THE INTERNATIONAL CONFERENCE ON THE 120TH ANNIVERSARY OF THE BULNAY EARTHQUAKE: ADVANCES IN ASTRONOMY AND GEOPHYSICS

Regional stress fields in the Mogod seismic dislocation zones (preview results)

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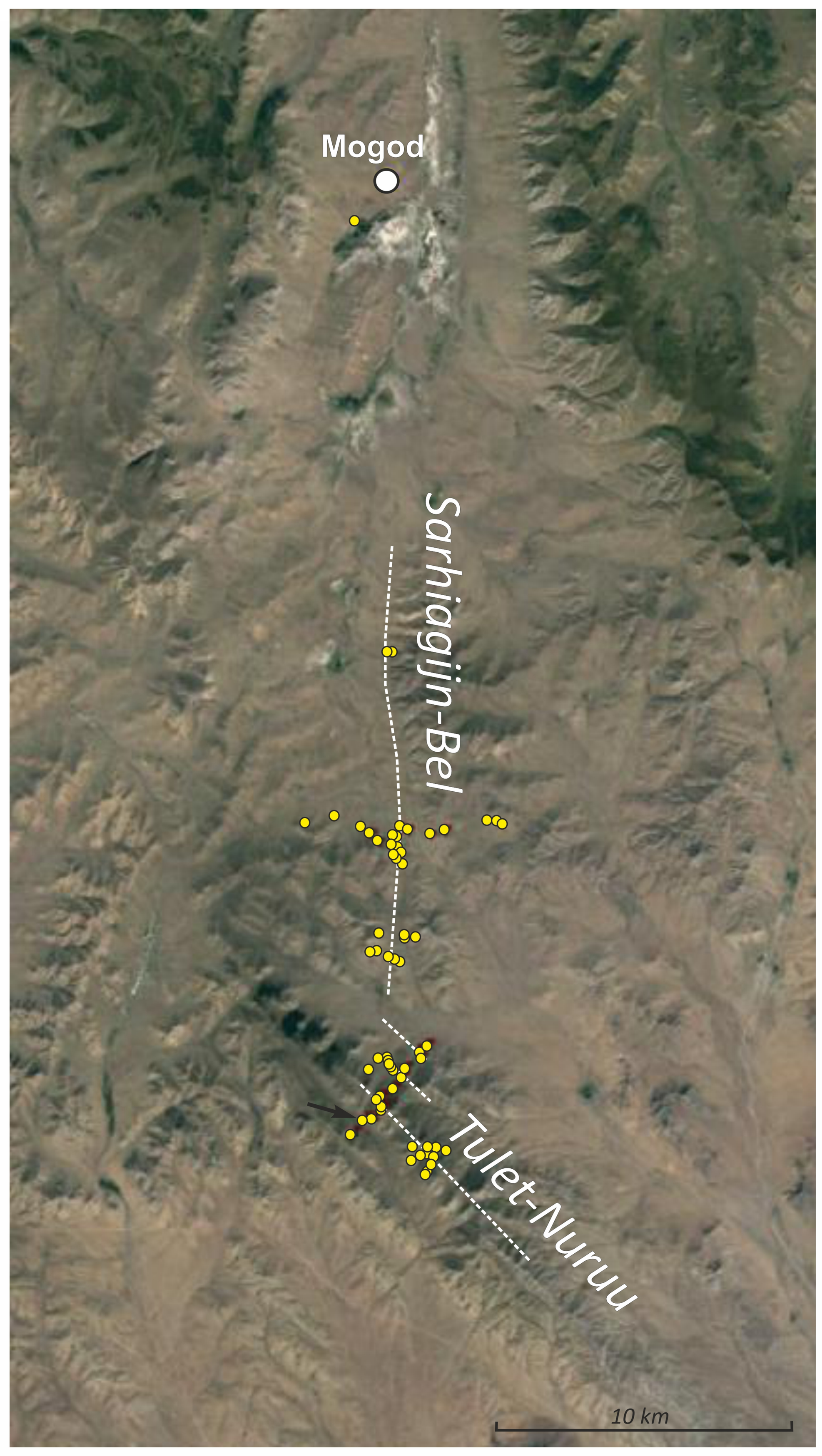
Introduction

The dynamic settings of fault formation are studied using different methods. One of the recently developed techniques is the method of specialized mapping of crustal fault zones and stress fields [*Seminsky, 2014*, 2015]. It is based on a new approach to the structural paragenetic analysis of complex fracture networks.

This method uses statistical mass measurements of rock fractures (joints) and allows you to reconstruct the dynamic settings of their formation and the conditions for the activation of faults and fractures at different stages of tectonic development of some upper Earth's part.

