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## Late Cenozoic fault pattern and stress fields in the Barguzin rift (Baikal region)

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### Abstract

New structural and tectonophysical data, combined with the published geophysical and seismological evidence, were used to map the Late Cenozoic fault pattern and crustal stress in the Barguzin rift. Faults striking in the NE direction are the most abundant elements of the rift structure. A special part in the Late Cenozoic patterns of faults and stresses belongs to an over 400 km long N-S lineament which shows up as a system of separate fault segments between 110° and 110°30' E. The Late Cenozoic evolution of the rift has been controlled mainly by extension punctuated with local shear stresses derived from the regional extension stress and accommodated by strike slip, combined with the dominant normal motion, along NE or N-NE faults and/or along their cross faults. Extension was of a relatively stable NW-SE direction, almost rift-orthogonal. The obtained fault pattern and stress maps can be used for reference in mapping seismic hazard associated with ongoing faulting in an active and changeable stress field.

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**Keywords:** Fault; stress field; Late Cenozoic; Barguzin rift; Baikal region

### Introduction

Investigation into patterns of faults and related crustal stresses is a key point in geotectonics. Faulting controls the surface topography, rate and style of sedimentation, seismicity, volcanism, and many other geological and geophysical processes while stress commands the mechanism of tectonic movements and the geodynamic regime. We mapped the fault pattern and reconstructed the stresses that acted in the Barguzin rift and its surroundings through the Late Cenozoic (Fig. 1). It was a nontrivial task as the rift area is almost fully covered with a mantle of mostly Quaternary soft sediments. The faults buried under soft sediments and poorly detectable by the common structural methods were traced into the inner parts of the rift basins using the special mapping method by Seminskii (1994) together with the methods we developed for studying soft sediment deformation (Gladkov and Lunina, 2004; Lunina and Gladkov, 2004a, b; Seminsky et al., 2005). Combined with the remote sensing mapping techniques, studies of faults in rocks of different ages and lithologies makes it possible to map the regional structure of the faulted crust and to predict relative ages of stresses and active faulting.

### Geological and geophysical background

The Barguzin rift basin stretches in the NE direction from the Barguzin Gulf in Lake Baikal to the Barguzin River headwaters (Fig. 1). Like other basins in the Baikal rift system, it has a clearly asymmetric transversal profile. The asymmetry is especially prominent at basin-mountain junctions: The basin floor has a steep border in the northwest with the highly elevated Barguzin Range but it smoothly grades into the slopes of the relatively low Ikat Range and the Golonda Bald Mountains in the southeast. The Barguzin rift consists of the Ust'-Barguzin and Barguzin basins and several companion smaller basins. The two large basins are separated by the Shamanka spur, a low-elevated topographic high. The axis of the basin subsidence is shifted toward the Barguzin horst, according to geophysical data (Nevetrova and Epov, 2003; Solonenko, 1968) and the sediment thickness is the greatest (2.5 km) about 10 km south of Kurumkan Village (Nevetrova and Epov, 2003; Solonenko, 1981). A large part of the Barguzin basin is occupied by sand hills, locally called *kuituns*. Florensov (1960) interpreted them as remnants of the eroded mantle of fluvioglacial deposits which were displaced by rivers and are preserved today only on basement uplifts. Electrical imaging resolves the *kuituns* as blocks slightly

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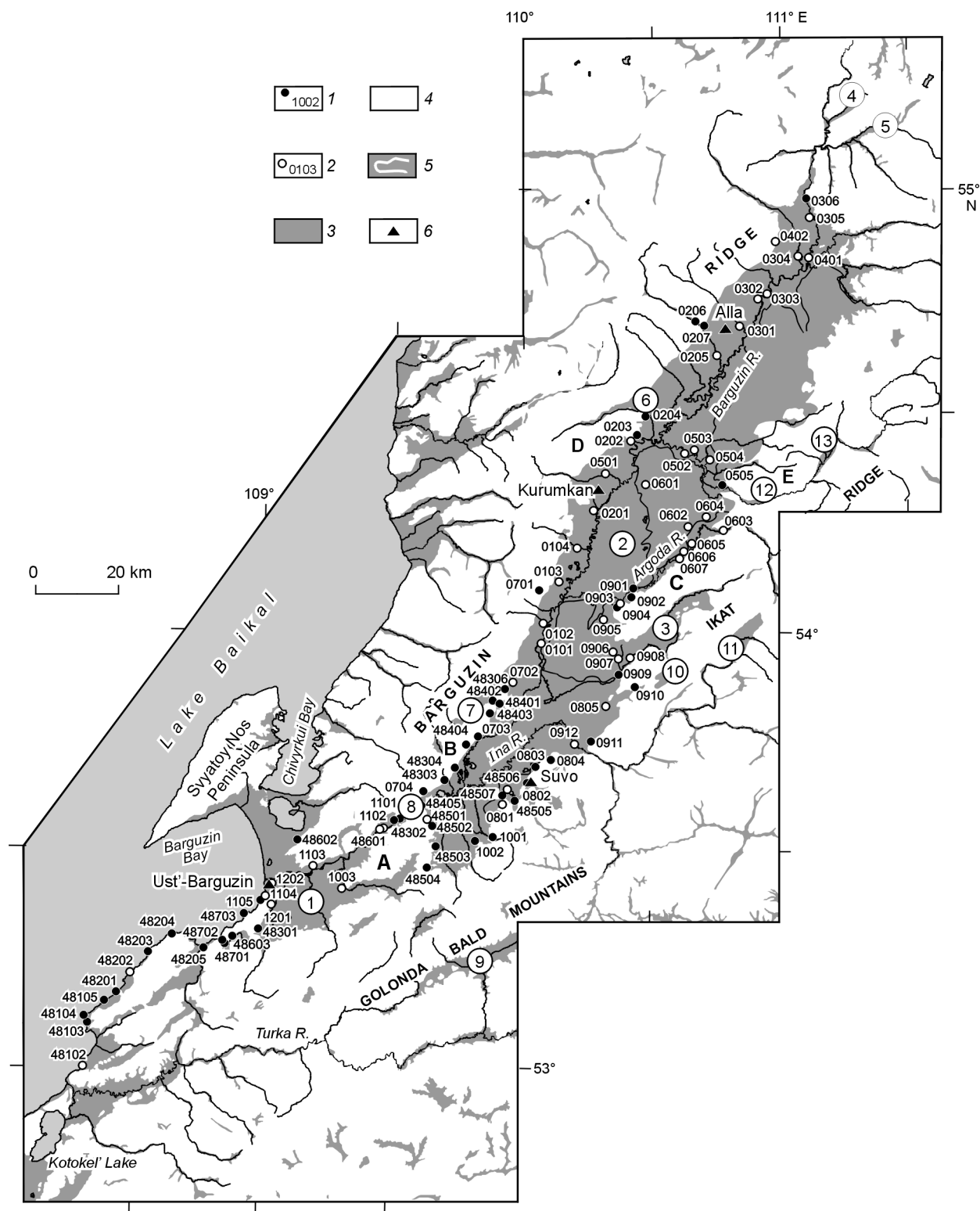


