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Figure 1. Planned seismic survey, approximately 30,000 km.

'Geology Without Limits' Seismic Project Sets Caribbean Investigation

By KEITH H. JAMES, NICKLOLAY AMELIN, LASLO MILES and EUGENE PETROV

The so-called "Caribbean Plate" is one of the most complex and tectonically interesting regions of our planet.

Despite numerous studies, this area of several million square kilometers remains poorly understood – especially in its interior, where crustal structure is known only from sparse survey lines.

The good news: A major, three-year regional study will commence there at the end of this year.

It's being led by "Geology Without Limits," an international scientific consortium based in Moscow that undertakes regional, holistic, deep investigation of the world's marine basins.

The Caribbean Plate investigation's main objective is to study:

- ▶ Interrelationships of blocks of continental and oceanic crust.
- ▶ The role of rifting, shear and thrust tectonics in the regional structure of the basement and sedimentary cover.
- ▶ Controls of the distribution and structure of carbonate platforms.

"Geology Without Limits" integrates organizations and specialists of states bordering the basins and employs the latest technology – and the resulting dialogue leads to exchange of ideas and better understanding.

The consortium completed a major survey in the Black Sea in 2011-12, and

others are under way in the east and west Russian Arctic, Laptev, east Siberian, Chukchi, Barents and Kara seas. Others also are planned for the Caspian and Bering seas.



JAMES

An international consortium will undertake a major, three-year regional study of the Caribbean, beginning later this year.

The Consortium includes a number of Russian scientific organizations (government JSC "Soyuzmorgeo," Moscow State University Geological Department, the State Geological Institute of the Russian Federation Academy of Sciences and the Schmidt Institute of Physics of the Earth of the Russian Federation Academy of Sciences).

It also will include geological institutions, state geological surveys and services of Caribbean countries – once their governments agree to participate.

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This article was largely abstracted from the detailed program proposal.

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Seismic Operations

The investigation will begin with regional synthesis of existing information and current understanding.

Leading scientists from participating countries will be invited to join the project, and oil companies with experience in the area will be consulted. At this stage existing problems and data blank spots will be identified and the survey will be modified appropriately.

The program will employ marine, deep 2-D CDP reflection seismic surveys, bottom and buoy-based seismic acquisition for reflection-refraction and OBS-refraction surveys, electrical,

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magnetic and gravity surveys, heat flow measurements, geochemical investigations, seabed sampling and stratigraphic drilling and environmental monitoring of offshore areas.

Over a period of 10-12 months a Russian-flagged research vessel will acquire some 30,000 kilometers of new reflection and refraction seismic data along an irregular grid with line spacing of about 250 kilometers (figure 1).

The lines are mainly located in deepwater, over the most poorly studied part of the area. They will tie together the region's major geological structures – and integrated with existing geophysical data they will allow construction of a comprehensive model of area's evolution.

Specially designed long offset reflection and refraction field acquisition and state-of-the-art processing will achieve the desired depth of investigation (45-60

kilometers). Joint acquisition of reflection and refraction data will permit computation of a combined wavefield.

A special feature of the survey will be the use of floating seismic systems (sonobuoys, deployed and recovered by a support vessel) to record refracted waves at offsets exceeding 50 kilometers. The data set will allow recording of reflections and construction of a detailed velocity model of the earth's crust.

Funding will come from purpose-oriented programs of participating countries, international organizations and oil companies. Those providing significant funds will be able to influence the program plan, to be represented during program execution and will receive data and results.

Profile Targets

The Work Performance Area covers the Caribbean Sea and neighboring areas.

Five regions are defined:

- ▶ The Bahamas.
- ▶ The Lesser Antilles.
- ▶ The Greater Antilles.
- ▶ Central America.
- ▶ South America.

The planned seismic profiles cross waters of Colombia, Venezuela, Panama, Costa Rica, Nicaragua, Honduras, Belize, Cuba, the Cayman Islands, Jamaica, the Commonwealth of the Bahamas, the Turks and Caicos Islands, Haiti, the Dominican Republic, Puerto Rico, the British and U.S. Virgin Islands, Anguilla, Saint Kitts and Nevis, Montserrat, Guadeloupe, Martinique, Saint Vincent and the Grenadines, Trinidad and Tobago, and the Leeward Antilles (Aruba – Blanquilla).

They are designed to cross all major geological and tectonic elements in the area.

Working Together

Interpretation and analysis of the new data will be carried out by the consortium workgroup that will include representatives of participant countries.

Programs of this kind have the highest academic value when local geological institutions collaborate. The joint interpretation and analysis of geological and geophysical information by the international scientific workgroup will be organized on the basis of a distributed-access system. This will provide access to a geological/geophysical database combining existing data with the new geophysical information.

Regular roving seminars will facilitate exchanges of opinion and formulations of intermediate decisions of the workgroup.

Several field trips will familiarize the workgroup with the geology of the region.

The scientific results will be published and presented at international conferences and will describe the model of evolution of the area as agreed by all participants.

Finally, the model may become the basis for further joint operations of geological surveys and scientific institutions of the participant states.

The major hydrocarbon provinces of the Gulf of Mexico and northern South America bracket the Caribbean. In these areas, and elsewhere in the world (e.g., Brazil, east and west Africa, India), industry is moving increasingly into distant and deep waters, finding significant new hydrocarbon reserves and geological surprises.

The survey planned by "Geology Without Limits" in the Caribbean can be expected to provide major learnings and reasons to explore more widely in the area. ■

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