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Physical modelling of structural features of the Agulhas Basin and its evolution (South Atlantic)

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The evolution of the Agulhas oceanic basin was influenced by the formation of the southern part of the Mid-Atlantic Ridge (MAR) as a result of the jump of the spreading axis. This sector of the South Atlantic began to open up as a result of the breakup of Gondwana about 135-140 million years ago. The process of opening was accompanied by kinematic rearrangements in the movement of the lithospheric plates. According to some evolutionary models, the jumps of the spreading axis in the area of the Agulhas basin occurred under the influence of hot spots. The hot spots of Shona, Bouvet, and Discovery played an important role in the evolutionary process of plate boundaries.

The previously active Agulhas spreading ridge is located in the central part of basin. From the east, the basin is framed by the Agulhas plateau, from the west is the Meteor rise. On the north the basin is bounded by the Agulhas transform fault, and on the south by the Southwest Indian Ridge.

Using the method of physical modeling, the formation of volcanic provinces that influenced the formation of the Agulhas basin was modeled.

The first series of experiments is devoted to the jump of the spreading axis of the Agulhas Ridge and the formation of the MAR and the Meteor rise. The purpose of the experiments was to determine the conditions for the formation of Meteor rise, located on the western edge of the Agulhas basin. Experiments have shown that the formation of this block may be due to the action of a hot spot, and the block itself may have a complex structure and contain inclusions of continental crust, which could have separated during the break of the Falkland Plateau and the jump of the spreading axis.

The second series of experiments was devoted to modeling the Agulhas ridge, located on the northern rim of the Agulhas basin. The ridge has a linear structure extending along the Agulhas-Falkland transform fault. The purpose of the experiments was to test the hypothesis of the magmatic origin of this ridge in the conditions of a transform fault with transtension under the thermal influence of the Shona and Discovery hot spot. Experiments have shown that a linear magmatic ridge similar to the Agulhas ridge is formed in the transtension condition. It is also possible that the formation of the ridge may be associated with a change in the speed and direction of spreading.

The Antarctic sector of the South Atlantic, and in particular the Agulhas Basin, has a complex history of evolution. This is due to the displacement of the three major Gondwanan continents, and the activity of hot spots in this region and kinematic rearrangements, and the spatiotemporal migration of the Bouve triple junction with a complex stress field, the existence of the continental Falkland Plateau, and other factors.

The geological environment of the Agulhas basin is characterized by objects and structures that allow us to approach the history of the evolution of this complex area.