:

1. Conducting topographic work while accounting for complex geographic conditions, which include:
 - Geodetic works (updating the existing planimetric and levelling geodetic network, verifying the elevation of border crossing points);
 - Survey work: preparation of large-scale topographic maps (1:10,000–1:100,000) and plans (1:2,000–1:50,000), orthophotos, and other types of cartographic materials of the border zone;
 - Obtaining topographic information for the preparation of longitudinal and transverse profiles of the border line;
 - Determination of the parameters of the state border (section lengths, turning angles, and slopes of the border line and border strip);
 - Researching information on, and conducting an inventory of, the physical, geographical, and socio-economic features in the border zone;
2. During delimitation work, the determination of the probable locations of the border line and their preparation for approval by the commissions;
3. Demarcation of the delimited border line in difficult relief and socio-economic conditions (off-road areas, hard-to-reach locations, glacial firm fields, rockfall zones, destroyed infrastructure, etc.).

As a result of the study, the following objectives were achieved:

- On the 1:50,000 scale map along the border line, by creating a system of pickets with a frequency of 2 km, the points that constitute the state border line were coordinated and integrated into a single system. Ultimately, the length of the land border between Georgia and Abkhazia was 249.82 km (Table 1).

picketing	Name of the object	Coordinates		H
		Y	X	
P K 0	The source of the Psou River: a trail 130 m to the left, meadows on both sides of the border (with bushes on the left); at +320 m on the Russian side, a rocky cliff begins; at +740 m, a fragment of a glacier begins..	423284,64	615261,44	2315.2

Table 1. Absolute heights and rectangular coordinates of the border line pickets and their intersections with important objects (Fragment).

- By comparing cartographic sources published at different scales and times, discrepancies were identified in the locations and attributes of the constituent points of the border. For example, the final point of this section of the border - the intersection of the state and autonomous republic borders - is shown in different locations (Figure 1).

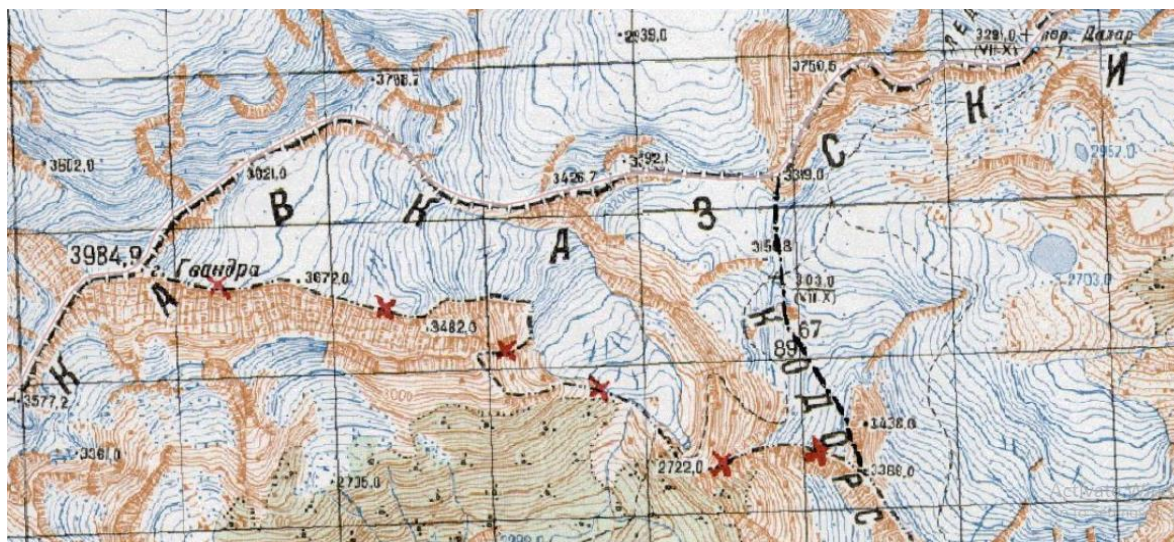


Figure 1. Intersection of the Georgian-Russian state border with the administrative border of the Autonomous Republic of Abkhazia, at a scale of 1:50,000.

- A geographic and cartometric analysis of the border zone was carried out using electronic versions of topographic maps published in the 1970s and 1980s. This analysis determined the slopes of the river and terrain, the frequency of the river network, and other relevant factors. Glacier areas were delineated using both topographic maps and modern orthophotographs. Comparison of the resulting data showed that over fifty years, these values have noticeably decreased (up to 26%).

The results of the study are presented in the relevant materials (tables and graphs).