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DETRITAL MODES OF UPPER PALEOZOIC SANDSTONES DERIVED FROM ANTLER OROGEN IN NEVADA: IMPLICATIONS FOR NATURE OF ANTLER OROGENY

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ABSTRACT. *The composition and stratigraphic relations of sandstones and associated conglomerates derived from erosion of the Antler orogenic belt in central Nevada provide constraints for plate tectonic models of the mid-Paleozoic Antler orogeny. Clastic detritus in the following sedimentary assemblages was derived mainly from provenance terranes within the strongly deformed Roberts Mountains allochthon, which was the principal structural element of the Antler orogen: (A) the Antler foreland succession, largely of Mississippian age, deposited in an elongate foreland basin that lay east of the Roberts Mountains thrust front; (B) the Antler overlap sequence, of Mississippian to Permian age, deposited atop the Roberts Mountains allochthon after erosion and subsidence had reduced the elevation of the Antler highlands; and (C) the Havallah oceanic terrane, of Mississippian to Permian age, deposited within an ocean basin that lay west of and adjacent to the Antler orogen. Characteristic sandstones are chert-rich lithic and quartzose types low in feldspar and volcanic rock fragments; chert and quartzite clasts predominate in conglomerates. Inferred source rocks were chiefly chert-argillite sequences, quartzose turbidites, and minor greenstones thought to be of oceanic origin.*

The Roberts Mountains allochthon was probably the subduction complex or accretionary prism of an intra-oceanic Antler arc-trench system that faced east, with subduction downward to the west. Its emplacement by thrusting over the Cordilleran miogeoclinal terrane of lower Paleozoic strata occurred in earliest Mississippian time during an inferred arc-continent collision that began in latest Devonian time and is termed the Antler orogeny. The Mississippian foreland basin formed by down-flexure of the surface of the subducted continental block under the tectonic load of the allochthon and the sediment load of debris derived from the allochthon. Pre-collision backarc spreading behind the presently buried Antler arc apparently continued after arc accretion as post-collision sea-floor spreading, which generated the ocean basin west of the Antler orogen where the Hallavah sequence developed. The Hallavah sequence was later deformed into the Golconda allochthon, which was emplaced tectonically above the Antler belt in Early Triassic time during another inferred arc-continent collision termed the Sonoma orogeny.

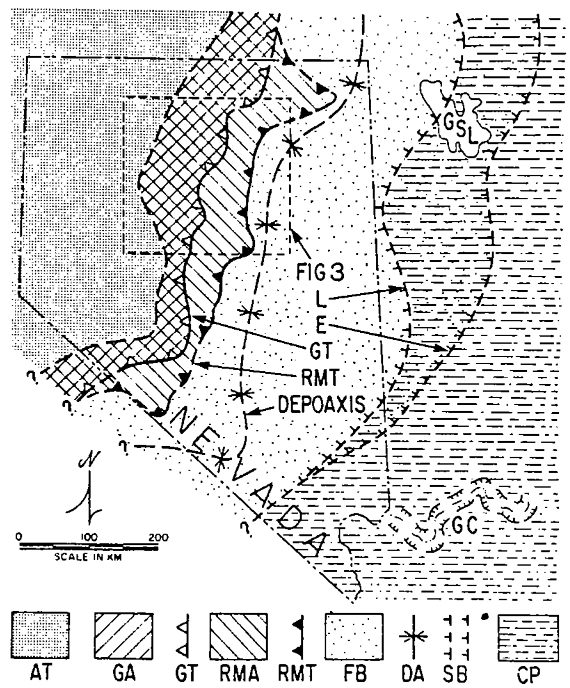

Fig. 1. Outline map of Nevada and adjoining areas showing tectonic and depositional features related to Antler orogeny; key to symbols: AT: Composite arc terrane (Sonomia of Speed, 1979) accreted to continental margin during Mesozoic time; GA: Golconda allochthon (inferred original extent before erosion) of Permo-Triassic Sonoma orogeny; GT: Golconda thrust front of Early Triassic age; RMA: Roberts Mountains allochthon (inferred original extent before erosion) of Devonian-Mississippian Antler orogeny; RMT: Roberts Mountains thrust front of earliest Mississippian age; FB: Antler foreland basin of Mississippian age; DA: Approximate depoaxis of Antler foreland basin (after Poole, 1974); SB: Early (E) and Late (L) Mississippian carbonate shelf breaks marking eastern flank of Antler foreland basin (after Rose, 1976); CP: Mississippian carbonate platform fringing the interior craton. Great Salt Lake (GSL) and Grand Canyon (GC) shown in present locations for orientation only.

