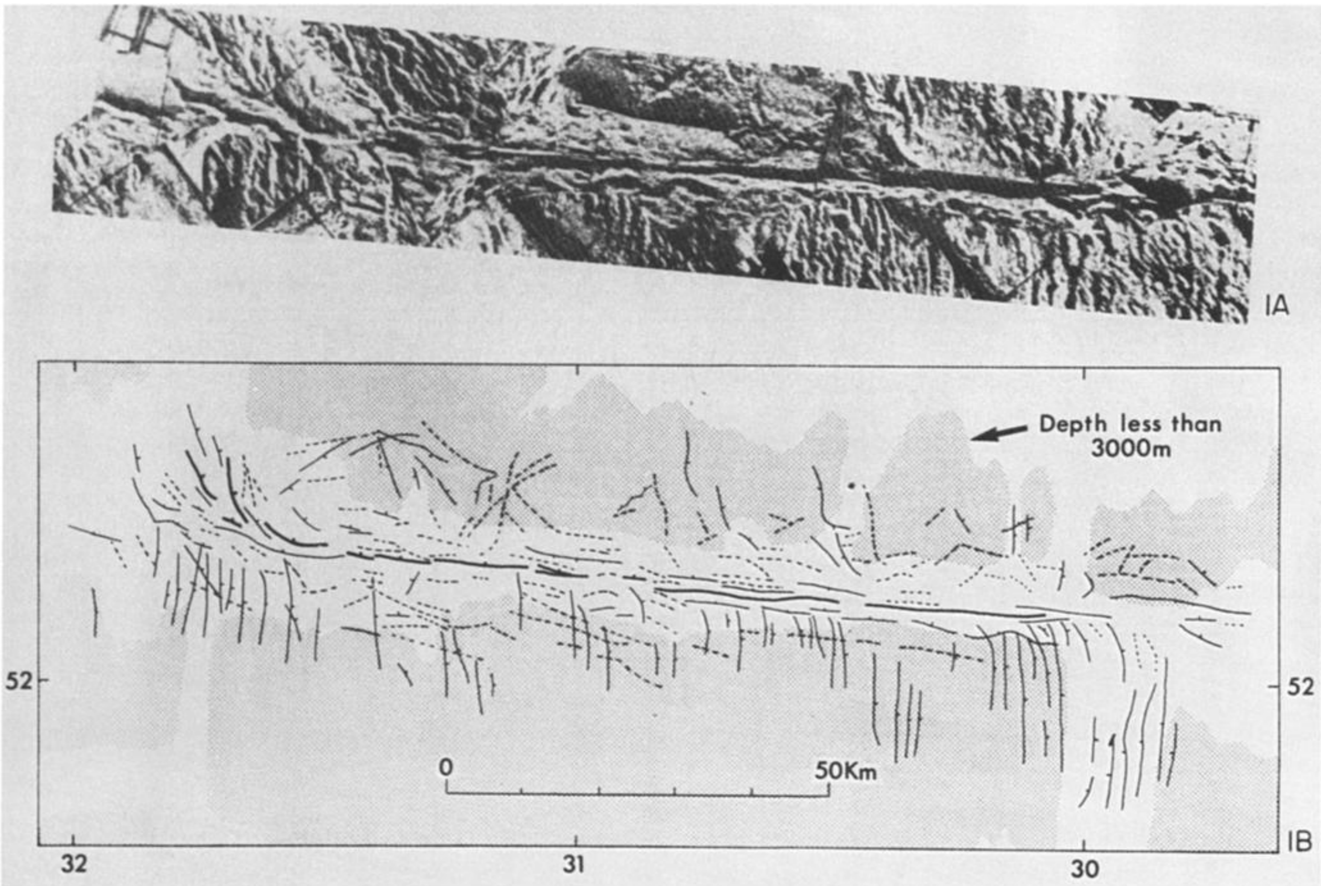

Fig. 3*b*. Section of sonograph mosaic and tectonic interpretation from the southern transform fault (striking essentially east-west in the central part of the image] of the Charlie-Gibbs Fracture Zone in the North Atlantic Ocean. Insonification is from north to south [from *Searle*, 1979].

between any pair of adjacent FZs, but the spacing between FZs is variable along the length of an oceanic rise. Fracture zone spacing increases with spreading rate [*Fox and Gallo*, 1984; *Sandwell*, 1986; *Abbott*, 1986]. Average spacing in the North Atlantic is about 55 km [*Macdonald*, 1986; *Vogt*, 1986]. In regions of complex plate interactions, there are fracture zones which converge toward each other, such as the Mendocino and Blanco FZs bounding the Gorda plate [*Stoddard*, 1987].

A distinctive linear fabric of abyssal hills occurs parallel to the rise crest and normal to the fracture zones (Figures 3*a* and 3*b*). Along the Mid-Atlantic Ridge (MAR), normal faults that dip toward the rift valley develop within 1-5 km of the spreading axis. This faulting creates the inner walls of the rift valley. Adjacent to this in some areas, in a zone 10-20 km wide, occur the relatively flat, faulted terraces, outwardly bounded by the outer wall, the rift mountains, and the abyssal hills [*Macdonald*, 1986]. The major scarps are generally continuous along the 40-60 km length between fracture zones [*Macdonald*, 1986]. The nature of the transformation of the rift valley outer wall into the abyssal hills is a matter of controversy but may involve tilting of the rift valley walls back to a horizontal position [*Verosub and Moores*, 1981], or overprinting by outward dipping normal faults [*Macdonald and Atwater*, 1978], or a combination of both. The presence and wide occurrence of abyssal hills distally from oceanic rises was noted early in the exploration of the ocean floor, and they were used in the definition of morphotectonic provinces [*Heezen et al.*, 1959] which cover up to 80% of the sea floor [*Menard and Mammerickx*, 1967]. Abyssal hills are elongate, oriented generally parallel to regional magnetic anomalies, and normal to fracture zones and possess relief of 40-1000 m and widths of 2-35 km [*Krause and Menard*, 1965]. Sonographs of the Mid-Atlantic Ridge show the linear nature and relatively regular spacing of abyssal hills (Figure 3*c* [*Laughton*, 1981]). R. A. Pockalny et al. (A morphological comparison of abyssal hill topography using high-resolution, multibeam bathymetry data, submitted to *Journal of Geophysical Research*, 1989) reviewed three models for the formation of abyssal hills: (1) the horst and graben model [*Needham and Francheteau*, 1974], where abyssal hills were formed by inward and outward dipping normal faults; (2) the listric fault model [*Harrison and Stieltjes*, 1977], where listric faulting occurs to offset the effects of the inward facing faults of the rift valley walls, rotating crustal blocks and producing hills shaped triangularly in cross section, which result from the rotated half grabens; (3) the episodic magmatism model [*Kappel and Ryan*, 1986; *Pockalny et al.*, 1987; *Barone and Ryan*, 1988], where abyssal hill topography is generated by the interplay between episodic magmatism and extensional tectonism.

Recent work (R. A. Pockalny et al., submitted manuscript, 1989; P. J. Fox, personal communication, 1989) has shown that the spacing of abyssal hills is inversely related to spreading rate. Slow spreading ridges (<30 mm/yr) have relatively high abyssal hills (about 200 m) and an average