Fig. 1. Location map of Barguzin rift and observation sites. 1, 2 — observation sites in pre-Cenozoic bedrock (1) and soft sediments (2) and their numbers; 3 — basins with Cenozoic fill; 4 — basement exposures; 5 — contours of kuituns; 6 — villages. Circled Roman numerals stand for names of large basins: 1 — Ust'-Barguzin, 2 — Barguzin, 3–8 — their companion smaller basins: 3 — Ulan-Burga, 4 — Amnunda, 5 — Kovyli, 6 — Shamanka, 7 — Ulyun, 8 — Vaula; 9–13 — basins in Ikat Range: 9 — Yambui, 10 — Yassk, 11 — Bogunda, 12 — Poduluk, 13 — Marikta. Letters stand for names of large basin links (spurs): A — Shamanka, B — Ulyun, C — Argoda, D — Sakhuli, E — Molebka.

uplifted relative to the areas of greatest basement depth, with local depressions inside them (Nevedrova and Epov, 2003).

Some faults in the Barguzin rift were documented in detail

earlier (Solonenko, 1968, 1981; Zamaraev et al., 1979). They are especially a system of en-echelon faults within the Barguzin fault zone, which separates the large basins from the

rift northwestern shoulder, and a system of faults in the Ikat Range. No fault border was detected between the large basins and the southeastern rift shoulder, and that part of the rift was thus assumed to be involved in basement doming (Solonenko, 1981). The rift area was repeatedly shocked by large ( $M = 7.6$ – $8$ ) earthquakes in Late Pleistocene and Holocene time (Chipizubov et al., 2000; Solonenko, 1968) and by numerous smaller events over the period of instrumental seismicity since 1961 (Sherman et al., 2004), with their magnitudes no greater than  $M = 5.5$ , according to (Melnikova and Radziminovich, 1998; Solonenko et al., 1993) and to the Catalog of Earthquakes available from the Baikal Department of the SB RAS Geophysical Surveys at <http://seismo.crust.irk.ru>.

## Methods

The fault pattern in the Barguzin rift was mapped using structural measurements in a system of observation sites from the Turka River in the southwest to the place where the Barguzin River leaves the mountains in the northeast (Fig. 1). Altogether we documented 95 sites of which 47 are in Quaternary sediments and 48 are in pre-Cenozoic bedrock. Field data were collected in a way similar to that reported in (Seminsky et al., 2005). Field measurements were restricted to basins and their borders with the flanking mountains because active Cenozoic faults within the mountains are well detectable by remote sensing, e.g., by lineament analysis in topographic maps, in satellite images, or in 3D digital elevation models. Faults in mountains were also mapped earlier in the course of 1:200,000 geological surveys. All these data (field structural measurements, results of lineament analysis of topographic maps, deciphered satellite imagery and elevation models, and the 1:200,000 geological map) were used for reference to compile a new regional map of faults (Fig. 2). We mapped only the faults which, besides other evidence of their existence, are expressed in the surface topography and/or in deformation of Late Cenozoic sediments.

Earlier we (Gladkov and Lunina, 2004; Gladkov et al., 2005; Lunina and Gladkov, 2004a; Seminsky et al., 2005) inferred that soft sediment deformation can show up in different ways, namely, in areas of greater fracture density similar to fractured zones or even zones of shearing and crushing; offset of markers in loam, sandy loam or other sediments of different colors and lithologies; cleavage and displaced cleavage of pebbles and cobbles; striation on the surface of pebbles and cobbles; dikes filling extension joints; convolutions (seismites), etc. When mapping faults in soft sediments we examined each deformational structure very carefully to decide whether it has a tectonic or erosional or man-caused origin. The tectonic origin of the mapped deformation is grounded in (Gladkov and Lunina, 2004; Gladkov et al., 2005; Seminsky et al., 2005).

Reconstruction of stresses and the ensuing reconstruction of slip geometry followed the methods of Nikolaev (1992) and Gzovsky (1975). The methods stem from the fundamentals of brittle failure mechanics implying that relatively uniform

loading of solids produces two conjugate systems of fractures. In Nikolaev's method, their orientations are detected in stereograms plotted from measurements of 50 to 100 fractures. With Gzovsky's method, principal normal stress directions are inferred from conjugate shears; the slip direction and geometry can be reconstructed therefrom correspondingly but are to be checked against field structural data on slip if available at a given site.

## Fault pattern

NE faults are the most abundant elements of the mapped fault pattern in the Barguzin rift (Fig. 2, A), both in basins and in the flanking mountains. They strike mainly at  $40$ – $60^\circ$  in the basins, including the faults on basins borders (Fig. 2, B), and at  $30$ – $70^\circ$  in the mountains (Fig. 2, C).

NE faults include the master faults along the sides of large basins and their companion smaller basins. Some faults are traceable inside the basin fill. The largest faults we mapped on the surface of soft sediments (Fig. 2) were detected from processing gravity anomaly data (see Fig. 56 in (Solonenko, 1981)). They are the faults that actually belong to the Barguzin fault system in the northwestern side of the Barguzin basin and those that continue the fault between the Argoda spur and the Ulan-Burga basin. NE faults are marked by fault scarps produced by past earthquakes (Solonenko, 1981; Chipizubov et al., 2000). We focused on faults that have been active in the Cenozoic and paid attention to any signature of activity. Namely, extension joints with even edges filled with sand and gravel compositionally different from the host sediments (Fig. 3, A). These joints, called neptunian dikes, are often associated with earthquake rupture (see Fig. 45 in (Nikolaev, 1992)). Other deformational structures we encountered in NE fault zones are those looking like convolutions (Fig. 3, B) or seismites (Fig. 3, C). Note that the sedimentary sections containing the documented sites had a visible thickness of a few meters from the day surface and consisted mainly of sand, loam, loamy sand, gravel, and less often pebble, which are of Holocene age in the Barguzin rift (Solonenko, 1981). Therefore, the deformation signature we documented is no older than 10 kyr BP.

