SALT DIAPIRISM AND ASSOCIATED FAULTING BENEATH THE EASTERN END OF GEORGES BANK[1]

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Abstract

The thick sedimentary sequence underlying the eastern end of Georges Bank is disrupted by faulting. These fault structures, which displace sediments as shallow as 550 m beneath the sea floor, may be the result of the plastic flow of Early Jurassic evaporites.

INTRODUCTION

The thick sediments of the passive continental margin off the east coast of North America are not extensively faulted. When faults have been recognized, they have been attributed to diapiric activity (Jansa and Wade, 1975; Wade, 1977), the reactivation of basement structures (McMaster, 1971; McMaster et al, 1980; Behrendt et al, 1980) or differential subsidence associated with compaction and facies changes (Grow, 1980).

Faulting is generally absent on multichannel seismic reflection profiles collected over the Georges Bank Basin off southern New England (Schlee et al, 1976; Grow et al, 1979; Austin et al, 1980). However, a short segment of a 6-channel stacked and deconvolved profile collected by the Woods Hole Oceanographic Institution over the eastern part of Georges Bank (see fig. 1) exhibits numerous faults (see fig. 2).

DISCUSSION

The near-vertical faults visible on figure 2 must be real. They do not correspond to course changes (see fig. 2) or alterations in sound source/receiving array configuration, and they cannot represent data processing anomalies because the same structures are discernible on concurrently recorded single-channel monitor records.

The faults come to within 0.55 sec (reflection time) or 550 m of the sea floor, based on a nearby sonobuoy refraction velocity solution for the overlying section of approximately 2 km/sec (Austin, 1978). They are overlain by undeformed, near-horizontal latest Cretaceous-Cenozoic sediments (Austin et al, 1980). Apparently, the faults have not been active since the end of the Cretaceous, although small displacements may be responsible for kinking of reflectors above 0.5 sec between 1730 and 1900 hrs (see fig. 2). The faults extend to a depth of at least 3.0 sec, displacing sediments of inferred Jurassic age at a converted depth of 5.0 km (Austin et al, 1980).

CONCLUSIONS

The cause of the faulting is indeterminate on figure 2. However, the existence of piercement structures on the upper continental rise off Nova Scotia (Jansa and Wade, 1975; Wade, 1977), beneath Northeast Channel (Schlee et al, 1977; Austin et al, 1980; see fig. 1), and underlying the southern part of Georges Bank (Austin et al, 1980) suggests that the tectonism is a response to the upward movement of evaporites. The recovery of Early Jurassic anhydrite from the COST (Continental Offshore Stratigraphic Test) G-2 well (Amato and Simonis, 1980; see fig. 1 for location) supports this interpretation.

The exact trend and regional extent of these faults is unknown because they occur on only one NE-NW profile. However, they are probably short (i.e., 25 km or less, based on the average density of Woods Hole Oceanographic Institution multichannel seismic profiles in the vicinity) with a general NW-SE strike. In fact, they may be caused by a single diapiric structure deep in the sedimentary section.

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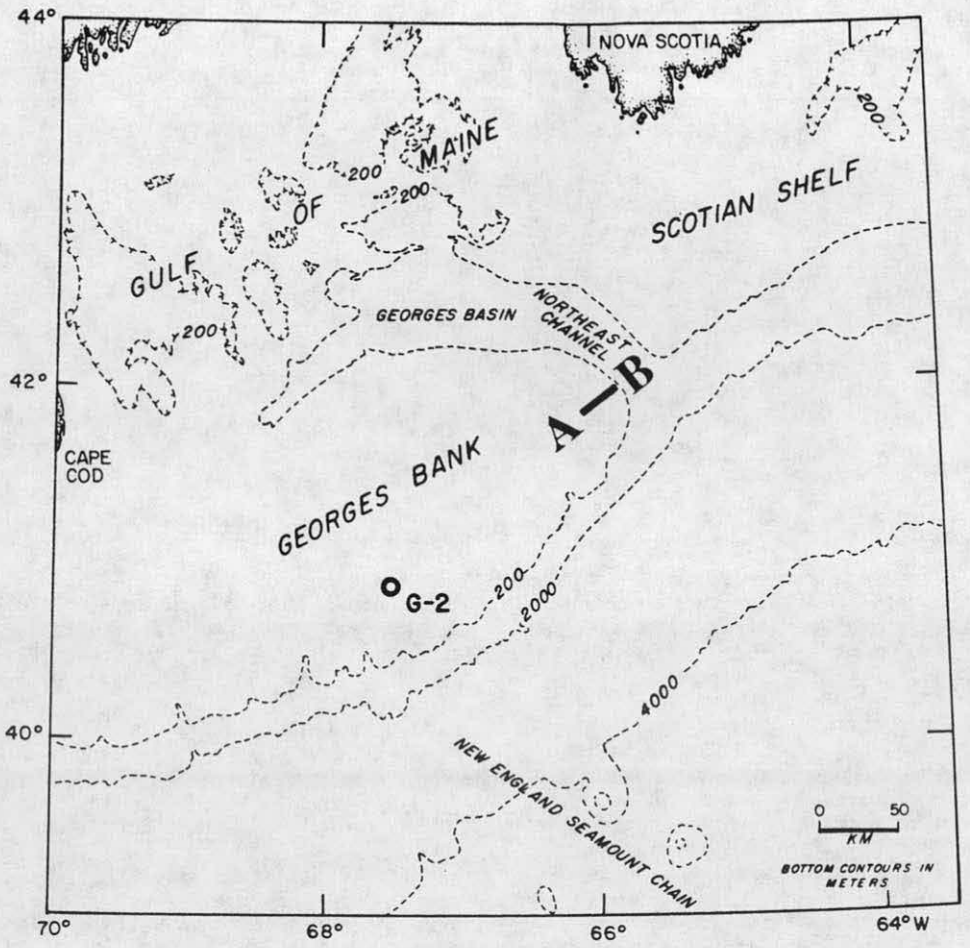