The purpose of this work is applying a new technique for analyzing small tectonic fractures to study regional paleostress fields using the example of the Mogod seismic dislocations in Mongolia. We propose to clarify the features of tectonic development of this rock massif and to compare it with the modern dynamic setting in the area. In addition, we suppose to identify the orientation and types of regional fault zones.




The main seismic dislocations on the area

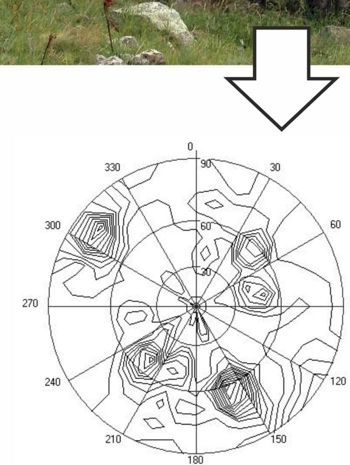

Points of geological structural observations, and one exumple of them

Materials

Geological structural observations were carried out in the northern part of Central Mongolia at 66 points, including statistical mass measurements of fracture attitudes (about 6400 measurements), which are the initial material.

The measurements were taken mainly in the rocks of the Paleozoic-Mesozoic (Permian-Triassic) in basalts, trachybasalts, trachyandesites, and a small part in the weakly cemented sedimentary rocks of the Cenozoic.

One of the 66 outcrops, in which a mass measurement of joints attitude was carried out



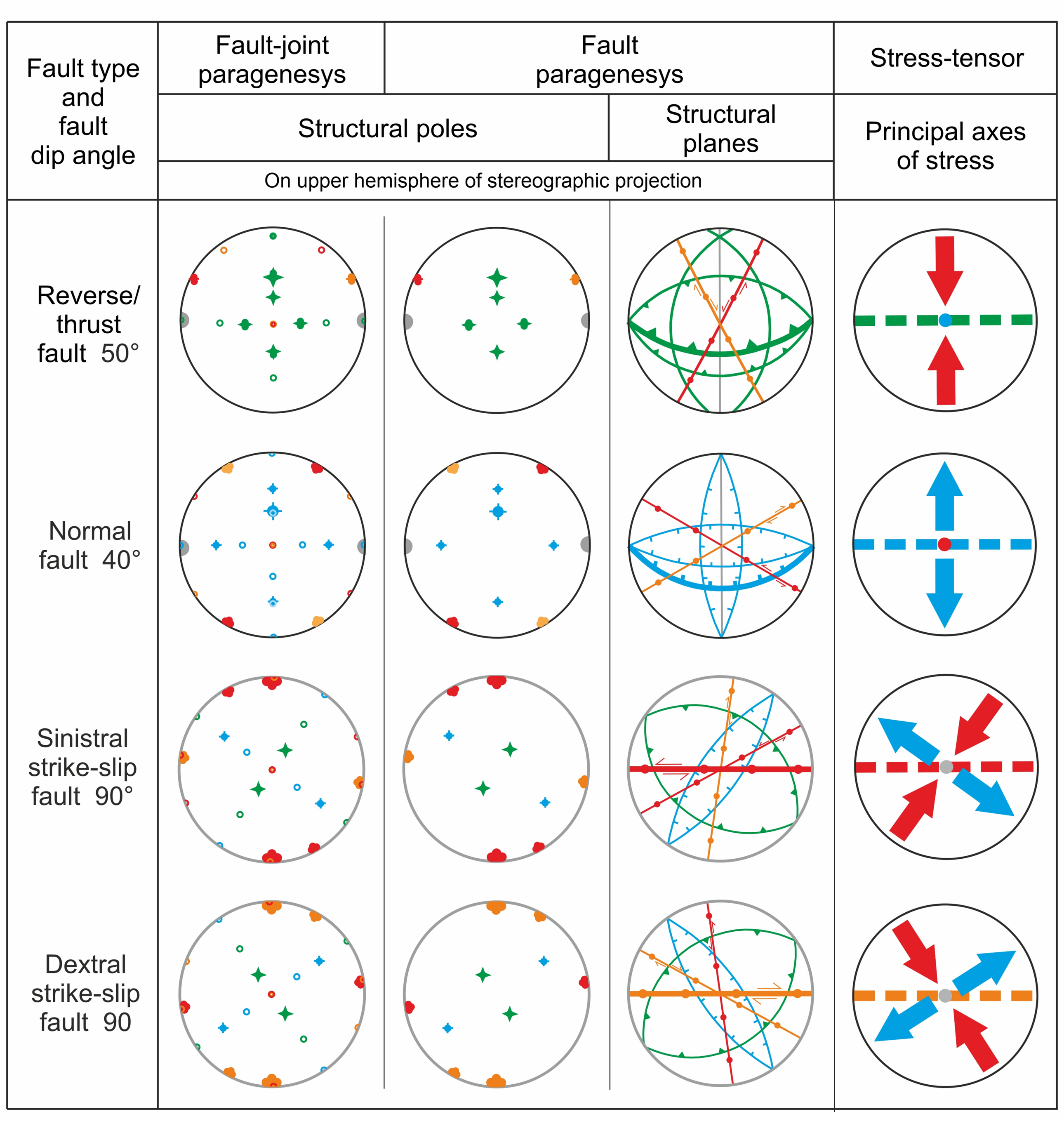
Fracture stereogram (Wulff net, upper hemisphere, averaging window 10 °, step between isolines - 1%, quantity of fractures - 117)