Current activity was inferred for one segment in the Barguzin fault striking at  $20$ – $25^\circ$  from surface rupture near the foot of the Barguzin Range about 7 km south of Sarankhur Village. Ruptures dipping at  $290 \angle 65^\circ$  and  $120 \angle 85^\circ$ , found 200 m east-southeast of site 0701, cut the W-E walls of a Buryat stupa (Buddhist cult building) put up presumably in the 1950s (Fig. 4, A). Two N-S walls of the stupa are dislocated by ruptures which dip at  $215 \angle 70^\circ$  and at  $180 \angle 80^\circ$  (Fig. 4, B) and are parallel to a W-E fault mapped along the lower reaches of the Argoda (Fig. 2). The seismic origin of the rupture causes no doubt. If the stupa was built before 1961, the rupture was most likely produced by the  $M = 4.8$  earthquake of 27.07.1961 at  $54.1^\circ$  N and  $110^\circ$  E (Solonenko et al., 1993), 4–5 km away from site 0701.

NE faults were found out to have a normal geometry, which is compatible with the earlier evidence. A small right-lateral

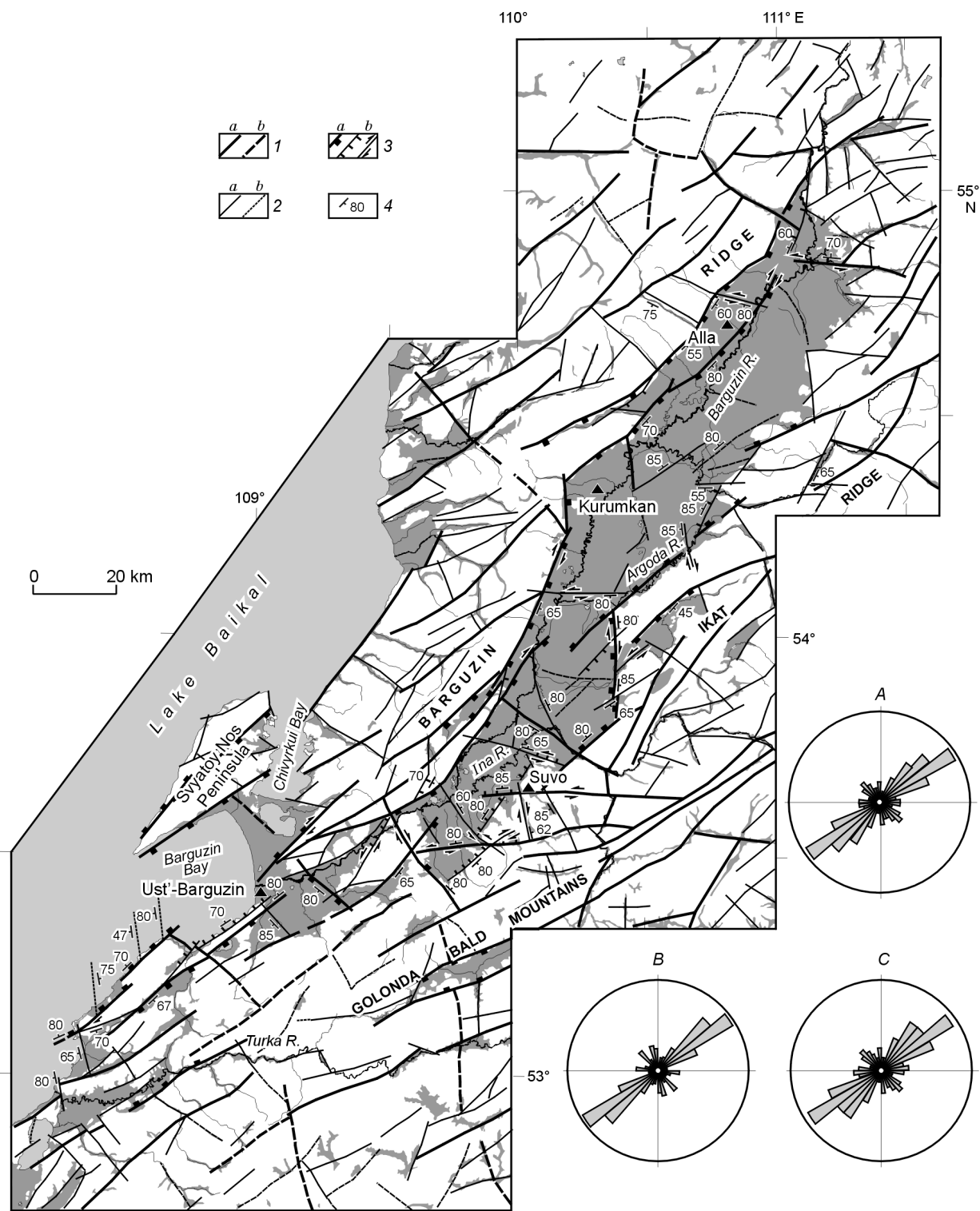


Fig. 2. Fault pattern in Barguzin rift and its surroundings. 1, 2 — observed (*a*) and inferred (*b*) regional (1) and local (2) faults; 3 — normal (*a*) and strike-slip (*b*) faults; 4 — strike and dip of faults. Other symbols are as in Fig. 1. A–C — rose diagrams of fault strikes: A — for whole area (total number of measurements  $n = 318$ , plotted at every 10 measurements ( $i$ ), maximum percentage — 16%), B — for large basins, including their master faults and basin links ( $n = 80$ ,  $i = 10$ , 20%), C — outside basins ( $n = 238$ ;  $i = 10$ , 15%).

strike-slip component shows up locally, more often on distal ends of large faults. The presence of strike slip in some NE faults was also inferred from fracturing patterns (Zamaraev et al. 1979) but normal slip is the dominant geometry of motion.

W-E faults, as well as faults of other orientations, are much scarcer than NE faults (Fig. 2) and are mainly restricted to the Ikat Range or are traceable on into the Barguzin basin. A system of several reliably detected and hypothetical fault

