1989) and Miocene-Pliocene deposits in southwestern Washington. The limestones of late middle to late Eocene age in southwestern Washington, therefore, contain the earliest examples to date of subduction-related communities.

The exact depth of water in which the Humptulips, Bear River, and Menlo limestones formed is uncertain. All the identifiable molluscan genera are extant, but their depth ranges are very broad. Except for *Calyptogena* and *Thyasira*, they range from intertidal or nearshore to about 3300 m (Keen and Coan, 1974; Okutani, 1974). The depth range of *Calyptogena* is 500 to 6000 m (Keen and Coan, 1974; Ohta and Laubier, 1987), and the depth range for *Thyasira* is 5 to 9100 m (Keen and Coan, 1974; Okutani, 1974). The siliceous sponge *Aphrocallistes* is extant, and its depth range is 28 to 2700 m (Rigby and Jenkins, 1983; Carey et al., 1990).

Benthic foraminifera from the Humptulips Formation indicate that deposition took place in bathyal depths (150 to 2500 m) (Rau, 1986). Benthic foraminifera from a siltstone within the Bear River deposit include the following extant genera: *Uvigerina*, *Gyroidina*, *Pullenia*, *Eponides*, *Bulimina*, *Nonion*, *Cibicides*, and *Lenticulina*. All range from shelf to bathyal depths except *Nonion*, which is primarily from shelf depths (Murray, 1973).

On the basis of (1) the modern-day depth ranges of the macrofauna and benthic foraminifera and (2) the fact that subduction is a relatively deep-water phenomenon, it is likely that the ancient Washington communities formed in bathyal depths around 500 to 2000 m and most certainly above the calcite compensation depth (CCD). The Pacific Ocean CCD was about 3200 m during most of the late Eocene, and it lowered to about 3400 m at the close of the Eocene, when cold water entered into the abyssal ocean (van Andel et al., 1975).

CONCLUSIONS

The regional subduction-zone setting, the petroliferous lime mud surrounding in situ fossils, and the high numbers of fossils whose modern congeners are known from chemosynthetic communities associated with subduction zones clearly indicate that the three localized limestones of late middle to late Eocene age in southwestern Washington formed in the same way that bivalve- and tube worm–rich carbonate sediments are forming today in the subduction zone off the coast of Oregon. On the basis of depth ranges of extant genera in the fossiliferous deposits and CCD considerations, the depth of water in which the communities lived was probably between 500 and 2000 m. These Eocene assemblages are the earliest examples of subduction-zone–related communities known anywhere in the world.

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