Haven Dolomite enables a more refined paleogeographic interpretation to be made at this time.

The Fish Haven Dolomite (260 m or 800 ft, average thickness) of central Idaho is composed of 16 different carbonate facies which can be grouped into three sequences; facies within each sequence are depositionally related. The basal sequence is a blanket deposit composed of normal marine, shallow to deep subtidal, bioclastic dolowackestones. The western sequence, aerially restricted, occurring above the basal sequence, is composed of laminated dolomudstones and intraclastic dolorudstones of oxygen-poor, deep subtidal conditions. The eastern sequence, forming the bulk of the formation and overlying the basal sequence, is lithologically variable. It is dominated by normal marine, deep to shallow subtidal, bioturbated, bioclastic dolowackestones and oncolitic dolorudstones and capped by cross-bedded dolograinstones.

Overall, the facies and sequences indicate that a carbonate ramp formed in central Idaho outboard of the craton and a hinge zone, within a subsiding area of the miogeocline. Shallow subtidal ramp deposits were probably deposited in approximately 30 m (100 ft), or less, of water depth. Deep subtidal, laminated ramp deposits were probably deposited in approximately 100 to 60 m (300 to 200 ft) of water depth. During this time interval, open ocean, anoxic bottom waters extended up into deep subtidal regions (60 m or 200 ft).

The outermost part of the ramp deepened upward as indicated by western over basal sequence. This portion of the ramp was also subject to downslope movement of outer ramp deposits. The remainder of the ramp, its central to inner parts, shallowed upward as indicated by eastern over basal sequence. The shallowing-upward and deepening-upward cycles were approximately coeval events along the ramp.

This information indicates that the Late Ordovician carbonate ramp underwent backstepping at its outermost portion resulting in drowning of the western ramp, and eventual migration of transitional facies deposits (Roberts Mountains Formation) over miogeoclinal deposits. Simultaneously, the remainder of the ramp shallowed-upward into shoals and beach deposits. Starved basin conditions existed in the eugeocline as only 22 m (70 ft) of the argillaceous Phi Kappa Formation was deposited. Tectonics played an active part in the deposition of the Fish Haven Dolomite in the miogeocline of central Idaho. The ultimate cause of the tectonism is not known at this time, but could be related to changes in the rate of sea-floor spreading, active structures within the continental margin, proximity of the Ordovician Klamath Mountains island arc Terrane, or unknown processes.

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Permian and Triassic Paleogeography of the Eastern Klamath Arc and Eastern Hayfork Subduction Complex, Klamath Mountains, California: Evidence from Lithotectonic Associations and Detrital Zircon

Middle Permian and Middle Triassic volcanic-hypabyssal intrusive complexes form ensimatic arc deposits in the eastern Klamath terrane. Sedimentary matrix melange with blocks of sandstone, chert, and Tethyan fauna-bearing limestone compose the westward-lying eastern Hayfork terrane. Limestone olistoliths were derived from seamounts and incorporated into a subduction complex that was active during the Late Triassic and perhaps as early as the Permian. Geologic and biogeographic relations have previously been interpreted to imply a genetic relation between an ensimatic arc and subduction complex, constraining Permian(?)–Triassic subduction as eastward dipping.

Quartzarenite from the melange matrix was derived from a mature continental source and yielded detrital zircon for isotopic provenance study. Homogeneous dark pink to ruby red, very well-rounded zircons confirm well-mixed continental provenance, and were difficult to subdivide into color and morphology fractions of possible age significance. Nevertheless, nine multi-grain fractions were sorted and some dispersion of ages was achieved. $^{207}Pb/^{206}Pb$ ages cluster between 2.046 and 2.139 Ga, and generally correlate to slight changes in color. Such ages suggest, but do not require, a North American source. Based on quartz and zircon provenance, neither the zircon nor the quartz arenite was directly derived from older units in the Klamath Mountains. These data imply that the trench intersected a continental source along strike, and quartz sands were transported longitudinally within the trench.

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Segmentation and Thrusting Along the Offshore Newport-Inglewood–Rose Canyon Zone of Deformation

The offshore Newport-Inglewood–Rose Canyon (NI-RC) zone of deformation is a 106-km-long, linear zone of folds and faults that extend from Newport Beach to La Jolla. It is typically a positive flower structure that becomes more complex in its northern part. Since its conception in the middle Miocene, there has been over 4 km of right-lateral displacement and up to 1 km of vertical movement.

Using seismicity and high-resolution and digitally processed seismic reflection data, three distinct fault segments are defined. These segments control the position and trend of shelf break: (1) the Laguna Beach segment (Corona Del Mar to San Mateo Point), a right-stepping zone with activity decreasing southward to San Mateo Point, where the latest activity was middle Holocene. (2) The San Onofre segment (San Mateo Point to Oceanside), where a major, 2-km-wide, left-stepping break occurs near the center of this segment opposite San Onofre; it is associated with an apparent basement discontinuity, a major blind thrust ramp and bowing of the continental slope. Shoreward of the NI-RC zone a 20-km-long synclinal fold trends subparallel to the zone. (3) The La Jolla segment (Oceanside to La Jolla), north of Encinitas, overlapping, left-stepping fault splays are associated with folding and thrusting. A landward splay forms a compressional ridge that deflects paleostream channels and documents Late Quaternary or historical activity.

Preliminary earthquake focal mechanism studies suggest that right-lateral faulting, with a minor reverse component, is dominant along the NI-RC Zone. Earthquake foci do not seem to be related to the thrust faults.

Compressional deformation along the zone is thought to be a direct result of relative North American/Pacific plate motion direction changes at 4 Ma. Deformation was concentrated near the left-stepping break in the San Onofre segment, perhaps producing a detached block or flake. Mapped structures suggest the NI-RC is dislocated by the "blind" thrust ramp.

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Principal Components Granulometric Analysis of Tidally Dominated Depositional Environments

Sediments often are investigated by using mechanical sieve analysis (at 1/4 or 1/2 ϕ intervals) to identify differences in weight-percent distributions between related samples, and thereby, to deduce variations in sediment sources and depositional processes. Similar granulometric data from groups of surface samples from two siliciclastic estuaries and one carbonate tidal creek have been clustered using principal components analysis. Subtle geographic trends in tidally dominated depositional processes and in sediment sources can be inferred from the clusters.

In Barnstable Harbor, Cape Cod, Massachusetts, the estuary can be subdivided into five major subenvironments, with tidal current intensities/directions and sediment sources (longshore transport or sediments weathering from the Sandwich Moraine) as controls.

In Morro Bay, San Luis Obispo County, California, all major environments (beach, dune, bay, delta, and fluvial) can be easily