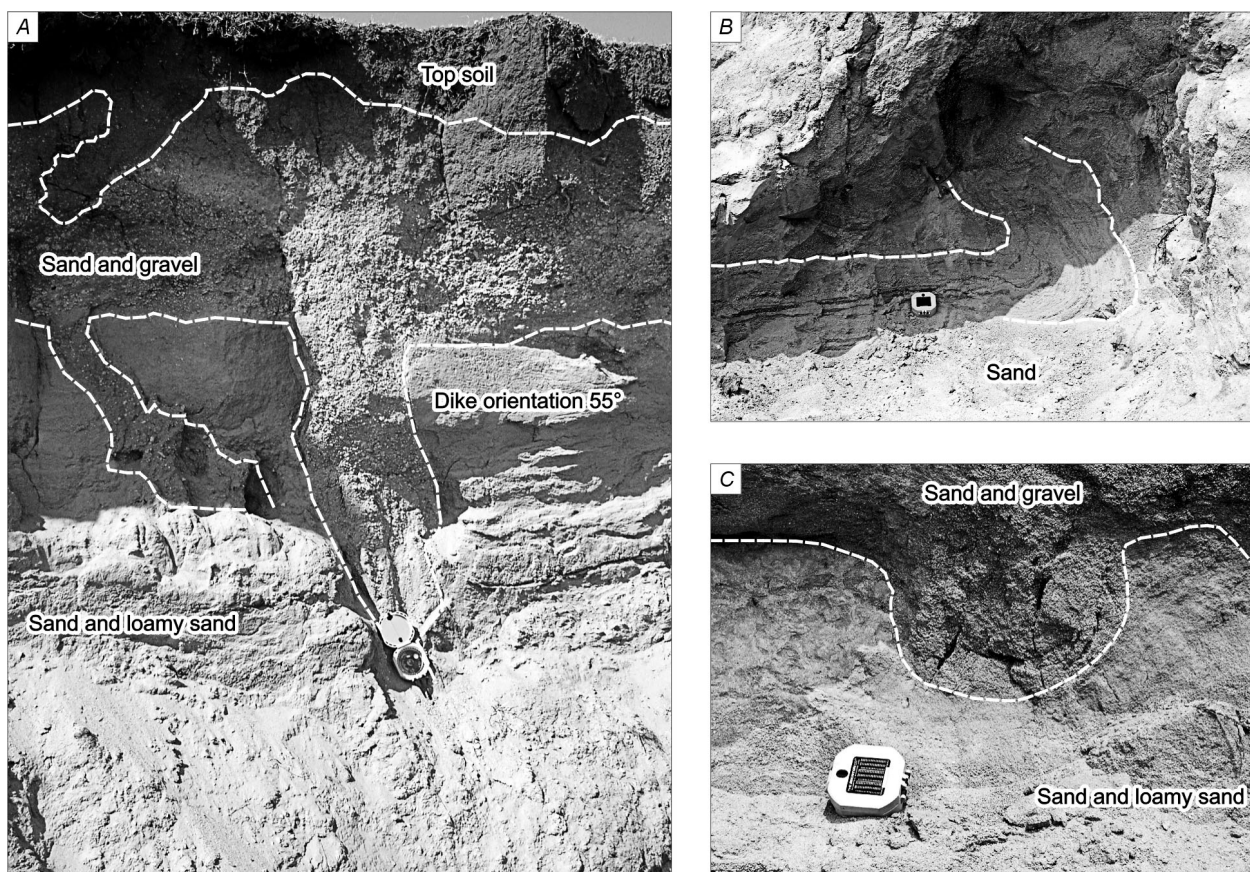


Fig. 3. Examples of brittle and plastic deformation of Quaternary sediments in NE faults. A — neptunian dike at site 0903, boundary between Argoda spur and Barguzin basin; B — lying fold at site 1202 located in Ust'-Barguzin Village opposite mechanical service station; C — seismite-like structure at site 1202.

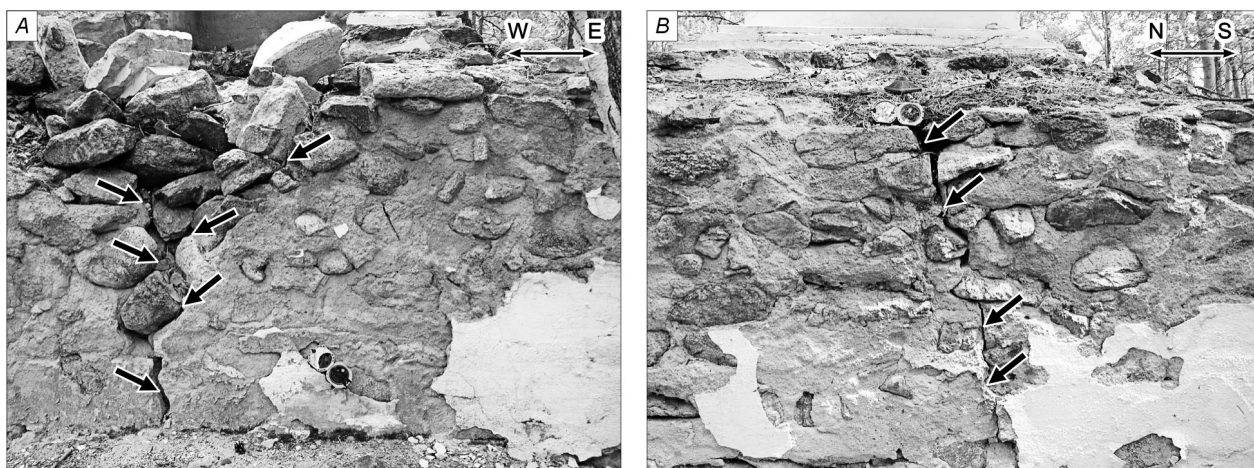


Fig. 4. Rupture in walls of stupa located 200 m east-southeast of site 0701 near Barguzin Range foot. A — dip  $290^{\circ}/65^{\circ}$  and  $120^{\circ}/85^{\circ}$  in W-E wall; B — dip  $215^{\circ}/70^{\circ}$  and  $180^{\circ}/80^{\circ}$  in N-S wall.

segments runs across the mountain border of the Kovyli basin toward Lake Baikal. Well-pronounced W-E faults in the rift central part straddle the Barguzin basin. They are marked by a few meters thick zones of high fracture density in bedrock and by a dense system of joints of the same orientation showing both normal and strike slip of a few centimeters in soft sediments (Fig. 5, A). Fracture patterns in W-E faults unambiguously indicate left-lateral strike slip, locally with a

normal component. At the rifting stage, they must have been subsidiary relative to NE and NW faults that accommodate normal-slip motion of blocks. The rupture in the stupa walls (Fig. 4) bears solid evidence of simultaneous motion on NE, NEN, and W-E faults.

