

T32A-8

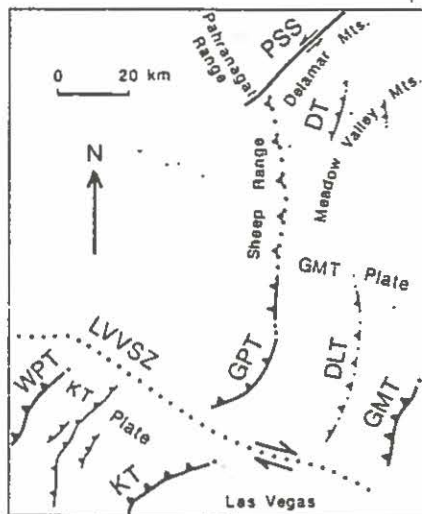
TITLE POSTER

**Regional Correlation of the Delamar Thrust Fault, Sevier Thrust Belt, Southern Nevada**

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The Delamar thrust (DT), exposed in the southern Delamar Mountains, has been correlated with either the Guss Peak (GPT) or the Dry Lake (DLT) thrusts. Alternatively, we propose that the DT is one of several separate, discontinuous subsidiary thrusts in the Glendale-Muddy Mountain thrust (GMT) plate. Correct correlation is important because thrusts are used to reconstruct the terrane before variable degrees of Cenozoic extension occurred across accommodating shear zones.

Both the DT and GPT (northern Sheep Range) placed Upper Cambrian over Permian-Pennsylvanian rocks. The DLT, a subsidiary thrust in the GMT plate, placed Upper Cambrian over Ordovician to Permian-Pennsylvanian strata, and is roughly on strike with the DT. The DLT might cut down section northward across facies strike to connect with the DT, but exposures in the Meadow Valley Mountains make this correlation unlikely. A probable trace of the GPT that continues north and west of the DT indicates that these are separate thrusts. Dissimilar facies patterns in Paleozoic rocks of the southern Delamar Mountains and Sheep Range support this conclusion. Upper and lower plate facies of the DT are more similar to Pahrangat Range facies which match the observation that rocks are offset by Cenozoic extension along the sinistral Pahrangat Shear System (PSS). Discontinuous subsidiary thrust faults are also present south of the Las Vegas Valley Shear Zone (LVVSZ) in the Keystone thrust (KT) plate between the Keystone and Wheeler Pass (WPT) thrusts.



**T32B BH: Brooks Wed 1330h**  
**Tectonism/Volcanism Cascades — Basin and Range Transition II — Posters (joint with V)**  
**Presiding: R D Catchings, USGS, Menlo Park**

**T32B-1 1330h INVITED POSTER**

Age and Distribution of Volcanism - Susanville/Eagle Lake Area, Northeastern California

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A cooperative geologic mapping project (DMG-USGS) in northeastern California provides a better representation of the distribution and age of volcanic rocks in this region. The study area coincides with the juncture of the Sierra Nevada, Basin and Range, and Cascade Range provinces (SN, BR, CR), each characterized by its own lithologic and tectonic style. The area is underlain primarily by late Cenozoic volcanic rocks that overlie a basement consisting of Cretaceous and pre-Cretaceous granitic and metamorphic rocks. Basement is exposed in the SN portion of the map and also locally in the Gaffan Peak horst south of Eagle Lake.

SN volcanic sources were located along the present Sierran crest and to the east generating a sequence of rhyolite, andesite, and basalt flows and pyroclastic deposits generally distributed along the Tertiary drainage systems. The Honey Lake fault zone, a NW-trending zone of en-echelon, right-lateral

oblique slip faults marks the boundary between the SN and BR provinces and is the northwestern continuation of the Walker Lane of Nevada. The BR is characterized by mountainous terrain and intervening lowlands. Mountain peaks are mostly older andesite to basaltic stratovolcanoes with the lowlying areas underlain by younger basaltic flows or fluvial and lacustrine deposits. The Modoc Plateau is transitional between CR and BR. A general westward decrease in the age of volcanism is evident from new and published K-Ar data with a hiatus between 6 and 9 Ma. Volcanism in the CR is mostly younger than 3 Ma.