Methodology

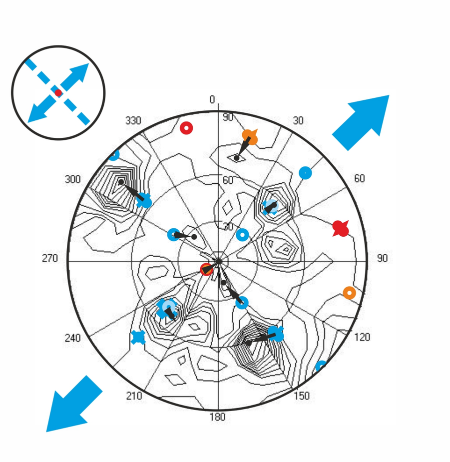
Analysis of the fracture network is carried out by comparing the natural tectonic fracture stereogram with the standard circle diagrams (patterns) of idealized fracture joint-fault parageneses. We identified the most suitable standard diagram for each stereogram by group of coincident fracture sets.

It determines the solution for a single outcrop: the orientation and the morphogenetic type of the local fault zone, and the stress field, in which the joint network was formed. Next, a rank analysis was performed using results from local points and idealized fault parageneses, and thus regional stress fields are determined.

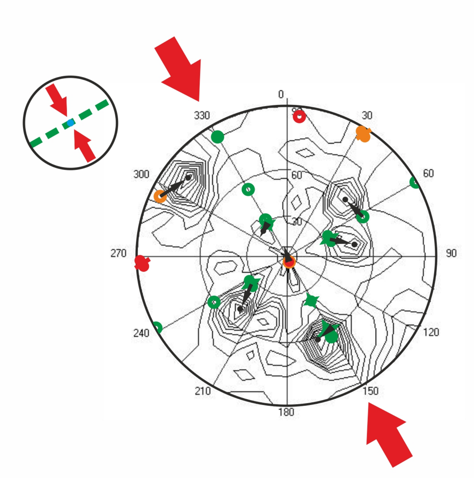
Fracture standart patterns in fault zones



Exumple of analysis of the one stereogram – two final solutions of local rank about the dynamic settings of extension and compression



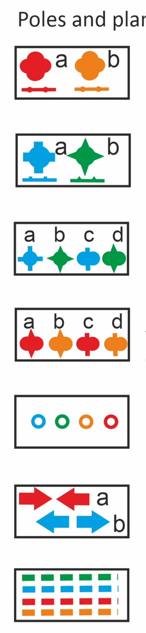
Standard pattern: normal fault
Main fault attitude: 220∠50



Standard pattern: reverse fault
Main fault attitude: 160∠60

Legend

Poles and planes of joints sets on standard pattern:



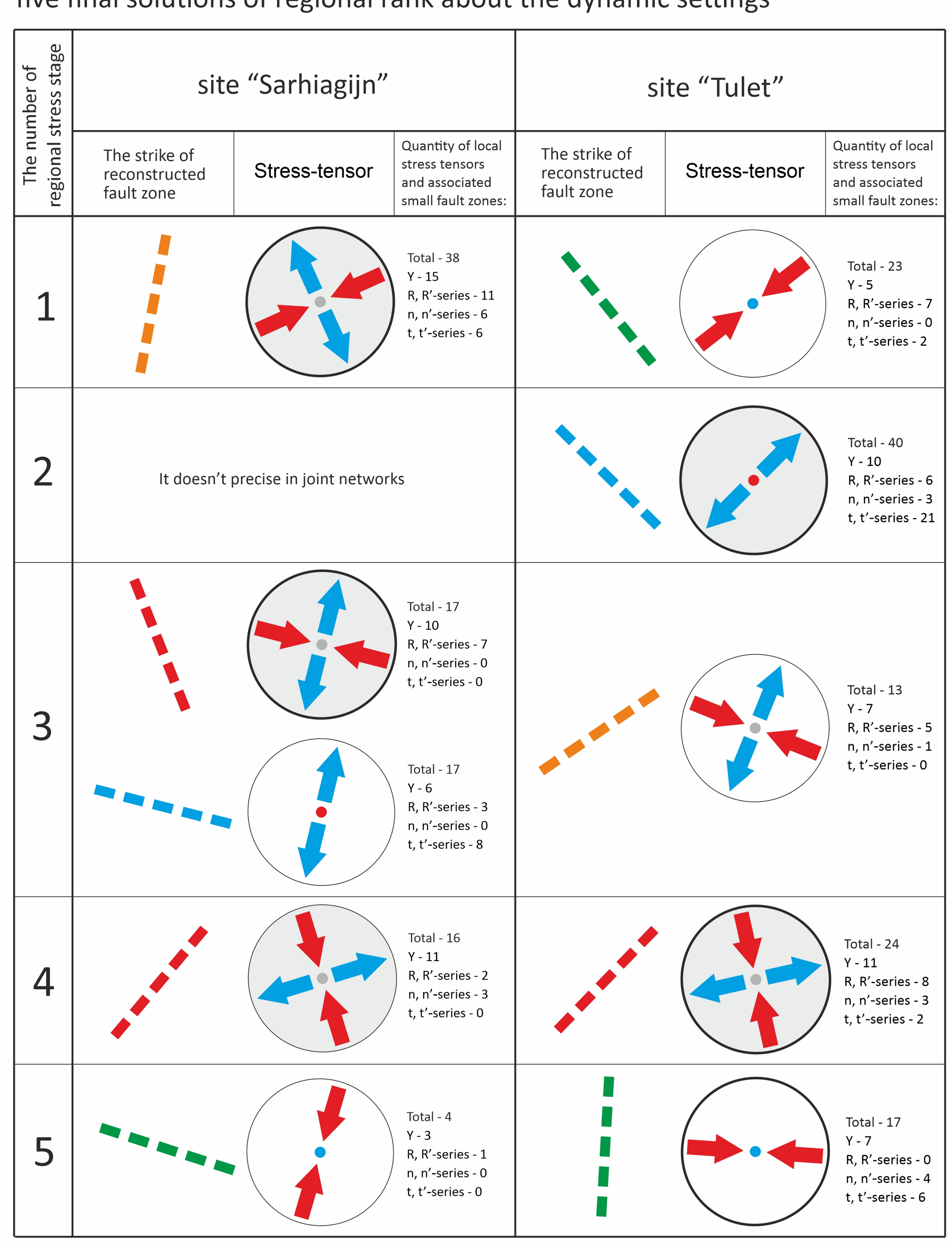
Results and conclusions

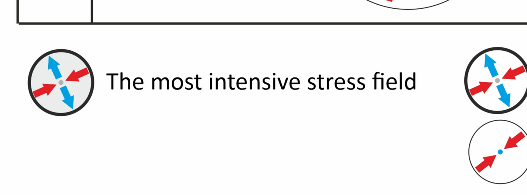
At the first stage of the analysis, 224 local solutions on stress tensors, as well as the type and orientation of small fault zones, were reconstructed, at the second stage (rank analysis) 10 regional stress fields were obtained, some of which are paragenetically related to each other.

The results of the structural paragenetic analysis made it possible to reconstruct 5 stages of development of this part of the Earth's crust with varying degrees of reliability. Among them, shear fields predominate (3 stages); there is also a NE-SW extension field and the weakest sublatitudinal compression field.

The stress field maximally manifested in brittle fracturing coincides with the focal mechanisms of the Mogod earthquake in 1967 – with the ENE strike of the horizontal compression axis and the NNW strike of the horizontal extension axis in the presence of a submeridional right-lateral fault zone.

Reconstructed regional stress fields:
result of rank analysis of 224 local stress tensors from 66 stereograms –
five final solutions of regional rank about the dynamic settings





Application of the method to different amounts of source material showed that small statistics give a minimally acceptable result, while large statistics of initial data give more detailed result on stress fields of the highest possible rank.

This independent approach allowed us to identify both the modern field and more ancient tectonic stress fields. Next we plan to study the sequence of ancient 4 fields, as well as a comparison with the results of studying stress fields using other methods.

Acknowledgments
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