NW faults occur mostly in the Barguzin Range, in the southern Barguzin and Ust'-Barguzin basins, and near the Baikal shore. Slip geometry was determined for three faults



Fig. 5. Examples of brittle and plastic deformation of Quaternary sediments in W-E and NW faults. A — normal slip on a fault dipping at  $0^{\circ}/74^{\circ}$  in alternating sand and loam at site 0303 located in northern Barguzin basin; offset about 5 cm; B — normal slip on a fault dipping at  $250^{\circ}/43^{\circ}$  in sediments of different lithologies at site 1003 located in Ust'-Barguzin basin near Shamanka; offset 1 m; C — seismite-like structure at site 1003.

all showing different directions of motion. One fault was interpreted as a right-lateral strike slip with a small reverse component at site 48302 where the Shamanka spur meets the Barguzin Range and as a normal fault at site 48504 near the junction of the spur with the Ikat Range. Another fault, north of the former, shows a left-lateral strike slip at site 1001. The fracture pattern at sites 1003 and 1103 records normal slip on the third fault located in the Barguzin basin, which is confirmed by a 1 m offset of a sand-gravel layer (Fig. 5, B). An extension of the latter fault was detected from topographic relief along the link between the Barguzin and Chivyrkui gulfs. The thickness contrasts in Cenozoic sediments in different parts of the link indicate that the Barguzin gulf may have been downthrown on an NW fault (Agafonov, 1970; Solonenko, 1981), which is consistent with our structural data. Furthermore, the large offset of 1 m (Fig. 5, B), intense plastic deformation (folds of intricate shapes, dispersed loam pieces, etc.), and high limonitization of the deformed sediments (Fig. 5, C) evidence of the seismic origin of the dislocation.

N-S faults play a special part in the fault pattern of the rift. They are quite few but most of them align within a broad zone between  $110^{\circ}$  and  $110^{\circ}30'$  E (Fig. 2) which lies on the extension of a hypothetical large segmented fault. The fault

(Fig. 6, A) was detected by geophysical surveys and imaged in the map of faults of southern East Siberia (Khrenov, 1982) to begin at the Mongolian border and end 30 km south of the Turka River, not reaching the Barguzin basin. However, it may extend on northward, and the N-S faults we mapped may belong to this lineament more than 400 km long which was reactivated and further segmented during rifting. The large linear structure must have been a major agent in the tectonic evolution of the Barguzin basin. The lineament changes its orientation from NE to N-S in the central part, and the same orientation is followed by the basin master faults (Fig. 2). The N-S fault zone is clearly traceable in the elevation model (Fig. 6) to extend outside the Barguzin rift and run along the meridian almost as far as the northern tip of Lake Baikal.

Comparison of deep electrical imaging, namely the map of basement depths in Fig. 4 from (Nevedrova and Epov, 2003), with the map of faults (Fig. 2) indicates that N-S faults in the central Barguzin basin delineate the boundary between the area of greatest basement depth and the relatively uplifted Upper Kuitun. Therefore, the long N-S fault zone between  $110^{\circ}$  and  $110^{\circ}30'$  E, clearly expressed in the surface topography and in deformation of pre-Cenozoic and Cenozoic rocks, exists in the consolidated crust and is of a deep origin. The

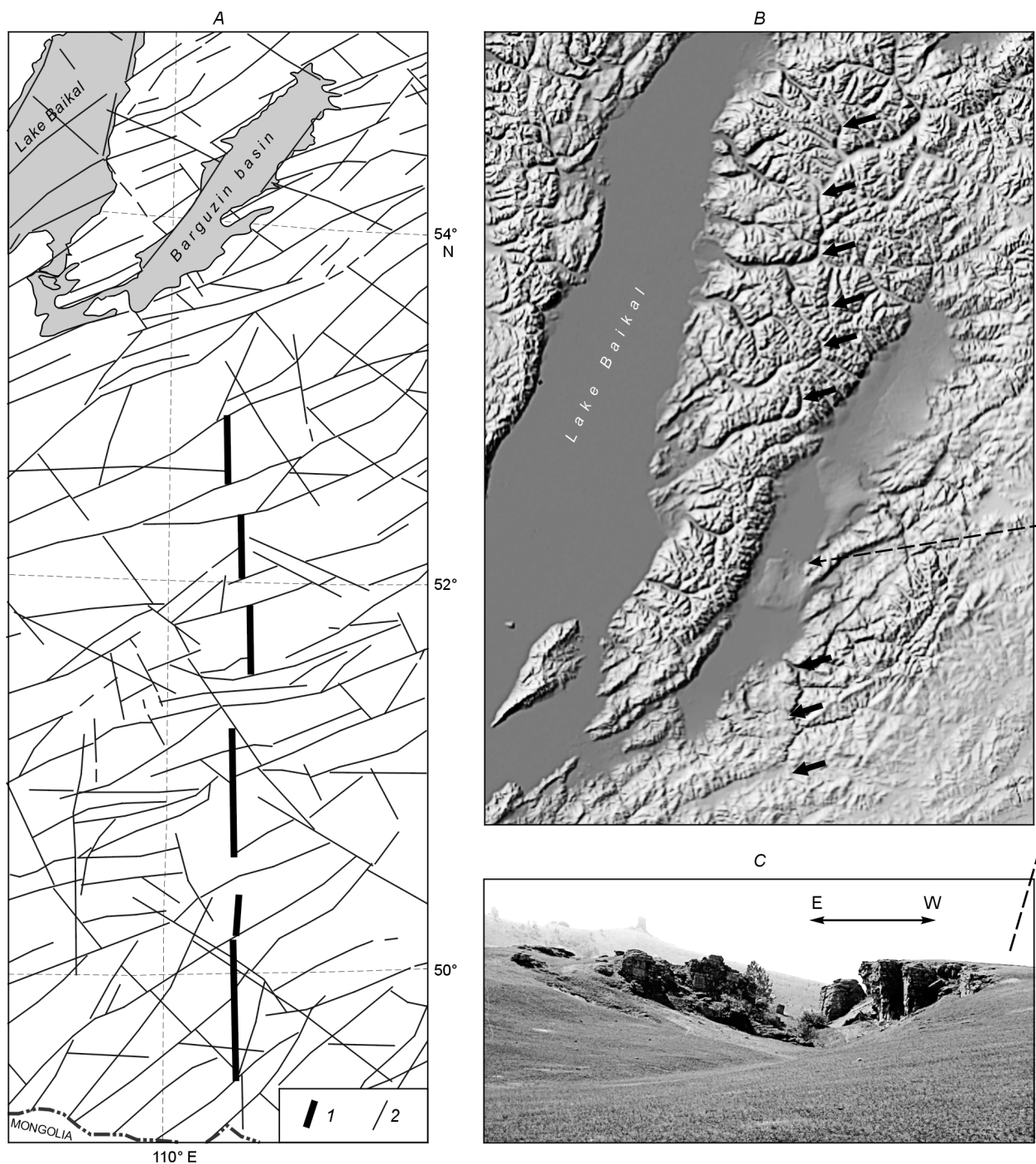


Fig. 6. Large N-S lineament between  $110^{\circ}$  and  $110^{\circ}30'$  E. A — In simplified map of faults of southern East Siberia (Khrenov, 1982). 1 — large fault imaged by geophysical data; 2 — other faults; B — in 3D digital elevation model (available at [www.geomapapp.org](http://www.geomapapp.org)) as a system of straightened river valleys and geomorphic elements, shown by arrows; C — in a fault zone including a 15 m wide canyon striking at  $180^{\circ}$ , site 0904.

available resistivity data (see Fig. 5 and 6 in (Sanchaa et al., 2004)) confirm the existence of another fault we hypothesize in the northern Barguzin basin. The fault strikes about the N-S direction in its south near the Ikat Range and turns to northwest in its north (Fig. 2). It is detectable to a depth of 1200 m or deeper into the basement (see the resistivity section in Fig. 6 from (Sanchaa et al., 2004)) according to low resistivity along the vertical component.

