Lineament field distortion and its analysis.

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Blanchet mentioned that the basis of his method relied on the concepts of the existence of planetary fracturing.

Rose diagrams of lineament directional distribution contain rays with the following dominant orientations: North – South, East – West, Northwest – Southeast, and Northeast – Southwest.

This group of lineament systems was called planetary fracturing. Figure 1 is an example of planetary lineament field.

Figure 1

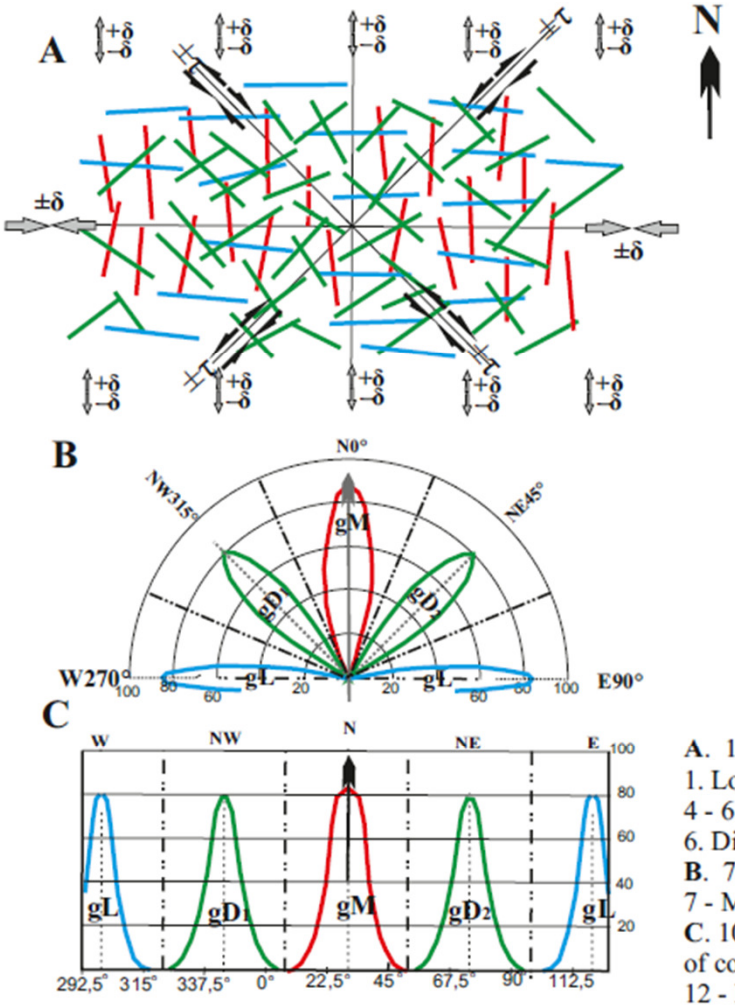
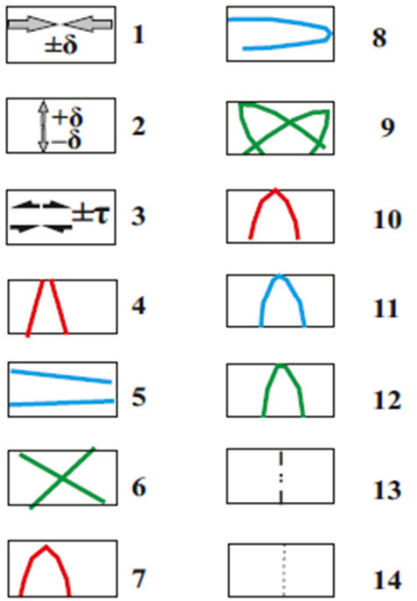


Fig. 2. Global lineament field: **A** - plan; **B** - rose-diagramm; **C** - Rose-diagramm in rectangular system of coordinates.



