therefore that the competition coefficients should be treated cautiously but need not be rejected. The conclusions about niche breadth were not, as Minot states, derived from the competition coefficients, but inferred from the results in my Table 1, and only refer to the breeding season. I did not imply that, at other times of the year, this situation holds.

In the second part of his criticism Minot concludes that, because BT breeding numbers vary less than GT numbers, there could be a contribution of the relative proportion of each species to relative competitive ability. This may be so at high combined densities, but using only the data where the variance of the two species is not different (my low combined density years, upper line in Fig. 1) my conclusion is not affected.

I am grateful to Minot for pointing out the difficulty of this type of a posteriori data analysis. I think that critical field experiments designed to test hypotheses will contribute more to our understanding of this problem than further manipulation of the data. The first results from such experiments[4,5] show that outside the breeding season great and blue tit also compete strongly, but that the situation is reversed and that the blue tit is more affected by it than the great tit.

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Cordilleran Benioff Zones

CONEY AND REYNOLDS[1] have interpreted the radiometrically dated igneous rock pattern in the southwestern boundary of North America in terms of the evolution of a convergent plate margin. They conclude that the pattern reflects a progressive decreasing of the Benioff Zone dip angle from about 130–110 Myr to about 55–40 Myr ago and a rapid increasing of dip from about 40 to 15 Myr. Because of these changes in dip, the magmatic arc zone was displaced about 1,000 km inboard from the convergent margin until 55–40 Myr, then swept it back towards the trench by about 20 Myr. The width of this magmatic zone also changes as a function of the dip angle, from narrow at steep angles to very wide at low angles. Although the data seem to be consistent in supporting their interpretation, another interpretation based on the application of the same plate tectonic scheme[2–5] used by Concy and Reynolds can be proposed.

According to the model of Dickinson and Hatherton[2–5], the surface arc magmatism occurs above the zone in which the descending plate intersects the low-velocity layer of the upper mantle. This zone extends from a depth of about 100≤ 300 km. By extrapolating this concept to the earlier stages of development of a magmatic arc, it can be expected that the width of the surface manifestation zone increases as the descending plate reaches greater depths within the low-velocity layer. When the plate reaches the 300 km-limit, if no changes in dip occur, the width of the magmatic arc zone remains nearly constant, until the subduction process ends and the geometry changes. In respect of the zone between 0 and 100 km depth, called the zone of shallow earthquakes, the dip can be different compared to the dip in the low-velocity zone as a consequence of the differences in properties and factors which control the plate interactions in the margin. Thus we can expect two dip angle zones[6], which have been recognised in several parts[2–6] and different dip changes in time. At the earlier stages the dip is steep and decreases as the margin evolves until the subduction process finishes or the geometry changes.

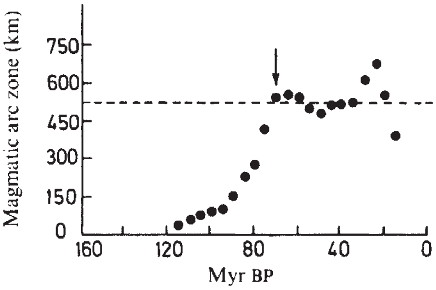

Fig. 1 Growth of the magmatic arc zone. The time when the descending plate approximately reached the 300 km limit of the low-velocity layer is indicated by the arrow.

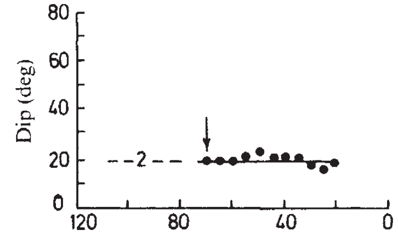

Fig. 2 Magmatic production zone dip angle as a function of time beneath southwestern North America.

By examining the data of Coney and Reynolds, we find that the width of the magmatic zone increases from about 130 to about 70 Myr and remains nearly constant between 70 and 20 Myr with certain changes from 30 to 20 Myr (Fig. 1). By using a limits of 100 to 300 km for the low-velocity layer and the width of the magmatic arc zone, we can calculate the magmatic production zone dip angle, which is nearly constant from 70 to 20 Myr (Fig. 2). In respect of the zone of shallow earthquakes, the dip angle in this zone experiencies a progressive flattening from 130 to about 70–60 Myr, remains constant between 70–60 and 30 Myr, followed by a rapid steepening from 30 to 15 Myr (Fig. 3).

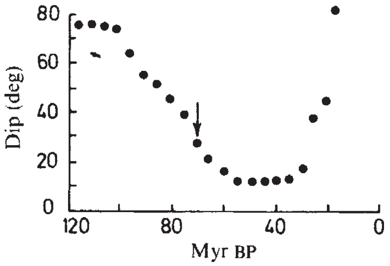

Fig. 3 Shallow earthquakes zone dip angle as a function of time beneath southwestern North America.

The subduction rate during the earlier stages of development can be easily estimated from Fig. 1. The rate increases from 130 to 70 Myr. The changes in the interval between 30 and 20 Myr could represent the evolution of the Kula-Farallon triple junction as suggested in the reconstruction of Atwater[7]. Thus, these changes can be explained as the result of cessation of subduction caused by the change in plates geometry.

It is expected that the model sketched here represents a more reliable approach to understanding the evolution of the southwestern margin of North America. The qualitative aspects of this model were already included in a work under preparation which includes studies of the metallogeny zoning in northwestern Mexico and the evolution of Baja California peninsula. Further details of the present discussion will also be reported elsewhere.

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