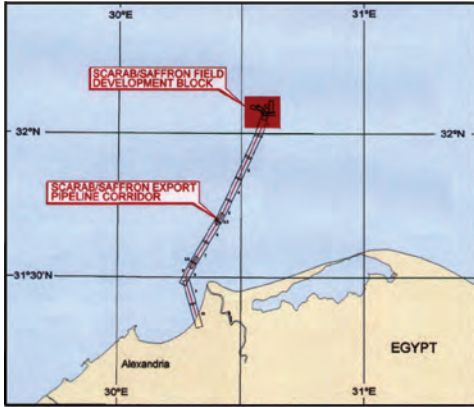


PROJECT PROFILE

GEOHAZARDS ASSESSMENT FOR OIL PIPELINES IN THE NILE DELTA OF EGYPT

The Burullus Gas Company was the developer of the Scarab/Saffron field offshore from Egypt, and the Bechtel INTEC Consortium (Consortium) was the deep-



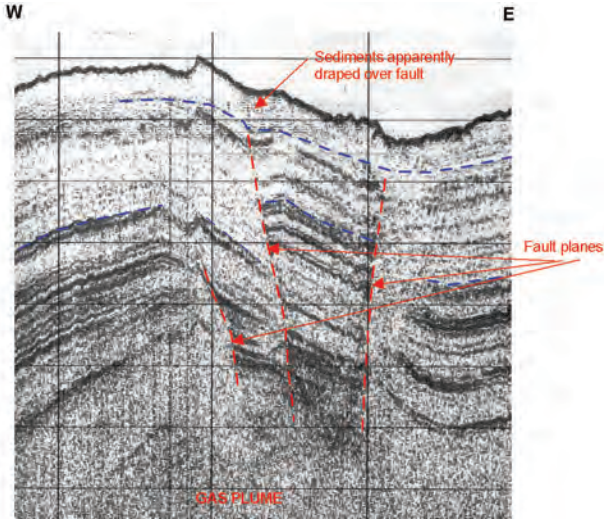
Location of the project area.

water managing Contractor for the project. The project comprised a number of subsea wells with individual pipelines connected to a subsea manifold. The multiphase production fluids are conducted from the subsea manifold to an onshore processing facility by additional pipelines. D'Appolonia was retained by the Consortium to evaluate the potential sea floor displacement

ment from fault movements and the possible effect on the aforementioned pipelines and to perform a seismic hazard study.

The geology at the Scarab/Saffron site was very complex. Several surface fault features and a five-kilometer-diameter diaper structure were found to be present in the offshore block. Thick deposits of very soft clay were present in deepwater areas. Moving shoreward along the pipeline corridor, the thickness of soft sediments decreased, and stiff soil conditions were encountered at the location of the pipeline landfall.

The path of the deepwater pipelines passed near a number submarine soil slopes. Seismic stability of these slopes, and the potential for landslide run-out that might impact the pipelines was evaluated. As the widespread presence of gas-charged sediments was expected to affect stability,

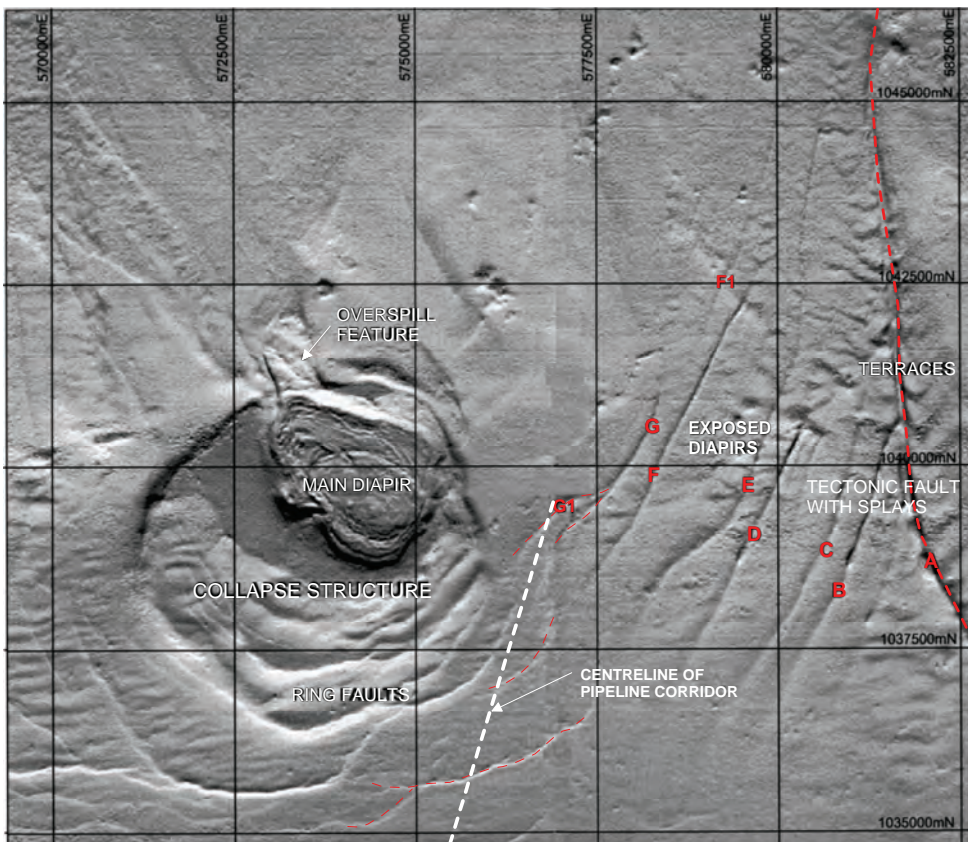


Subbottom profile over main tectonic fault.

both geotechnical test data and back analysis of existing slopes were used to define soil strength parameters.

A large circular-shaped depression approximately five kilometers in diameter and up to 100 meters deep was found in the southwest portion of the survey area. The entire feature is the seabed expression of a large mud diapir with an associated ring fault collapse structure. The ring faults were observed as channels and scarps. Historical gas seepage along underlying fault planes was interpreted to be the origin of the channel features, as well as of pockmarks observed on the seabed.

East of the ring faults a series of NNE-trending linear channels were observed that appeared to tie into a main N-S trending channel. These features appeared to be tectonic faulting within a regional group that could possibly be active. Based upon the results of C^{14} dating used to determine sedimentation rates in the area of the sea floor displacements, the main tectonic fault was found not to have moved within about the past 15,000 years. The seabed scarps associated with ring faults also appeared to be relics of ancient movement. About one to two meters of undisturbed sediment cover these features, indicating that they were formed in the range of 1,700 to 3,300 years ago.



Offshore bathymetry in the vicinity of the site. Both diapiric and tectonic displacements of the sea floor are evident.