Legend

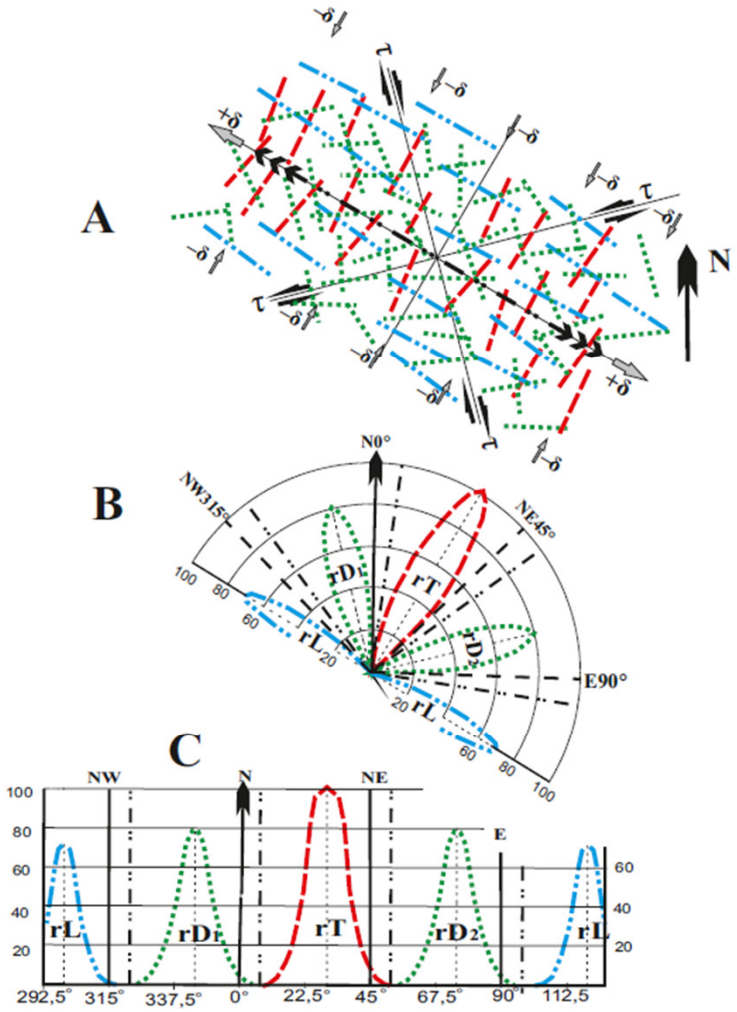
A. 1 - 3. Components of variable stress field: 1, 2 - Maximum normal ±**σ**: 1. Longitudinal, 2. Meridional; 3 - Maximum shear ±**τ**.
4 - 6. Lineaments of systems: 4 - Meridional **gM**, 5. Longitudinal **gL**, 6. Diagonal **gD1** and **gD2**.
B. 7 - 9. Graphics of lineament direction distribution in rose-diaramm: 7 - Meridional **gM**, 8 - Longitudinal **gL**, 9 - Diagonal **gD1** and **gD2**.
C. 10 - 12. Lineament direction distribution in rectangular system of coordinates: 10 - Meridional **gM**, 11 - Longitudinal **gL**, 12 - Diagonal **gD1** and **gD2**.
13, 14 - Limits (13) and axis (14) of lineament systems.

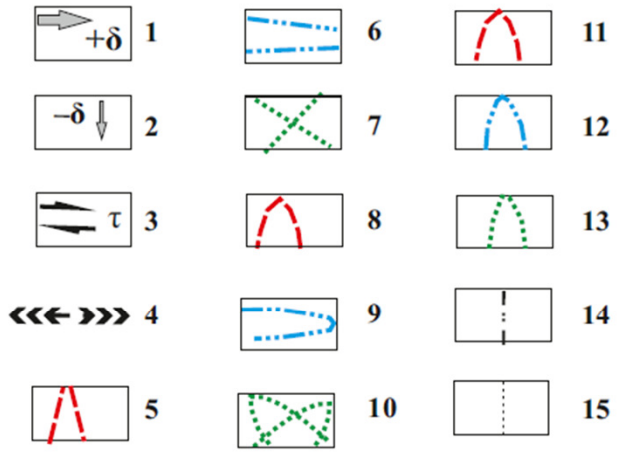
One of the regional lineament systems is oriented parallel to the axis of the regional folding, the other – perpendicular to it.

Two additional lineament systems are oriented at an angle of ± 45° to the axis of the regional folding.

Regional fracturing is the term we use for such systems of fractures. The manifestation of regional fracturing on Earth's surface is what we call regional lineament field.

Figure 2





Legend

A. 1 - 3. Components of stress field: 1, 2 - Maximum normal **σ**; 3 - Maximum shear **τ**. 4. Axe of folding.
5 - 7. Lineaments of systems: 5 - Transverse **rT**, Lengthwise **rL**, Diagonal **rD1** and **rD2**.
B. 8 - 10. Rose diagram of lineament direction distribution:
6 - Transverse **rT**, 7 - Lengthwise **rL**, 8 - Diagonal **rD1, rD2**.
C. Graphics of lineament direction distribution in rectangular system of coordinates:
11 - Transverse **rT,** 12 - Lengthwise **rL**, 13 - Diagonal **rD1, rD2**.
14, 15 - Limits (14) and axis (15) of lineament systems.

