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**Upper Paleozoic Tectonostratigraphic Framework for the Western Margin of North  
America**

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## **Introduction**

The late Paleozoic continental margin of western North America is characterized by a succession of tectonically-controlled sedimentary basins. Unconformities that separate genetically related stratigraphic successions provide the key for understanding this upper Paleozoic lithotectonic history (Fig. 1). These packages of rock represent regional depositional packages created by a combination of eustatic and tectonic influences. The result is regional, and relatively long-lived, depositional systems composed of widely varied lithofacies. These depositional systems are conceptually similar to systems tracts, but much larger in scale. Evidence for the tectonic origin of these unconformities varies widely - even for the same unconformity. Where subjacent strata are deformed by folds and thrust faults, the tectonic origin is obvious. Other unconformities are marked by only slightly angular, and some are disconformities that can only be detected by detailed biostratigraphic data. More subtle evidence may come from superjacent strata that reflect changes in provenance of clastic detritus or paleocurrent directions. Classic lithostratigraphy and low resolution biostratigraphy are insufficient to identify these discrete successions.

The repeated creation and destruction of these basins indicates that the continental margin was tectonically active throughout the upper Paleozoic, and that it did not return to a "passive" state between the Antler and Sonoma orogenies as is commonly believed. Implications for this revised tectonic framework include: 1) we must now reassess the regional extent of Mesozoic deformation, for which some of the upper Paleozoic deformation has been mistaken, (2) similarly the Antler deformation should be reassessed because this younger deformation overprints and may mimic Antler structures, and (3) this upper Paleozoic deformation must be integrated into tectonic models for the western U.S. during the time interval for the classic "Ancestral Rockies orogeny".

## **Background**

The primary focus of this paper is on the upper Paleozoic of eastern and southern Nevada - the "Antler foreland". To the east and southeast of this region, the classic Ancestral Rocky Mountain uplifts and basins were developed in the craton and eastern miogeocline. In contrast to the Ancestral Rocky tectonism, it is generally thought that tectonic quiescence resumed along the continental margin. Following the Antler orogeny little happened until the latest Permian-Early Triassic Sonoma orogeny, except for local uplifts within the Antler orogenic. For example, the Pennsylvanian continental margin succession have been modeled platform carbonates recording only mild

deformation. The Sonoma orogeny is generally thought to mark the end of the upper Paleozoic tectonic quiet, and the initiation of the prolonged period of terrane accretion to western North America during the Mesozoic and early Cenozoic.

In contrast to the classic models, and as emphasized here and in some previous studies, tectonism along this continental margin continued throughout the upper Paleozoic, not only within the Antler Highlands, but in the Antler foreland as well. Evidence includes angular unconformities throughout the section, widely varying thicknesses of strata, and abundant coarse clastic units that were derived from uplifted and eroded Antler foreland strata, i.e., second- and third-cycle clastic sediments derived originally from the allochthon. The style of tectonism is one of complex segmentation of the foreland, ongoing deformation, local basin formation, and at least one episode of folding and thrust faulting.

### **Unconformity-based Stratigraphic Framework**

In general, the upper Paleozoic stratigraphy of the western US varies highly both along the strike of the continental margin and across the margin from foreland to craton. Both spatial and temporal variation record tectonic activity that created uplifts and basins along the western continental margin. These evolved through time. Although each tectonic event was unique both in style and in area of effect, each one sent a signal that can be read regionally. In addition, important eustatic sea-level changes affected the entire region, but in different ways in different places. Most of these are unconformities are regional in scale (Fig. 1), but local tectonic subsidence may locally produce a record of continuous sedimentation across the boundaries.

We have attempted to include many of the widely used stratigraphic names, in some cases these names have never been formally defined but are nonetheless broadly used. We have not tried to make a distinction between units that have or have not met Stratigraphic Code criteria for Formation status. We also made no attempt to catalog all stratigraphic names used in the region. We do, however, propose what we believe to be the least confusing uses of the most common names. As a guiding principle, we adhere to local definitions and descriptions wherever possible. The names of the basin in Figure 1 are not the key issue because these change depending on specific geographic location; the key is to identify the regional unconformities which bound stratigraphic successions. Thus, the basin names on Figure 1 only reflect those proposed for the western margin of North America.

The C1-C2 succession is the classic Antler Foreland Basin fill. It is comprised of the deeper-water turbidites and related sediments that were shed eastward from the young Antler highlands. This basin reflects the flexural loading from the emplacement of the Roberts Mountain allochthon during the Late Devonian-Early Mississippian.

A distinct phase of deformation preceded the C2 boundary which defines the base of the Antler Successor Basin. This basin, in contrast to the deeper water succession of the Antler Foreland Basin, filled with marginal and shallow marine strata.

The stratigraphic succession(s) of the classic Ely and related basins comprise the C3 to C5 interval. These are characteristically cyclic carbonates deposited in a shelf to ramp setting. The cycles reflect eustatic sea level fluctuations. The C4 unconformity is not fully documented, and may reflect either a minor phase of regional deformation or be entirely local in extent.

The C5-C6 succession is a problematic in that it has typically been considered as part of the Ely Basin fill. However, recent work has underscored the importance of distinguishing the Hogan Basin from that of the underlying Ely. Sweet and Snyder (this volume) provide a summary of the importance. Basically, everywhere the Hogan Formation is recognized as a lithostratigraphic unit, it is a fine-grained mixed siliciclastic-carbonate unit. The unconformity between the Hogan and subjacent Ely marks a sudden change from relatively shallow-water, open carbonate platform or ramp depositional setting to a deeper-water, basinal setting. Locally, the uppermost part of the Ely is deformed by thrust faults and folds.