Our structural data predict right-lateral oblique slip (with

different proportions of the normal and strike-slip components) on N-S faults which confirms the earlier inference on the geometry of motion along a segment of the N-S Barguzin fault in the mouth of the Tun valley (Zamaraev et al., 1979).

The mapped faults of different orientations (Fig. 2) cut the crust into blocks of mainly rectangular shapes typical of compression and extension environments and less often into triangular blocks common to shear zones (Sherman et al., 1999). The map of fault density (Fig. 7) compiled using a

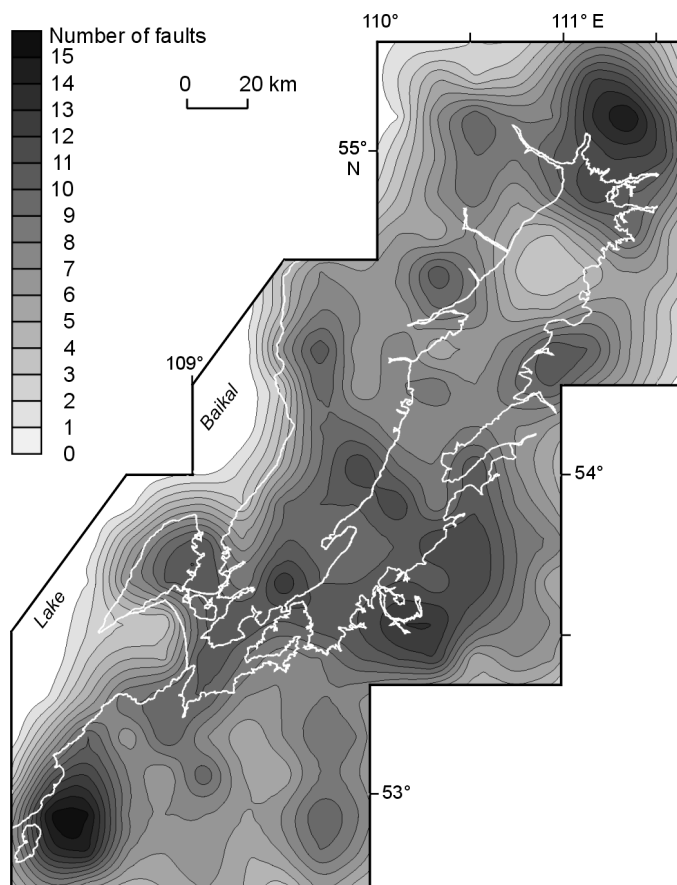


Fig. 7. Density of faults in Barguzin rift and its surroundings. Map compiled using a round sliding window of 1% of surface area. White line contours large lakes and basins with Cenozoic fill.

round sliding window of 1% of the area surface clearly images zones of more and less faulted crust corresponding to relatively small and large blocks. The zones of high fault density mark NE faults, as well as the N-S fault zone that traverses the central part of the Barguzin rift.

### Stress fields

We obtained 110 reliable stress solutions at 92 sites (Fig. 8) using the reconstruction methods of Nikolaev (1992) and Gzovsky (1975). The stress types were determined from the dip of principal stress directions (Sherman and Dneprovsky, 1989). Extension was inferred in 57 solutions (52%), transtension in 18 solutions (16%), shear in 27 solutions (25%), transpression in 2 solutions (2%), compression in 5 solutions (4%), and one solution (1%) showed an uncertain stress regime in which compression and extension axes dip at 39 and 34°, respectively (Fig. 8, C). Extension obviously predominates in the rift (Fig. 8, A) but shear stress also plays an important part (Fig. 8, B). Both extension and shear stresses show more or less uniform spatial distribution. Shear solutions are, however, few near Lake Baikal and in the Ust'-Barguzin basin but more frequent in the northern Shamanka spur and in the southern Ikat Range, as well as in the Argoda spur where the axis of

the Barguzin basin changes its strike from NE to N-S (Fig. 8, B).

Extension directions are mostly within 300–310 and 320–340° in the solutions corresponding to extension (Fig. 8, D), are at 290–300 and 330–340° in transtension solutions (Fig. 8, E), and at 270–280, 290–320 and 330–340° in shear solutions (Fig. 8, F). The orientations of local stresses are rather stable (Fig. 8, G) except for some scatter typical especially of local shear stresses which notably change from NW to NWN in the central Barguzin basin (Fig. 8, A). Note that extension directions in many shear solutions turn in that area from NW to W-E (Fig. 8, B).

Radial extension is inferred locally in the Barguzin rift from typical structural patterns of shear pyramids in fracture stereograms (Rastsvetaev, 1992) which give two stress solutions with roughly orthogonal horizontal extension and vertical compression. Three of seven such solutions were obtained for the Ust'-Barguzin basin (Fig. 8, A), including at site 1003 where we found normal slip on an NW fault (Fig. 5, B).

Compression and transpression stress fields are quite few (Fig. 8, B) and all were reconstructed from structural measurements in pre-Cenozoic rocks. The sites of pure compression cluster along the Lake Baikal shore and along the foot of the Ikat Range. The compression stresses have NW directions at three sites and N-S and W-E directions at two other sites. Transpression was obtained in a small offshoot of the Barguzin Range near the Shamanka link and within the Ulyun spur. Compression axes in both transpression solutions strike in the N-S direction.

Timing the stress fields of different types can provide clues to their origin and role in the rift structure. Stresses corresponding to extension and, possibly, transtension (Fig. 8, A) obviously date back to Late Cenozoic and present time, which is compatible with the known earthquake mechanisms (Fig. 9). Shear stresses recorded in fracturing patterns were attributed to the shear regime at early evolution stages of the Baikal rift (San'kov et al., 1997). We estimate that shear stresses have been active in the Late Cenozoic as well because 17 of 27 shear solutions were reconstructed from measurements in Quaternary sediments. Note that shear stress fields are very rarely related to NE regional faults according to the directions of conjugate shears used for their reconstruction. A single pure shear solution reported for the mechanism of the 25 May 2003 earthquake in the Barguzin Range (Fig. 9) shows NW and N-S orientations of possible rupture planes (Melnikova and Radziminovich, 2004). The scarcity (or rather absence) of pure shear earthquake mechanisms in the Barguzin rift can indicate either that shear strain in this part of the Baikal rift system is weak at the present evolution stage or that the crust in the area fails to accumulate large shear stress to be released in a strike slip in a relatively large event. In the latter case, however, shear stress can release in minor strike slip of a few centimeters detectable only in fracturing.