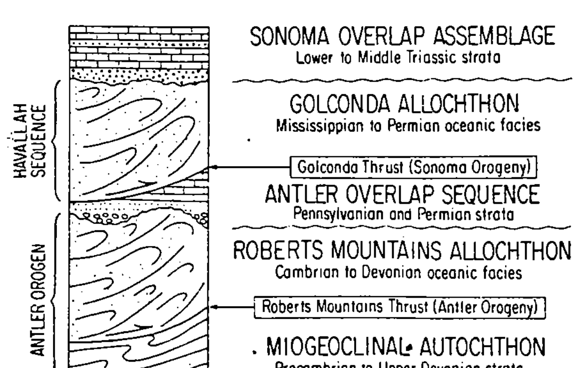

Fig. 7. Diagram showing structural position of Havallah sequence above eroded Antler orogen in central Nevada. Lower Mississippian strata are locally incorporated into and overridden by leading edge of Roberts Mountains allochthon (Johnson and Pendergast, 1981), and Upper Mississippian strata are present locally as part of Antler overlap sequence.

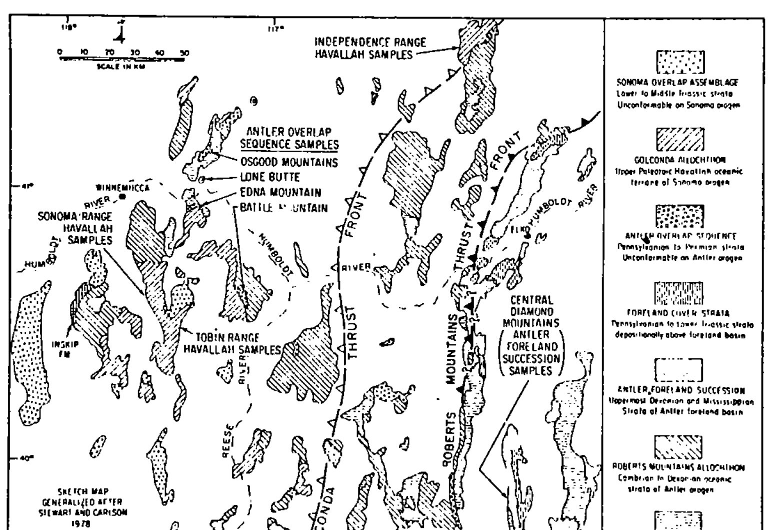

Fig. 3. Distribution of major outcrops of tectonic assemblages related to Antler and Sonoma orogenies in north-central Nevada; see figure 1 for location of map area; see text for discussion of Inskip Formation, a Devonian and/or Mississippian trench-slope basin (?) deposit. Tables 1 and 3 and figure 4 show compositions of sandstones and conglomerates sampled from places indicated within Antler foreland succession, Antler overlap sequence, and Havallah oceanic terrane. Adapted from Stewart and Carlson (1976, 1978). Stratigraphic relations are especially complex in the region southwest of Elko (for example, Johnson and Pendergast, 1981; Ketner and Smith, 1982), where the Roberts Mountains thrust front is queried.

TABLE 2

Detrital modes of Antler-derived sandstone suites

Suites	N	Qt	F	L	Qm	F	Lt	Qp	Lv	Ls
				A. Antler Foreland Succession*						
Submarine fan and slope facies (Chainman Shale)	8	72	3	25	49	3	48	49	1	50
Coarse delta-slope facies (transitional strata)	4	71	3	26	38	3	59	54	2	44
Delta-front and delta-plain facies (Diamond Peak Formation)	6	75	0	25	51	0	49	49	0	51
Overall mean (± SD)	18	73 ± 7	2 ± 3	25 ± 8	47 ± 14	2 ± 3	51 ± 14	50 ± 10	1 ± 1	49 ± 10
				B. Antler Overlap Sequence**						
Lower strata (basal 40m) at Battle Mountain	4	60 ± 10	5 ± 1	35 ± 10	47 ± 10	6 ± 1	47 ± 10	27 ± 8	28 ± 12	45 ± 5
Upper strata (other 200m) at Battle Mountain	7	73 ± 6	1 ± 1	26 ± 6	44 ± 11	1 ± 1	56 ± 11	55 ± 8	2 ± 2	43 ± 8
Edna Mountain section	1	89	0	11	52	0	48	77	0	23
Lone Butte section	1	70	0	30	20	0	80	62	0	38
Osgood Mountains section	1	95	0	5	29	0	71	93	0	7
				C. Havallah Oceanic Terrane***						
Mature quartzose sandstones	2	100	0	0	90	0	10	100	0	0
Chert-rich quartzose sandstones	2	88	0	12	76	0	24	48	0	52
Feldspar-bearing lithic sandstones	2	74	8	18	53	8	39	54	27	19
Chert-rich lithic sandstones	1	62	0	38	20	0	80	52	0	48
Sandy calcarenite turbidites	3	(quartz grains — 36; chert grains — 22; limeclasts — 42)								

* Samples from central Diamond Mountains collected and counted by D. W. Harbaugh (Harbaugh, 1980).
** Samples from Battle Formation collected and counted by A. H. Saller (Saller, 1980).
*** Samples from Sonoma, Tobin, and Independence Ranges collected by W. S. Snyder and counted by P. L. Heller.