Similar to the Ely Basin, the C6-P1-P2 stratigraphic interval is comprised of two distinct successions, separated by unconformities that are locally angular. We informally refer to these as the lower and upper Strathearn successions. In Carlin Canyon the Missourian lower Strathearn rests on highly deformed Ely strata as young as Atokan. The entire Hogan succession (C5-C6) is missing in Carlin Canyon, so we do not know if the sub-Strathern deformation there is pre-Hogan as it is in the central Pequop Mountains (see Sweet and Snyder, this volume).

During P2 to P4 interval, a series of deeper water basins and associated highs developed along the continental margin from Idaho to the Mojave Desert region (e.g., Wood River, Cassia, Ferguson, Dry Mountain, and basins in Death Valley). A shallow-marine carbonate shelf occupied the region between or east of these basins, although some areas were locally emergent (i.e., the Deep Creek-Tintic uplift). The Oquirrh basin apparently ceased active subsidence and was passively filled during late Wolfcampian.

The Phosphoria basin of the P4-Tr1 interval developed in late Leonardian time and persisted through the Wordian. It is widespread and apparently represents overlap of may of the Early Permian tectonic basins. The Phosphoria strata are unconformably bounded by a major middle Leonardian unconformity at the base and a widely recognized unconformity at the top. This basin was comprised of several depocenters, and at least two marine transgressions are recorded in the Phosphoria stratigraphic succession. Although the specific origin of the Phosphoria basin is still debated, it is clearly a tectonic basin.

## TECTONOSTRATIGRAPHIC BASINS OF NORTHEASTERN & EAST-CENTRAL NEVADA

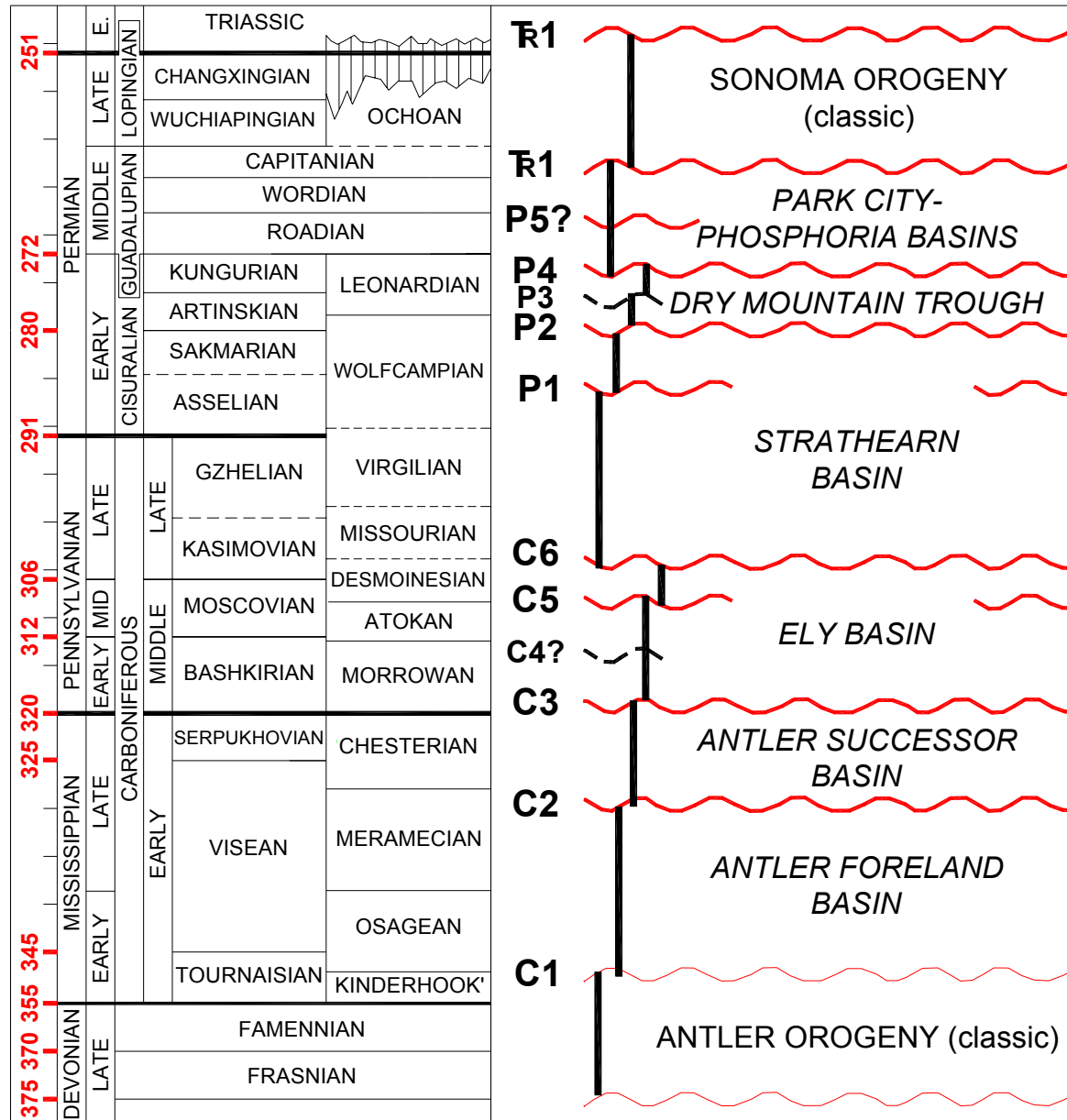


Figure 1.