**T32B-2 1330h INVITED POSTER****SEISMIC IMPLICATIONS for CRUSTAL COMPOSITION and DEFORMATION ALONG the BASIN and RANGE/CASCADE RANGE BOUNDARY**

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Three recently acquired seismic refraction transects, one in central Oregon and two in northeastern California and northwestern Nevada, cross the Cascade Range/Basin and Range boundary. One of the transects is a composite 550-km transect from the Cascade Range of northeastern California to the Basin and Range of the central Great Basin. This transect was constructed by merging two seismic transects, separated by only 80 km, with gravity constraints. These data suggest that the crustal lithology of the two areas may be largely the same since crustal velocities (2.5 km/s to 7.4 km/s) and heat flow (about 90 to 100 mW/m<sup>2</sup>) of both provinces are similar. The seismic data suggest that the crust of the two provinces has undergone or is undergoing different degrees of (but similar) deformation. In the upper crust, the difference between the two areas appears to be in the degree of block faulting. In central Oregon and northeastern California, the upper-crust of the High Cascades is largely characterized by deep (up to 5 km) basins; whereas in the Basin and Range is characterized by numerous fault blocks with large throws (up to 3 km). The lower crust appears to be characterized by magmatic underplating as evidenced by high velocities (7.3 km/s to 7.5 km/s) and densities (3.1 g/cm<sup>3</sup> to 3.12 g/cm<sup>3</sup>) beneath both the Cascade Range and the Basin and Range. However, the apparent underplating is much thicker beneath the Cascade Range than beneath the Basin and Range. In central Oregon, the total thickness of the crust appears to be about 37 km thick beneath the both the Cascade Range and the Basin and Range transition, but in northeastern California and northwestern Nevada, the crust is about 38 km thick beneath the Cascade Range and thins to a minimum of 32 km in the northwestern Nevada Basin and Range. The 550-km composite transect shows that laterally most of the crustal layers form a series of pinches and swells or boudins. The Mono, however, does not necessarily follow this pattern, perhaps because it is likely a young, dynamic boundary.

**T32B-3 1330h INVITED POSTER**

Cascade - Basin &amp; Range Transition East of Lassen Peak

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Geologic mapping in the E half of the Susanville 2° sheet in CA & in the far W part of the Lovelock 2° sheet in NV reveals westward migration of calc-alkaline arc volcanism since 12 Ma followed by HAOT back-arc volcanism & extensional faulting. The Cascade Range and the Basin and Range province represent modern expressions of this volcanic and tectonic migration.

The boundary between these two provinces involves a transition zone trending N35W, 15-25 km wide, and extending from Honey Lake to Hayden Hill and beyond probably to the Medicine Lake Highlands. This transition zone coincides with the NW continuation of the Walker Lane zone of right normal oblique-slip faulting. Major characteristics of the S part of the Cascade Range - Quaternary subduction- and extension-related calc-alkaline and HAOT volcanics, normal faults, and young volcanoes and flows - dominate W of this transition zone. Major characteristics of the W Basin and Range province - Miocene-Pliocene calc-alkaline and HAOT volcanics, normal faults, and eroded volcanic landforms - dominate E of this transition zone. The transition zone itself includes significant characteristics of both provinces. It is the trailing margin of the active westward migrating Cascade volcanic arc and accompanying zone of Quaternary faulting. It is also the western margin of the Modoc Plateau, a sub-province within the Basin and Range back-arc region that is anomalously quiet in terms of volcanism and tectonism relative to nearby areas.

**T32B-4 1330h POSTER**

Crustal Extension and Volcanic Extrusion Rates in the Lassen Region of Northeastern California

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The Lassen region of northeastern California lies near the junction of the Cascadia subduction system, the North American/Pacific transform system, and the Basin and Range extensional regime. The Pliocene to Quaternary volcanism in the Lassen region consists of a broad spectrum that includes small isolated mafic vents, fields of densely clustered monogenetic mafic vents, medium-volume stratovolcanoes and mafic shields, and several large-volume centers of intermediate to silicic composition. NNW-trending normal faults and aligned vents indicate ENE extension across much of the Lassen region.

