

CNAV SACKVILLE GEOPHYSICAL STUDIES

During its more than thirty year life as a research vessel Sackville carried out many important geophysical research cruises of various types.

Refraction seismic studies were the first, beginning in the 1950's with a two ship offshore refraction study of the Scotian shelf with Lamont-Dougherty' MV Vema. The results of this cruise showed for the first time that offshore Nova Scotia was a good potential site for offshore gas and oil production. Other later Sackville cruises by Dalhousie University on the Scotian shelf and Gulf of Saint Lawrence as well as others in the Gulf of Saint Lawrence and Labrador Shelf by the Geological Survey of Canada from Ottawa and the Atlantic Geoscience Centre added further crustal information of value to the oil industry from these areas.

Most of these cruises consisted of two ship studies in which one ship carried and set off the explosive charges from 50 to 500 lbs in size and the second ship received the resulting refracted signals on a trailing hydrophone array or later on sonobuoys..Some of the early Dalhousie cruises only were single ship operations where the Sackville set off explosive charges offshore and land bases seismic receiving arrays recorded the resulting refracted signals. These studies were usually looking to determine the earth's crustal structure down to the Moho. Some studies were of lesser depth but a more detailed determination of the shallower crust. Sackville was often used as the explosive carrying and setting off ship but occasionally as the receiving ship as well. In the 50's and 60's the explosives were mostly surplus WW II depth charges and other anti submarine explosives. Later cruise in the 70's used commercial explosives as the WW II surplus was gone.

Gravity studies were also an early and important type of cruise carried out on the Sackville by the Dominion Observatory in its mandate to determine the earth's gravity field strength over both onshore and off shore Canada. The offshore studies on the east coast of Canada were predominately carried out on the Sackville using a bottom gravimeter system. This was done by the ship holding station at a predetermined point while a bottom gravimeter encased in a weighted waterproof sphere was lowered to the bottom via an electro-mechanical cable from a winch on the foredeck. The gravimeter had to be kept stationary on the bottom for a few minutes while the gravity reading was collected. It was then raised on deck and the ship moved off to the next station where the procedure was repeated again. The ship's position and depth of the water at the measurement point was also recorded for each station.

The Sackville was also used to collect the earth's magnetic field strength in the offshore areas of eastern Canada. These begin in the early 1960's when Dalhousie used the Dominion Observatories newly developed proton precession magnetometer. This was done by trailing a magnetometer sensor some distance astern off the ship to be away from the ship's magnetic effect. A reading was taken every few seconds and the resulting magnetic signal strength was recorded on a chart recorder as well as digitally on a display. Water depth was also recorded continuously as the ship proceeded on surveying an area by traveling on a pattern of parallel lines over the area of interest. The resulting magnetic field pattern and anomalies recorded resulted from differences in the earth's underlying crustal structure or occasionally a sunken ship etc. .

Later in the late 60's and 70's various reflection seismic systems were used on the Sackville on various cruises. These consisted of the ship towing a sound source not far astern of the ship as well as a receiving array farther astern. The sound sources consisted of a sparker, a boomer or an airgun. The sparker was an electrode which was towed astern and a periodically a high voltage signal was sent down to the electrode which was near a ground source resulting in an immediate gas bubble that created a sound like a small explosive charge. The boomer was similar in that it trailed a boomer source which consisted of an electrical coil adjacent to a spring loaded aluminum plate. When the high voltage signal was sent to the coil it created a strong electrical field which rapidly repelled the plate resulting in an underwater pressure pulse similar to a small explosive charge. The airgun source was towed astern of the ship also and consisted of a high pressure air chamber device that was supplied by high pressure air from a ship mounted air compressor. A solenoid valve in the airgun was opened by a signal from the seismic recorder system periodically in times of a second to 10 or more seconds. The high pressure air in the airgun chamber of up to 2500 PSI was quickly released also resulting in a pressure pulse similar to a small explosive source. The resulting sound from any of the sources was transmitted through the water and into the bottom and reflected back from the various geological layers to the towed receiving array and then displayed on a graphic recorder. The boomer and airgun sources were usually towed fairly near the surface but the sparker also was often towed in a v-fin depressor to be nearer the sea bottom resulting in more detailed near bottom geological structure being acquired. The Nova Scotia Research Foundation was the main user and developer of this technique.

On most geological-geophysical research cruises magnetic, reflection profiling as well as geological core and bottom samples were collected on the same cruise. Often geochemical data collection was also included. In these cruises.