Fig. 2. Regional lineament field: A - plan; B - rose-diagram; C - Rose-diagram in rectangular system of coordinates.

Lineament field of local dome-shaped structure contains:

-System of radial lineaments, developed mainly in the central part of the structure;

-System of concentric lineaments, gravitating toward the periphery of the structure;

-Two systems of lineaments oriented at an angle of ± 45 ° to the radial direction, starting from the center of the dome. The former are uniformly distributed over the area of the structure.

Figure 3

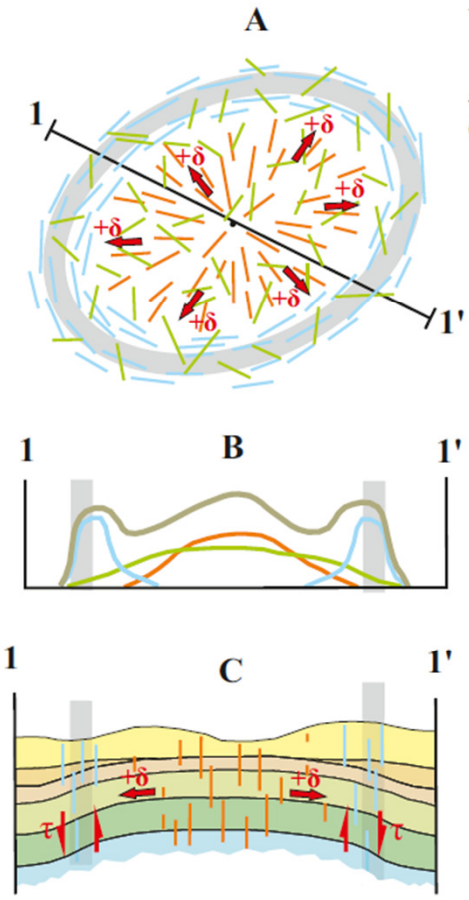
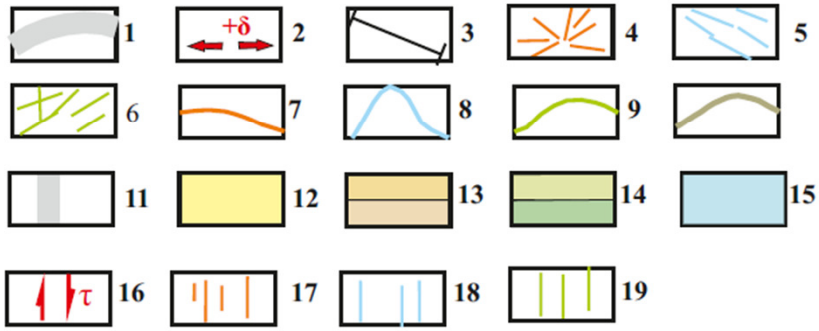


Fig. 3. Stress field and lineament field elements of local dome shaped structure

A - Map; **B** - Lineament distribution graphics along the line **1 - 1'**;
C - Schematic geological section along the line **1 - 1'**



Legend

A. 1 - 6 Map:

1 - Bounderies of local dome shaped structure; 2 - Stress field elements **δ**;
3 - Schematic geological section line; 4 - 6: Lineaments of dome shaped structure:
4 - radial system **R**, 4 - concentric system **C**, 5 - diagonal systems **D1** and **D2**.

B. Graphics:

7 - 10: Lineament density graphics of systems: 7 - radial **R**, 8 - concentric **C**,
9 - diagonal **D1** & **D2**, 10 - local dome shaped structure summary lineament density.

C. Schematic geological section:

11 - Bounderies of local dome shaped structure, 12 - Cover of friable superficial deposits,
13 - 15 Sedimentary rocks of different age, 16 - Shear stress elements **τ**,
17 - 19 - systems of brittle vertical dislocations:
17 - radial **R**, 18 - concentric **C**, diagonal **D1** and **D2**.