The compression and transpression fields are difficult to time yet as all these solutions were obtained at pre-Cenozoic sites. They may either be associated with the prerift evolution or record local disturbances to the Late Cenozoic regional

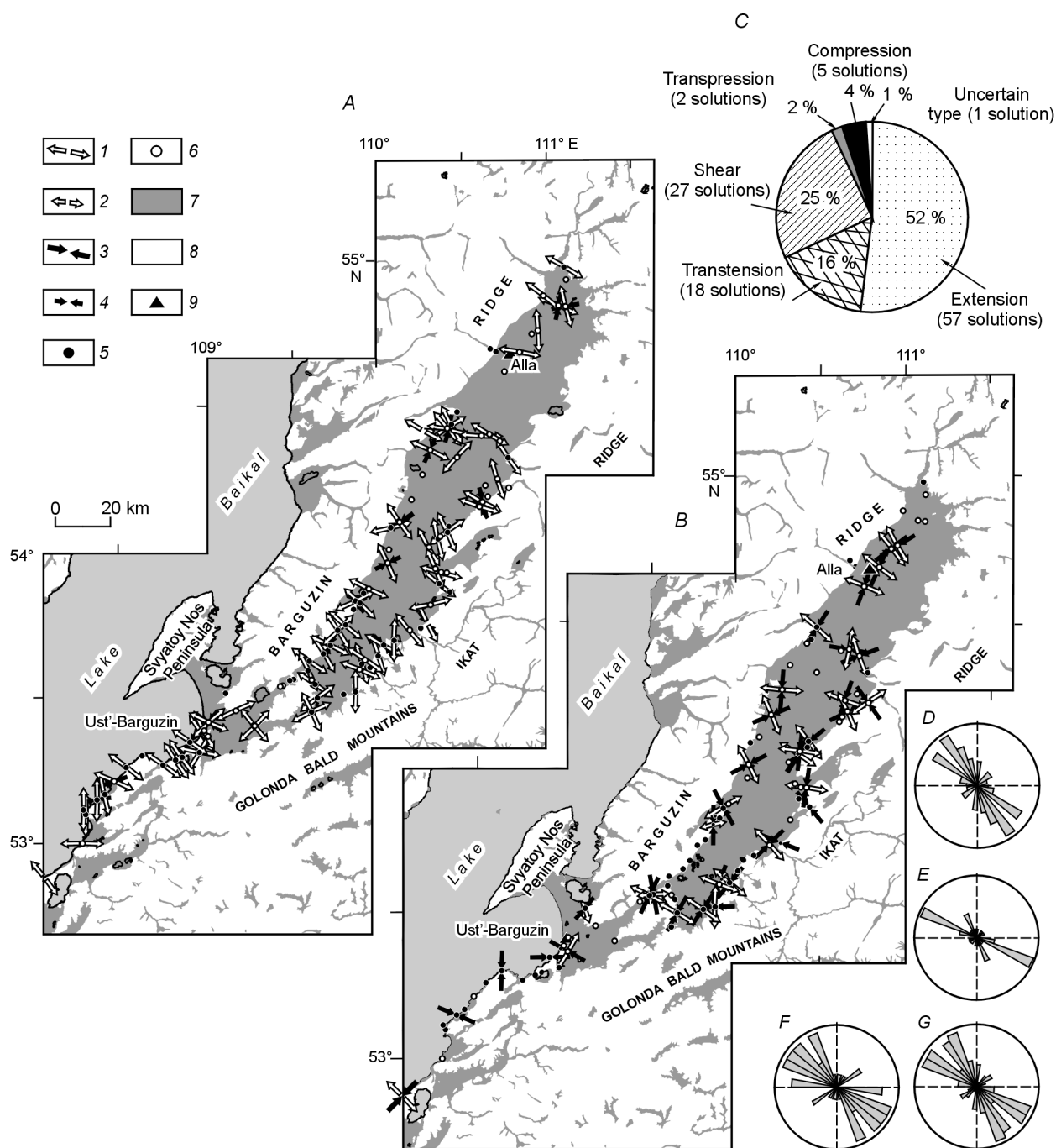


Fig. 8. Crustal stress fields in Barguzin rift and its surroundings, from structural data. 1–4 — directions of extension (1, 2) and compression (3, 4) dipping at 0–30° and 31–60°, respectively; 5, 6 — observation sites in pre-Cenozoic bedrock (5) and Quaternary soft sediments (6); 7 — basins with Cenozoic fill; 8 — basement exposures; 9 — villages. A, B — maps with stress solutions corresponding to extension and transtension (A) and compression and transpression, and uncertain stress (B); C — stereogram showing contributions of different stress types to total of obtained solutions; D–G — rose diagrams of extension directions in solutions corresponding to extension (D):  $n = 57$ ,  $i = 10$ , 17%; transtension (E):  $n = 18$ ,  $i = 10$ , 38%; shear (F):  $n = 27$ ,  $i = 10$ , 14%; total of three stress types (G):  $n = 102$ ,  $i = 10$ , 13%.

stress. The latter idea is supported by mechanisms of recent earthquakes of which three show reverse slip and one reverse oblique slip (Fig. 9).

The coexistence of different stress types within the Barguzin rift indicates a mosaic pattern of the regional stress field caused by continuous stress changes in the conditions of tectonic movements that act upon the faulted crust. The change

can be produced even by slip on a single fault. The coexistence of different stresses or their rapid changes within short time intervals from hours during an earthquake swarm to thousands of years during geological periods was reported from many regions worldwide (Plenefisch and Bonier, 1997; Muller et al., 1997; Seminsky, 2001; Lunina and Gladkov, 2004a; Caputo, 2005; et al.).