During the Quaternary (the past 2 million years), the Lassen region has had an average extrusion rate of about 4 cubic km per km of arc length per million years; however, within the region extrusion rates vary with volcanic style. For example, Lassen volcanic center (LVC), a largely unfaulted andesitic stratovolcano and flanking silicic dome field, produced approximately 200 cubic km of lava during the past 600,000 years for an average flux of 1.6 cubic km per square km per million years (average rate divided by area of vent field). Adjacent to the east of LVC, a roughly coeval field of unfaulted but strongly aligned monogenetic cones and mafic shields of primitive mafic compositions produced at least 60 cubic km of basalt and basaltic andesite during the past several hundred thousand years for an average rate of about 0.4 cubic km per square km per million years. The extrusion rate of the more evolved LVC magmas appears to be about four times that of the more primitive magmas to the east and reflects a flux of silicic crustal partial melts compensating a larger basalt flux into the lower crust. The extrusion rates of the two areas may differ because of an east-to-west decrease (over a distance of about 40 km) in crustal extension rate at the edge of the Basin and Range province, as well as an east-to-west increase in basalt flux into the lower crust.

**T32B-5 1330h POSTER**

Chromian Spinel Indicate a Heterogeneous Source Region for Primitive Lavas in the Lassen Area of the Cascades

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Two types of young primitive basalt occur in the Lassen region: (1) low-K, high-alumina olivine tholeiite (LKOT), which is similar to low-K basalts erupted in the Cascade Range and throughout the northwestern Great Basin; (2) calcalkaline basalt (CAB), which is similar to orogenic basalt found worldwide. The high compatible-element content of the most primitive members of each magma type suggest near-primary compositions. Primitive LKOT is remarkably uniform in composition, displaying only subtle variations in ratios of incompatible elements. On the other hand, primitive CAB shows considerable incompatible-element variation in low-K to high-K lavas, which is coupled to isotopic variation and spatial distribution. CAB is the parent for evolved volcanic arc lavas in this portion of the Cascades. LKOT is typical of Basin and Range volcanism; its presence in the Lassen region is the result of impingement of Basin and Range tectonism on the Cascade arc (Guffanti and others, JGR, in press). Compositional variation of Cr-spinel in primitive lavas provides evidence bearing on the relationship between CAB and LKOT.

Most primitive LKOT and CAB lavas contain liquidus Cr-spinel octahedra preserved in olivine phenocrysts. These display a wide range of Cr/Cr+Al = 10-80 (Cr#) and Mg/Mg+Fe<sup>2+</sup> = 20-80 (Mg#), with Cr# and Mg# displaying a strong negative correlation. LKOT spinels are the most aluminous, have a relatively narrow range of Cr# (10-20), have the highest Mg# (65-80), and have the highest Fe<sup>3+</sup>/Fe<sup>2+</sup>. In contrast, CAB spinels have a wide range of composition that correlates with the variation in host-lava geochemistry. High-K CAB contain low-Cr# (25-35) spinels, medium-K CAB contain intermediate-Cr# (35-55) spinels, and low-K CAB contain high-Cr# (40-80) spinels.

Any general model based on incompatible-element content that attempts to derive CAB from LKOT must do so in the sequence LKOT, low-K CAB, medium-K CAB, high-K CAB. Spinel chemistry should follow that sequence, but just the opposite occurs. Spinel in LKOT are most like those in high-K CAB and least like those in low-K CAB. Furthermore, the range of composition observed in CAB spinels is larger than can be attributed to decompression of LKOT magma. This mineralogic evidence supports the contention of fundamentally different sources for the two magma types. Both LKOT and CAB are derived from depleted-mantle sources that have experienced variable degrees and styles of incompatible-element enrichment. The composition of liquidus spinels reflects the mineralogies of the source regions and the degree of enrichment. Our model successfully integrates the mineralogic, petrologic, geochemical, isotopic, tectonic, and spatial aspects of primitive volcanism in the southernmost Cascade Range.

**T32B-6 1330h INVITED POSTER**

Post-7 Ma Basalts from the Cascade Range of Central Oregon

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Post-7 Ma basaltic lavas (<2 wt % SiO<sub>2</sub>) from the Cascade Range between latitudes 43 and 45°N have been analyzed chemically (160 samples for 23 elements; 28 of those for an additional 13 elements)

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