Figure 4

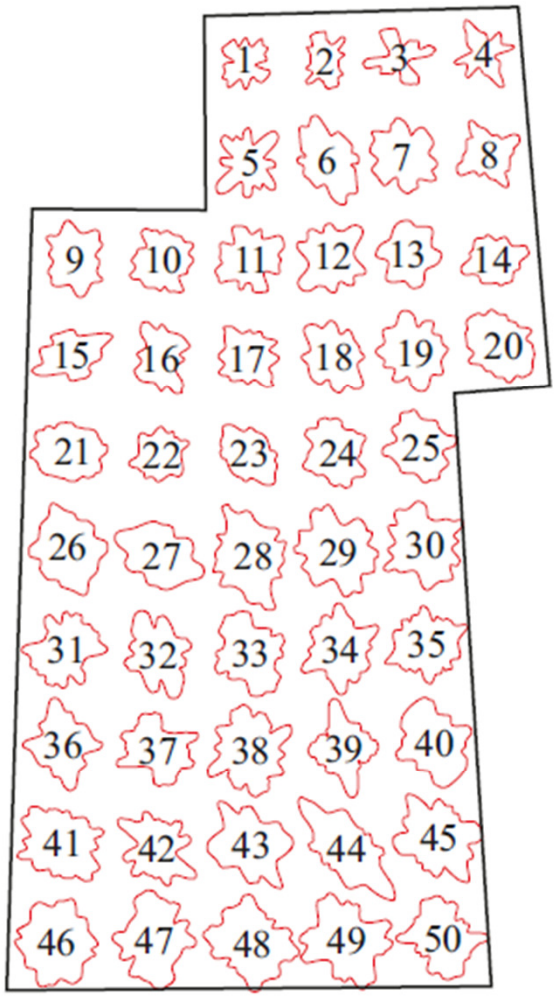


Fig. 4. Central section of Yenisey-Khatanga depression.
Rose-diagramms of lineament direction distribution.

Fig. 4a. Lineaments of Yenisey-Khatanga depression.

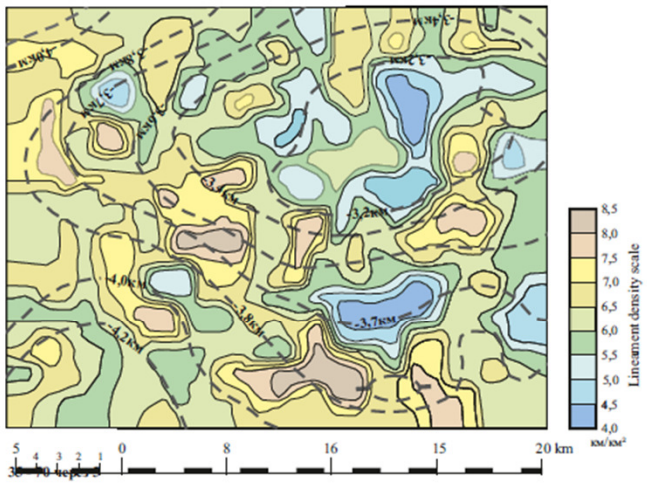
When fracture fields of different levels of generalization and age are superimposed, they interfere with and distort each other. To remind you, lineaments are traces of intersections of brittle dislocations with the Earth's surface, so a lineament grid shows us the result of the process of fracture fields superimposition and mutual distortion

We have developed a method for filtering lineament grids, which allows identifying positions of these distortions on the local or regional level – depending on the goals and objectives of the study.

In the next slides you will see practical applications of our method.

Figure 5

Fig. 5a. Lineament density map



Fid 5в. Lineament field distortion map

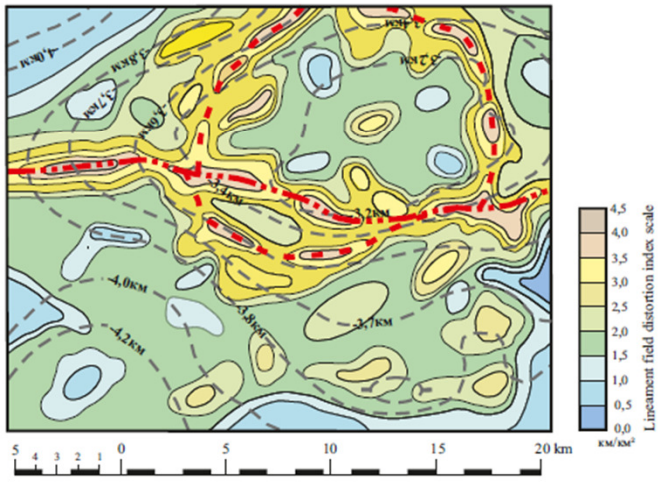
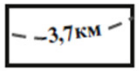


Fig. 5. LINEAMENT FIELD ANALYSIS
FOR OIL & GAZ DEPOSITS PROSPECTING

Sredneviluiskoe gas condesate deposit

Legend

Fig. 1 & Fig. 2



Roof Permian isohypses
(seismic horizon "TP").

