PALEOKINEMATICS AND PATTERN OF KIMBERLITE FIELDS LOCATION ON THE SIBERIAN PLATFORM BASED ON THE HYPOTHESIS OF HOT SPOTS

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The geodynamic model (see Figure) was obtained by the joint analysis of data on the spatial position and age of magmatites of 25 kimberlite and carbonate fields of the Siberian platform and its paleokinematics reconstructed from paleomagnetic data. The technique of such constructions is based on real precision of available dates (up to ±10 Ma) described by Zhitkov A.N. (1992). Similar methodical approach applied to other problems is regarded in the article by Gordon R.J., Cox A., O'Hare S. (1984). The calculations of kinematic parameters of Phanerozoic drift are made on the trajectory of apparent polar wonder path (APWP) of the East-Siberian paleoplate made up on the basis of summation of paleomagnetic data. The average coordinates of paleomagnetic poles obtained from dated geological objects correspond to the points on the trajectory. In constructing the trajectory all paleomagnetic determinations were given "ascribed" estimates of ages (terminology from E.Irving, 1984), they were ordered in the time series and averaged by window of 30 mln.yrs. wide with a step of 10 mln.yrs. All published data were taken into account: A.N.Khramov (1974, 1982, 1990), A.Ya.Kravchinsky (1981), E.Irving (1984) and new determinations obtained by the Irkutsk laboratory. The age referencing was performed by the international scale of Harland W.B., Arvstrong R.L., Cox A.V., et al. (1984).

It was found that the same age paleomagnetic poles and local fields of the deep-seated intraplate magmatism tend to locate along minor circles outlined around the common Euler pole in accordance with the hot spot hypothesis. The introduction of the Middle Paleozoic (355-340 Ma), Early Mesozoic (225-210 Ma) and Middle Mesozoic magmatites occurred in time of accelerated directed drift (mobile paleokinematic regime). Every epoch of kimberlite formation has individual kinematic parameters (angular and linear velocities, coordinates of the rotation pole) as well as appropriate spatial position of deep mantle plumes. The efforts to relate all kimberlite occurrences to the passing of the plate over the same plume causes controversies. Coordination of independent geological and paleomagnetic data for different epoches of magmatic activity are considered as a strong argument in favor of the model under discussion. The available fields of development of the Phanerozoic deep-seated magmatism are approximated by hot spots, i.e. the traces left on the moving plate by the mantle plumes. The model contains the calculated temporal tracers (tracks) of seven plumes: three Middle Paleozoic, three Early Mesozoic and one Middle Mesozoic. The estimates of paleokinematic parameters were obtained for each of them, except for the track of the probable position of kimberlite fields, and the predicted order of the value of the directed age change was indicated. In particular it was shown that these estimates lie beyond the limits of precision of available dates, but can be reached in carrying out the modern investigations.

The Middle Paleozoic tracks are described by the plate rotation around Euler pole with coordinates 73° N, 35° E in SW