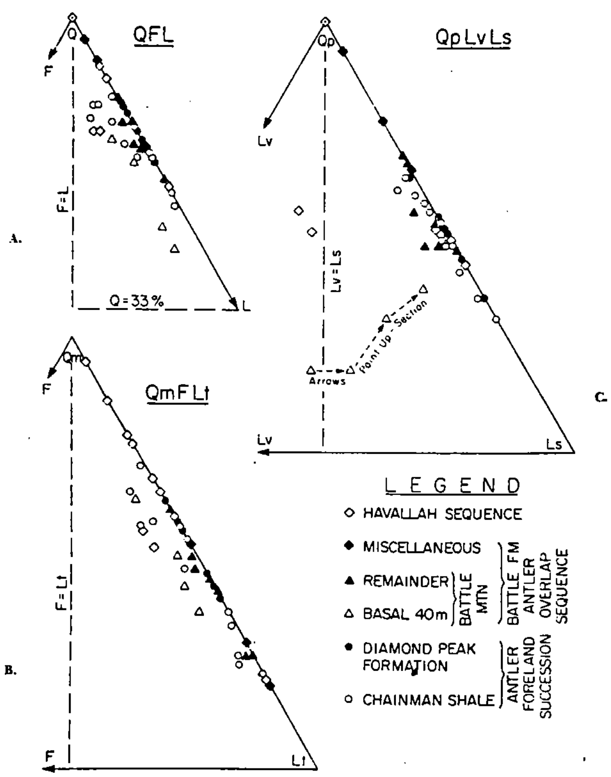

Fig. 4. Triangular diagrams showing detrital modes of Antler-derived sandstones in central Nevada: (A) QFL, upper left; (B) QmFLt, lower left; (C) QpLvLs, upper right. See figure 3 for collecting localities, table 1 for definition of grain types plotted, and table 2 for calculated mean detrital modes.

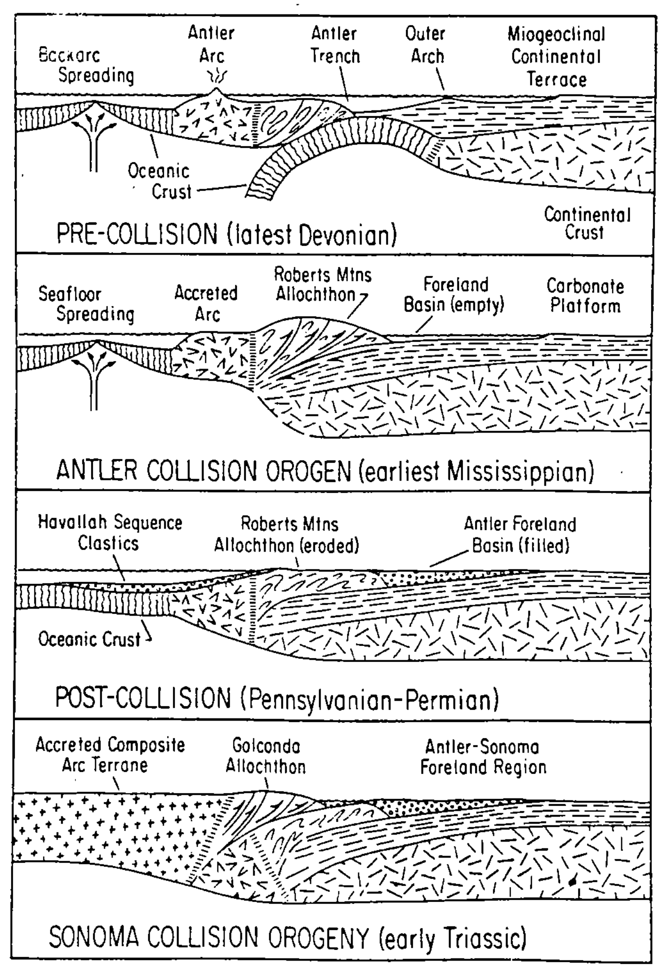

Fig. 8. Schematic diagrams showing inferred sequence of tectonic events in central Nevada during and after mid-Paleozoic Antler orogeny. Vertical exaggeration 4X-5X.