Fig. 2

Lineament field "ring" anomaly
- border of the gas cap.

Lineament field line anomaly
- trace of regional fault.

Figure 6

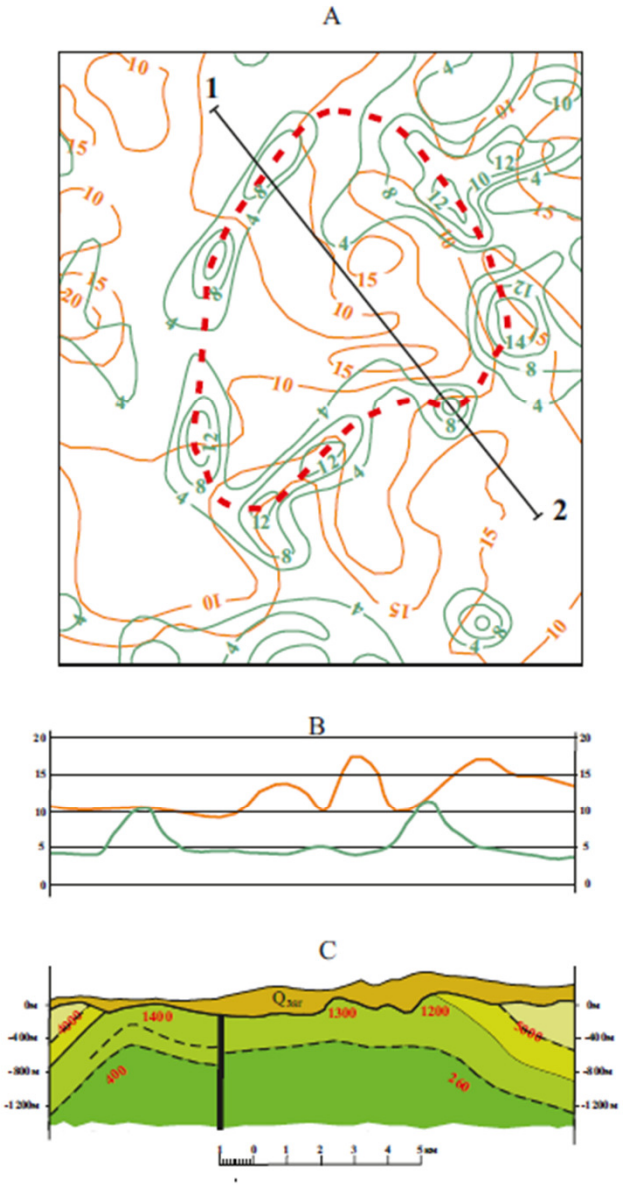


Fig. 6. Object "Astronomy".
Map of lineament parameters (A);
their variations along the line 1 - 2 (B);
geological section along line 1- 2 (C)

Legend

A
- Isolines of lineament density.
- Isolines of lineament field distortion.
- Anomaly circular of lineament field.
- Line of section **1 - 2** (B, C).

B
- Graph of lineament density
- Graph of lineament field distortion

Line 1 - 2

C
- Glaciofluvial deposits (Q3 sr).
- Geoelectric horizons - rocks of different composition presumably Late Cretaceous
- 1200 Geoelectric characteristics
- a b Geoelectric horizons borders: a) reliables, b) presumeds.
- Fault.