Figure 1. Map of the Georges Bank region showing the locations of the seismic reflection profile in Figure 2 and the COST G-2 well.

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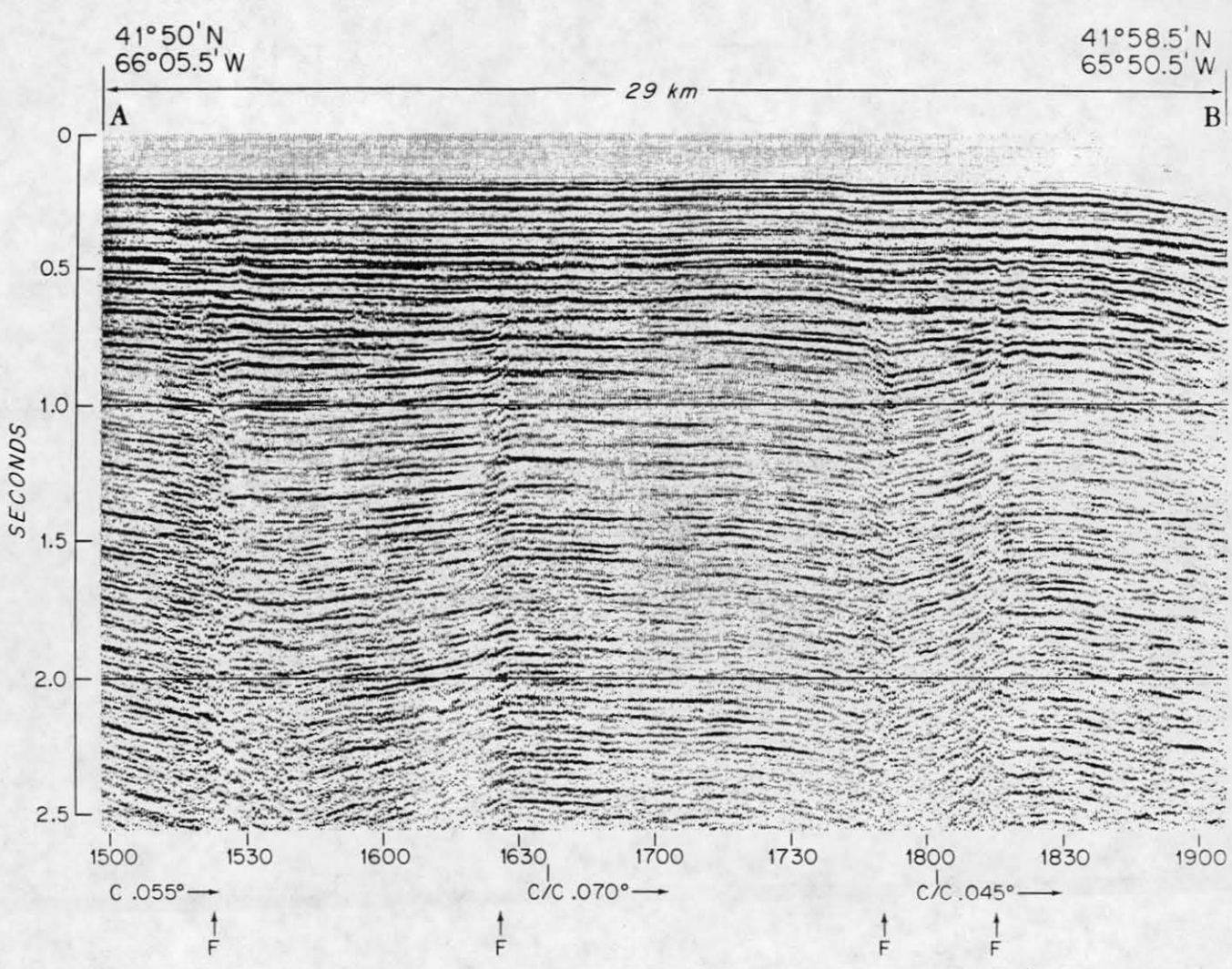

Figure 2. A stacked and deconvolved 6-channel seismic reflection profile from the eastern edge of Georges Bank. For location of section, see figure 1. Fault traces are indicated by the letter F. Annotations at the base of the section are in time. Note that course changes (c/c's) were made between the faults and could not be the cause of the bedding dislocations.

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