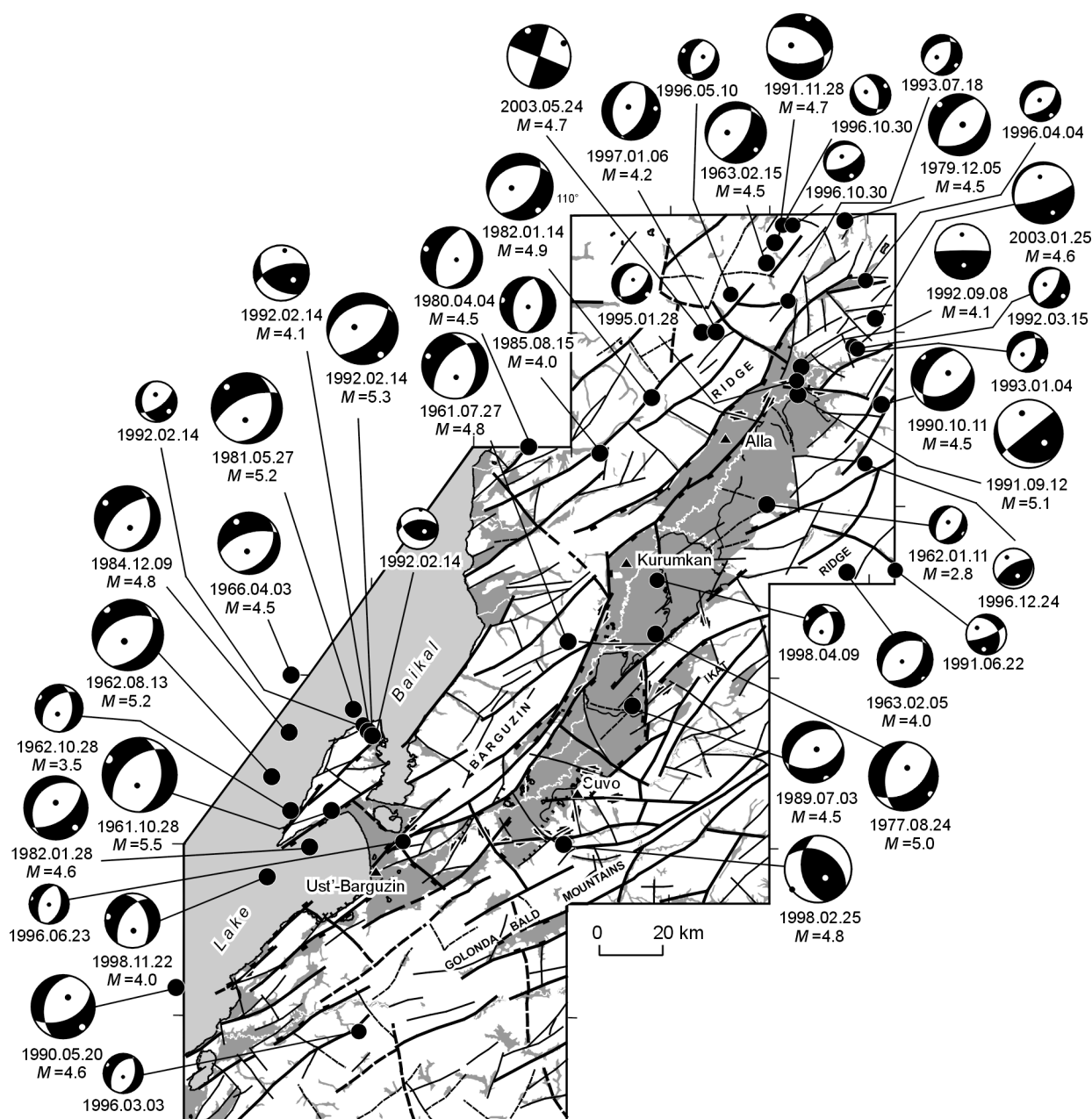


Fig. 9. Known earthquake mechanisms in Barguzin rift and its surroundings. Solutions are after published data (Solonenko et al., 1993; Melnikova and Radziminovich, 1998, 2003, 2004a,b), for periods of 1961 through 1998 and for 2003. Mapped are only earthquakes for which mechanisms were obtained from published data using RAKE software in lower-hemisphere projection. Black quadrants are compression, white quadrants are extension. Numbers below the mechanisms show dates and magnitudes of events (if available). Other symbols as in Figs. 1 and 2.

## Conclusions

The reported new structural data and the published geophysical and seismological evidence allowed us to reconstruct the patterns of Late Cenozoic faults and stresses in the Barguzin rift. The main results can be summarized as follows.

1. NE faults parallel to the Baikal rift play the major part in the fault pattern and predominate both in basins and in the flanking mountains. The structural style of the Barguzin rift is largely controlled by an N-S fault that extends for over 400 km long from the Mongolian border to about 80–90 km

off the Barguzin basin according to the map of faults of East Siberia (Khrenov, 1982). We infer that the lineament continues northward and shows up in both the basement and the sediment fill as a zone of several fault segments. Some its segments, along with NE faults, separate the Barguzin basin from its mountain border. The N-S fault zone is traceable in the surface topography almost as far as the northern tip of Lake Baikal and coincides with the axis of the transcontinental Vebirs zone, which was a subject of discussions in the 1970s (Sherman, 1978). Quite frequent are also W-E and NW faults which split the plates cut-off by normal faults into smaller

blocks and thus facilitate their motion. Thus, the crustal fault pattern in the Barguzin rift is controlled by the pre-existing tectonic framework.

2. Extension has been the dominant Late Cenozoic stress regime in the Barguzin rift, though local shear stress fields were rather abundant. They may have been derived from the regional extension and were accommodated by strike slip, combined with normal-slip motion, along normal NE or N-NE faults and/or along their cross faults. Extension was of a relatively stable direction, from NW to SE, almost rift-orthogonal. It notably departs from this direction in the place where the axis of the Barguzin basin turns from the NE to N-S strike and where most of shear stress solutions were reconstructed. Local changes in dips and directions of principal stresses must be due to the presence of the large fault zone consisting of several N-S segments between 110° and 110°30' E.

3. The reported studies of faults in the Barguzin rift and their correlation with the available published gravity (Solonenko, 1981) and resistivity (Nevedrova and Epov, 2003; Sanchaa et al., 2004) data confirmed the efficiency of mapping the fault pattern from structural measurements in bedrock and soft sediments of different ages.

The maps of Late Cenozoic faults and stresses compiled on the 1:200,000 basis can be used for reference in mapping seismic risk associated with faulting in an active and changeable stress field. These maps provide clues to the heterogeneous structure of the crust with different physical, mechanic, and chemical properties which control the response to earthquakes. Thus, due regard for this structure is indispensable in studying deformation of the solid Earth and the related seismic process (Sadovsky and Pisarenko, 1991). The behavior of the faulted crust in response to a large event caused by slip on an active seismic fault can be predicted using our maps further supplemented with synthesis of structural evidence, past and instrumental seismicity, and, possibly, also other data. A model of this kind should predict at least the geometry and direction of postseismic slip on neighbor faults, possible shock intensity depending on the position of earthquake source relative to these faults, the focal mechanism of the main shock, and the local stress change it may cause. These objectives are expected to be the main line of our further studies.

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