Figure 7

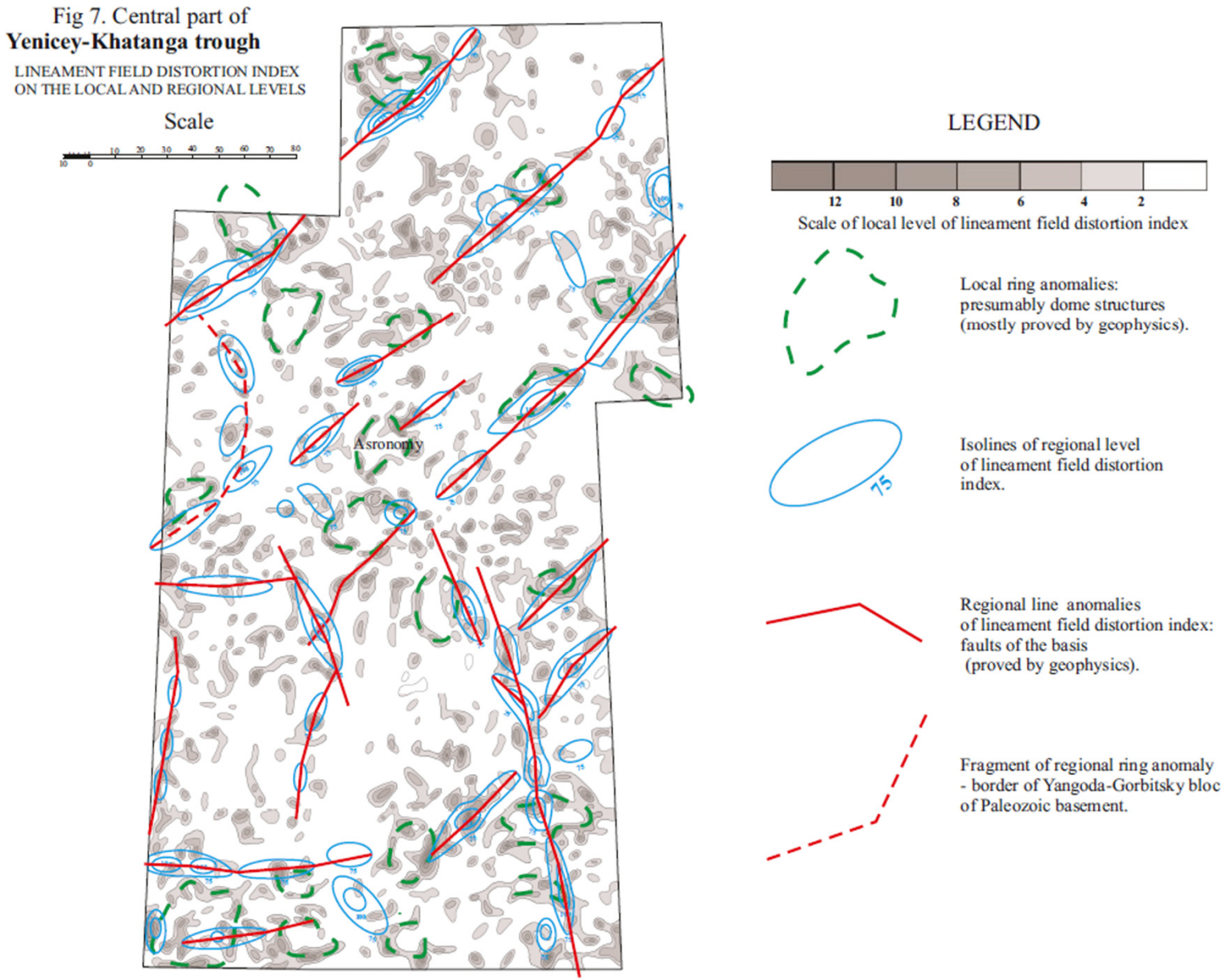


Fig 7. Central part of
Yenicey-Khatanga trough
LINEAMENT FIELD DISTORTION INDEX
ON THE LOCAL AND REGIONAL LEVELS
Scale
Asronomy
LEGEND
12 10 8 6 4 2
Scale of local level of lineament field distortion index
Local ring anomalies:
presumably dome structures
(mostly proved by geophysics).
75
Isolines of regional level
of lineament field distortion
index.
Regional line anomalies
of lineament field distortion index:
faults of the basis
(proved by geophysics).
Fragment of regional ring anomaly
- border of Yangoda-Gorbitsky bloc
of Paleozoic basement.

