basin south of the Wichita Mountains (1,200–1,400 m.y.).

The seismic character of the sedimentary rocks of the Anadarko Basin deteriorates close to the Wichita Mountain front, owing probably to wave propagation through Pennsylvanian-age granite wash, known to be a poor transmitter of seismic energy. The sedimentary rocks are inferred to extend deeply beneath the hanging wall of the Mountain View Fault (figs. 27, 28, 29), on the basis of reflections under the Lone Star well, which appear to step down to the south. These step-downs are interpreted as due to normal faults, which, on the basis of offsets in sedimentary reflectors, may have been active into Arbuckle Group time. There is little evidence for such faulting in the Arbuckle Group in places where it is exposed or has been drilled (R. E. Denison, personal communication, 1981). However, in the COCORP data, these inferred normal faults appear to be restricted to the deepest part of the Anadarko Basin, and possibly rocks from these regions have not been adequately sampled.

Anticlines occur higher in the sedimentary section (for example, Cordell Anticline). From seismic relationships, these are interpreted to be hanging-wall anticlines cored by listric thrust faults (figs. 28, 29; Brewer and others, 1982). These thrusts probably root in the Frontal Fault system and represent the response of the sedimentary layered rocks of the Anadarko Basin to crustal shortening and uplift of the crystalline rocks of the Wichita Uplift. This interpretation of these anticlines contrasts with earlier ideas of vertical or strike-slip movements along high-angle faults.

DISCUSSION: TIMING AND ORIENTATION OF PENNSYLVANIAN DEFORMATION

Structures of Pennsylvanian age along the Wichita trend are highly complex and are frequently cited as examples of left-lateral wrenching (for example, Groshong and Rodgers, 1978).

Uplift of the Arbuckle Mountains, which climaxed in early Virgilian time (Tomlinson and McBee, 1962), is usually interpreted as due to wrenching (Wickham, 1978; see Booth, 1981, for references), although Brown (1982) has shown that some structures might be equally consistent with folds and reverse faults that were formed possibly under lateral compression. The COCORP data suggest that movements on the Mountain View Fault and the listric thrust underlying the Cordell Anticline occurred mainly by the end of Atoka time, and the moderate dip and extent to depth of this fault are consistent with lateral compression normal to the Wichita trend at these times (R. E. Denison, personal communication, 1981). In this case, any later wrenching along the Wichita trend was probably along the fault trends established by earlier thrusting. A test of this hypothesis is the timing of faults along the south side of the Wichita Mountains (Burch, Waurika–Muenster trend); these faults have a sense of slip and *en-echelon* pattern consistent with left-lateral wrenching. They should be mainly Virgilian in age, and paleogeographic maps (Tomlinson and McBee, 1962) indicate that whereas some deformation along this trend occurred in Atoka time, it was most pronounced in Virgilian–Missourian time. Although this timing is reasonably consistent with earlier overthrusting followed by later wrenching, the COCORP data might be equally consistent with oblique slip (combined wrenching and thrusting) in both pre–end of Atokan and Virgilian times.

CONCLUSIONS

These interpretations of the COCORP data imply that present structures in southern Oklahoma reflect severe crustal shortening during the final stages of evolution of the aulacogen. The aulacogen has passed through a cycle of deformation in which an ancient fault trend was reactivated, first owing to crustal extension and then to crustal shortening; thus it evolved in a manner similar to aulacogens described from the Russian and Siberian Platforms (Milanovsky, 1981). These results, while not disproving the crustal updoming and radial-rifting origin of aulacogens proposed by Burke and Dewey (1973), raise the possibility that the aulacogen might have started by reactivation of the ancient fault trend under some alternative tectonic scheme.

These seismic data have started to reveal some of the fascinating details of the complex structural evolution of southern Oklahoma, yet they give little information on the equally fascinating igneous rocks that are exposed in the Wichita Mountains. Only by integrating surface and well studies with seismic and other geophysical evidence will the evolution of the basement rocks and their sedimentary cover be fully understood.

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