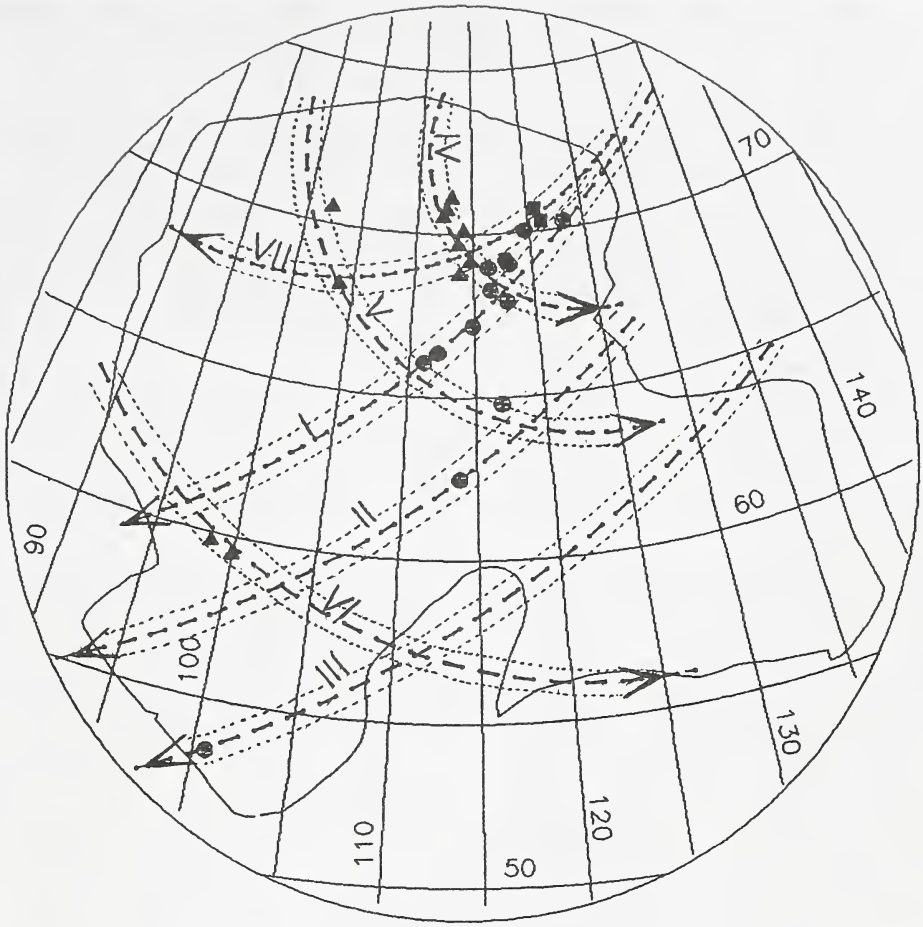

Figure. Geodynamic model of formation of Siberian platform kimberlite fields.

Dark figures denote kimberlite fields. The age of magmatites (from F.F.Brahfogel, 1984 with additions): circles - Middle Paleozoic, triangles - Early Mesozoic, squares - Middle Mesozoic. The only value is given for the fields with polychronous magmatism. The calculated routes of hot spot tracks: I - Mirninsky, II - Alakit-Kyioksky, II - Okinsky, IV - East Anabar, V - West Anabar, VI - Chadobetsky, VII - Molodinsky. Age: (I-III) - Middle Paleozoic (D_3-C_1); (IV-VI) - Early Mesozoic (T_1-T_2); VII - Middle Mesozoic (J_1). Arrows designate the direction of the drift and predicted ageing of kimberlites along the tracks.

direction with the average angular velocity about 1 degrees /ml.yrs. Ageing of kimberlites is predicted in the same direction. The Alakit-Kuoisky track uniting 10 available fields, is characterized by an average linear velocity about 50

km/mln.yrs. The perspectives of related new kimberlite fields may be associated with its northeastern and southwestern continuation. The indigenous sources of kimberlites in the Velma-Tychan interfluve of Krasnoyarsk Kray are confined to this track. The order of the predicted increase of the kimberlite age from Kuoyka to Alakit fields is estimated to be 10-15 mln.yrs. The Mirny track is calculated from the same paleokinematic parameters of the plate and coordinates of the center of Mirny field. The linear velocity along this track is somewhat higher (56 km/mln.yrs). Available diamond placers of the Irkutsk amphitheater are traced along them (from Tumanshet in Sayan Mts to Chona-Tungusska interfluve in the Katanga region). With this in mind the perspectives of discovery of kimberlite fields along this track are not disclosed entirely.

The distribution pattern of the Early Mesozoic kimberlites location is defined by the plate rotation around the Euler pole with coordinates 72°N, 126°E in SE direction with the average angular velocity about 2 degrees/mln.yrs. The East-Anabar (6 kimberlite fields), West-Anabar (2 fields) and Chadobetsky (1 field) tracks are characterized by a significant difference of linear velocities: 25, 44, 83 km/mln.yrs, accordingly. This feature explains unique location of kimberlite fields along the East-Anabar track and to predict their large scatter for two other. The tracks of the Middle Paleozoic and Early Mesozoic kimberlites differ markedly in orientation and agree with appropriate tracks of paleomagnetic poles which is considered as a strong argument in favor of the hypothesis discussed.

The Middle Mesozoic track of kimberlite fields is drawn through the middle position of the Molodinsky and Kuoysky fields and Euler pole calculated from paleomagnetic data (78° N, 97°E, angular velocity 2.8 degrees/mln.yrs). The ageing of magmatites is predicted in the western direction. The available and predicted occurrences of polychronous magmatism are confined to the intersections of different age tracks of kimberlite fields.

The adequate interpretation can be made for the facts which cannot be explained in terms of other hypotheses, e.g. exotic composition and restricted amount of kimberlite magmas, diversity of tectonic situations of kimberlite occurrence, failure to discover deep faults controlling position of kimberlite fields, polychronous development. Altogether, there are counter arguments of the hot spot hypothesis in general and its applications to the problem considered in particular. Without discussing this, we note that two kimberlite fields discovered for six years, which passed after the first data on the model were published, are located along the Chadobetsky route and in the node of juncture of the Mirninsky and Western-Anabar tracks. The accidental nature of such a coincidence is hardly probable.

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