Figure 8

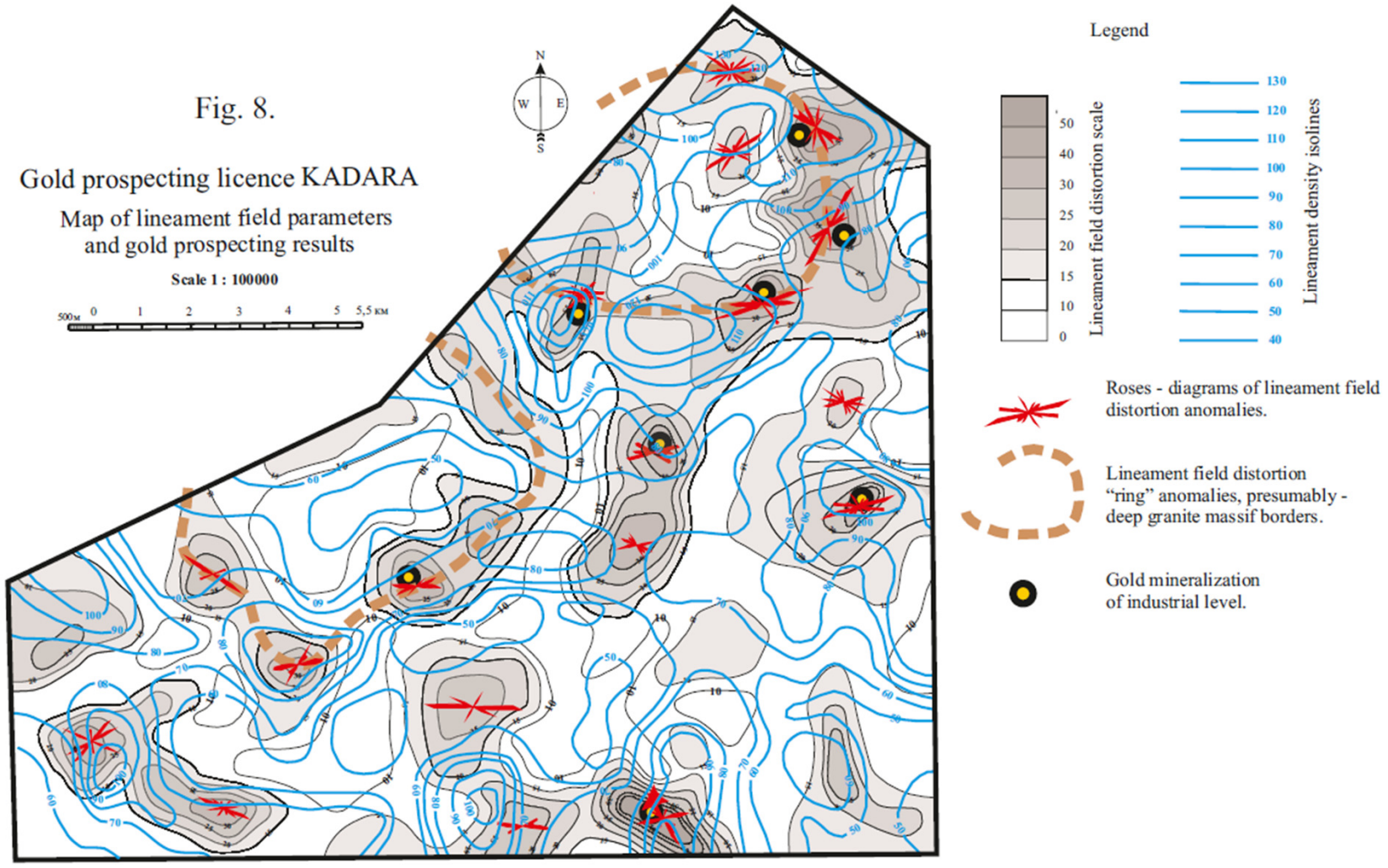
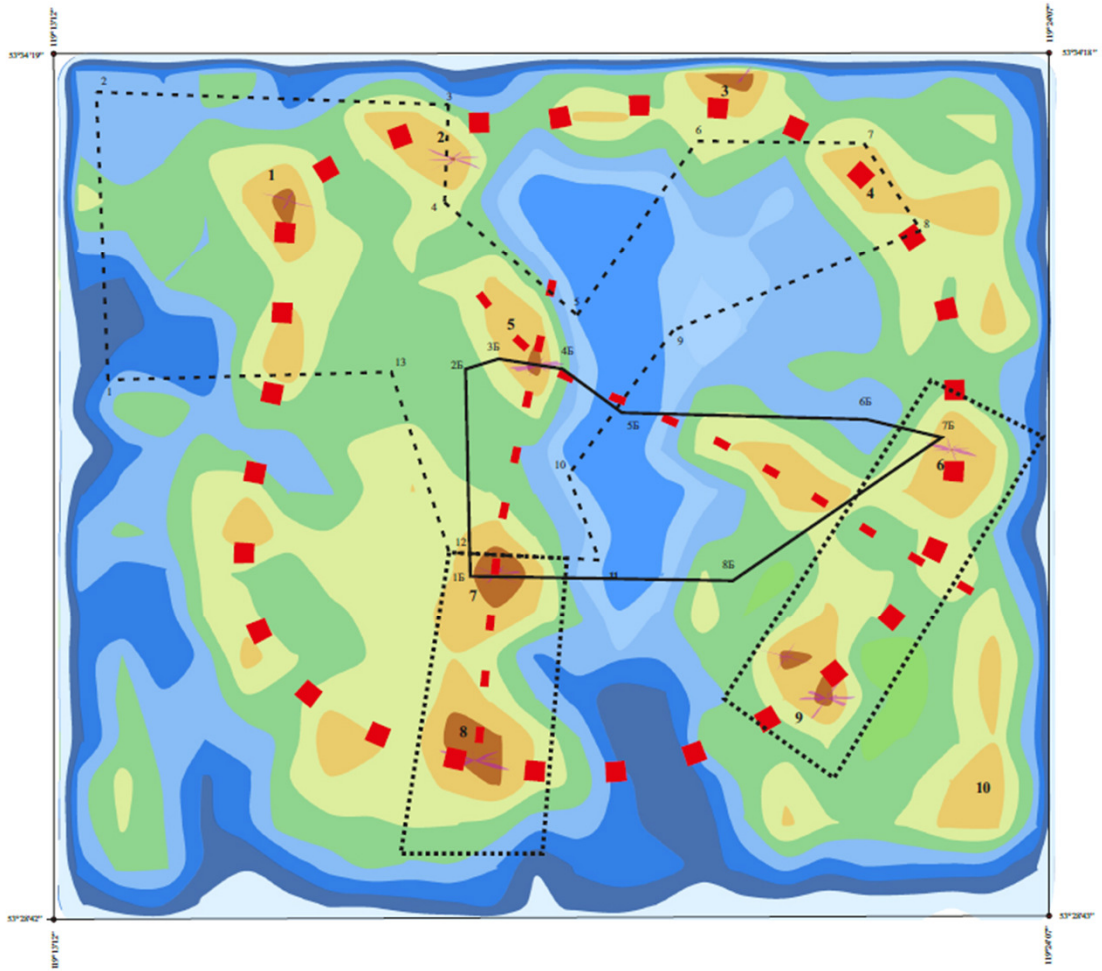


