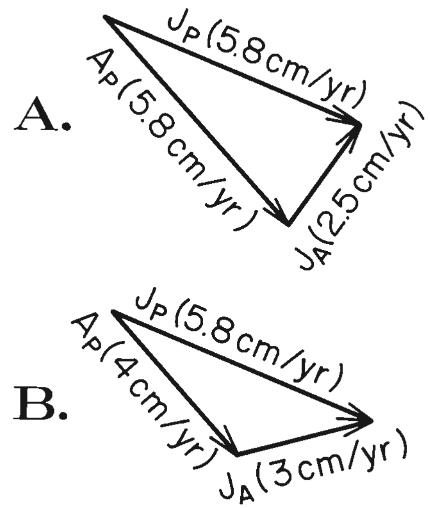

Figure 45-11
Vector diagrams for deducing relative motion between the Juan de Fuca and North American plates. Curved line shows trend of North American coast line. In both cases, the motion of the Juan de Fuca plate with respect to the Pacific plate (J_P) is assumed to be 5.8 cm/yr parallel to the Blanco fracture zone. A, The motion of the North American with respect to the Pacific plate (A_P) is assumed to be 5.8 cm/yr parallel to the San Andreas fault. The resultant motion of the Juan de Fuca with respect to the North American plate (J_A) is seen to be a compression in a north-northeast direction of 2.5 cm/yr. B, If the North American-Pacific rate of motion is assumed to be 4 cm/yr, then the Juan de Fuca-American motion (J_A) is seen to be an eastward compression of 3 cm/yr

plate remained to the north and continued to move eastward from the Pacific plate. Even though the spreading rate and direction changed (Vine, 1966; Menard and Atwater, 1968), and the manner by which the present spreading configuration evolved from the previous one is not understood, the Juan de Fuca plate is clearly a direct descendent of the Farallon plate. The fact that the anomaly sequence is complete just north of the Mendocino fracture zone and is very nearly complete

The direction of spreading changed at the Juan de Fuca ridge between 7 and 4 m.y. ago. This may be related to the onset of motion in the model of changing motions. However, it can be as easily explained using the model of constant motions by noting that the Farallon plate was steadily diminishing in size. Perhaps about 7 m.y. ago, it became too small to maintain its motion, and so it became partially coupled to the American plate.

Evidence from the Sea Floor off Central California

Figure 45–12 shows the magnetic anomalies west of central California. The complicated broken geometry and the slowing of the spreading rate may be interpreted as an indication that the Farallon plate broke up about 32 m.y. ago, as the ridge neared the trench and this part of the plate became very narrow (McKenzie and Morgan, 1969; Atwater and Menard, 1970). If this is correct, the broken pattern indicates that some part of the continent was nearby. Further support for this conclusion comes from Deep Sea Drilling Project operations off San Francisco. Late Miocene abyssal fan deposits were recovered near the bottom of the section (more than 400 km from the coast; see McManus and Burns, 1969), indicating that the continent was nearby and that the trench had been destroyed or overfilled before this time.

These lines of evidence support plate models in which North America either was moving approximately parallel to its own coastline or was fixed with respect to the Pacific for the last 30 m.y. In such models, the ages of near-coast anomalies of Figure 45–3 represent the actual times of the ridge-trench collisions. Both models presented above are of this type.

Evidence from the Aleutian Abyssal Plain and Island Arc

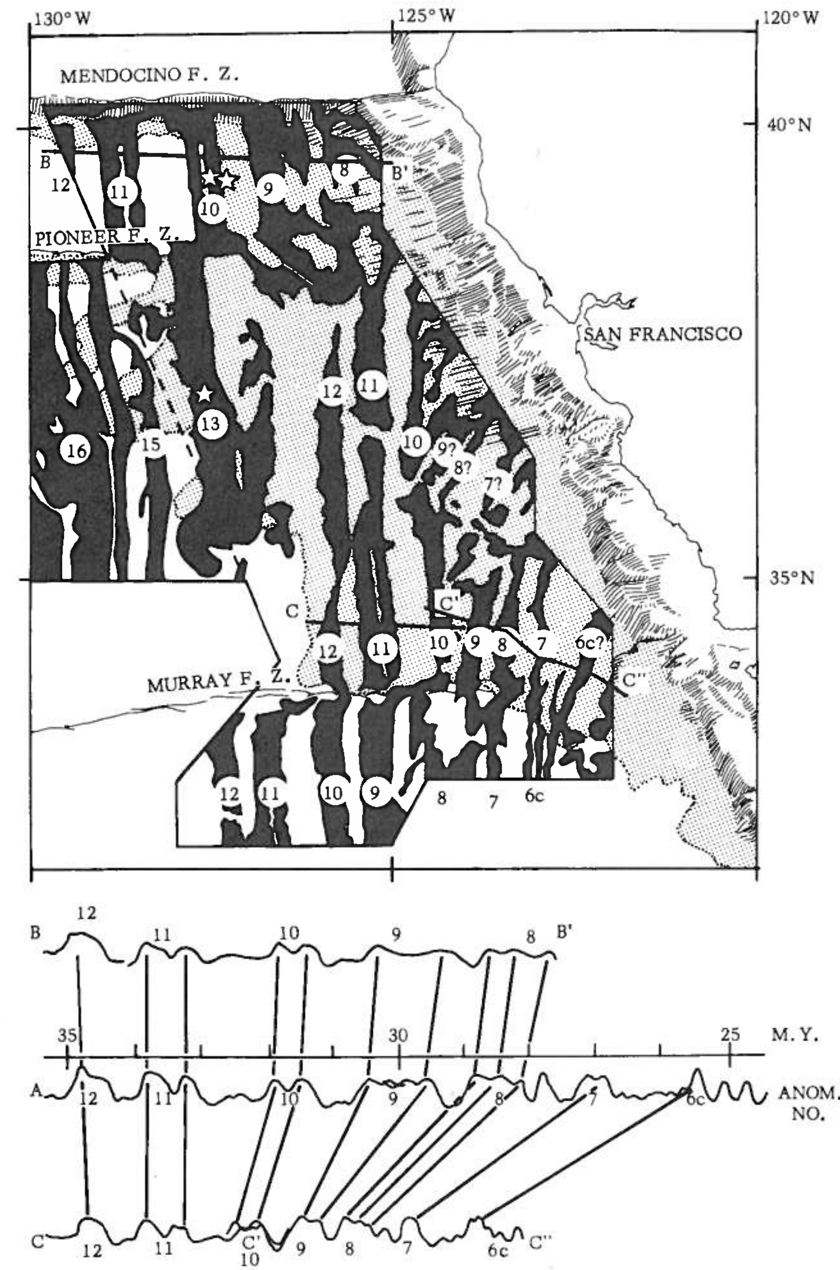

Figure 45-12
Magnetic anomalies and sedimentation off central California. Positive magnetic anomalies are shown in black (after Mason and Raff, 1961; Bassinger et al., 1969. Distribution of fan deposits (gray) and topographic features are from Menard (1964; physiographic diagram). White stars show locations of Deep Sea Drilling holes 32 (southern star), 33 and 34 which bottomed in late Miocene fan deposits. Magnetic