Fig. 8.
Gold prospecting licence KADARA
Map of lineament field parameters and gold prospecting results
Scale 1 : 100000
500м 0 1 2 3 4 5 5,5 км
N
W
E
S
Legend
Lineament field distortion scale
0
10
15
20
25
30
40
50
Lineament density isolines
40
50
60
70
80
90
100
110
120
130
Roses - diagrams of lineament field distortion anomalies.
Lineament field distortion "ring" anomalies, presumably - deep granite massif borders.
Gold mineralization of industrial level.

Figure 9

Fig. 9. Object Davenda. Lineament field distortion map.

Scale 1:50 000



Legend

Lineament field distortion scale

0 1,5 3,0 4,5 6,0 7,5 9,0 10,5 12,0

Rose-diagrams of lineament distribution in lineament field distortion anomalies.

Boundaries of supposed deep granite intrusion.

Faults - structural complications of supposed deep granite intrusion.

Limits of exploration licence.

Limits of prospecting licence.

New areas recommended for exploration.

CONCLUSIONS:

1) Tectonic processes cause the formation of specific stress fields and related plastic and brittle dislocations. The lineaments are one of the manifestations of these processes and dislocations on the surface. It is reasonable to say so of the lineament fields, spatially and genetically related to different geological structures and stress fields.

2) Grid of lineaments (better – general lineament field) – is the result of superimposition, interference and mutual distortion of lineament fields associated with geological structures of different sizes, ages, types, and shapes.

3) The method we developed using these ideas is a mathematically sound and field tested algorithm of the analysis of lineament field distortion. It is used for structural mapping and geological exploration. This algorithm allows determining the spatial position and the boundaries of different geological structures.

4) Our method was tested under real conditions at different scales and in different geological and geographical conditions in the area of 700,000 square km. To further support the method, it is important to know that in the areas where lineament field distortion is minimal or has an average value, no significant indigenous mineral deposit occurrences were found.

5) Using the structural maps created with our method at early stages of geological prospecting and exploration allow optimization of placement of expensive drilling and geophysical studies. Moreover, the method saves up to 30% of the financial costs while increasing the quality of information and accelerating the introduction of facilities.

THANK YOU!

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