The Upper Reaches of the Sierra Nevada Gold Channels, California and Nevada

Larry J. Garside, Christopher D. Henry, James E. Faulds, and Nicholas H. Hinz
Geological Society of Nevada Symposium 2005

ABSTRACT

The world-famous Eocene "Auriferous Gravels" and overlying Oligocene rhyolitic ash-flow tuffs of northern California and adjacent northwestern Nevada lie unconformably on Mesozoic or Paleozoic basement rocks. These are overlain by volcanic deposits of the Miocene ancestral Cascade volcanic arc. The erosion surface above the pre-Tertiary rocks represents a considerable hiatus, 40-60 Ma, during which time Mesozoic arc volcanics were eroded away. The eroded material was transported west, across the future Sierra Nevada, to the Great Valley sequence of central and northern California. It is clear that the pre-tuff erosional surface had some relief, with a well-developed system of westward-flowing streams in broad paleovalleys in western Nevada and adjacent California. These streams headed in a central Nevada highland. Locally, in western Nevada, stream deposits are preserved in the central parts of these valleys below the rhyolitic ash-flow tuffs. In adjacent eastern California, the Oligocene ash-flow tuffs lie on the Auriferous Gravels. In some areas farther to the west, only Auriferous Gravels are found in the paleovalleys. The source calderas of the Oligocene outflow tuffs found in the paleovalleys are apparently all located to the east in western or central Nevada; there are no known sources for these Oligocene ash-flow tuffs in the Sierra Nevada. Recognition that ash-flow tuffs of western Nevada and eastern California can be tied to their Nevada source calderas, and that they were deposited mainly in paleovalleys makes it possible to trace the middle Tertiary rivers upstream from where their courses are better known in the western Sierra Nevada.

Most gold in the lower reaches of the Eocene paleovalleys was probably eroded from gold-bearing mesothermal quartz veins, both in the main Mother Lode and in scattered deposits as far east as Lake Tahoe and Quincy. Some of that gold was later reworked in channels contemporaneous with Miocene andesitic volcanism and was also eroded into the present streams that were first worked by the forty niners. Some veins that were eroded to supply gold to Eocene rivers may have been completely eroded or their remnants are concealed beneath Miocene volcanic rocks. Some Eocene placer gold was eroded from polymetallic veins, particularly those associated with granitic intrusions and porphyry-copper-related mineralization. In northern California, Au-Cu-bearing veins in the vicinity of the Lights Creek Porphyry and in the nearby Genesee and Taylorsville districts (eastern Plumas and Lassen Counties) are potential sources. Similar mineralization in the Meadow Lake District of Nevada County supplied some gold to paleoplacers of the Tertiary Yuba River. In Nevada, gold in the known paleoplacer deposits under Oligocene ash-flow tuffs (Yerington and Little Valley) probably was eroded from similar polymetallic Au-Cu (quartz-tourmaline) veins. Speculative upstream continuations of various branches of the Tertiary Yuba and American Rivers enter Nevada near the Fort Sage Mountains, Hallelujah Junction, Reno (?), Little Valley, and Hope Valley (via Echo Pass). One branch of the Little Valley channel can be speculatively traced to the vicinity of Yerington.

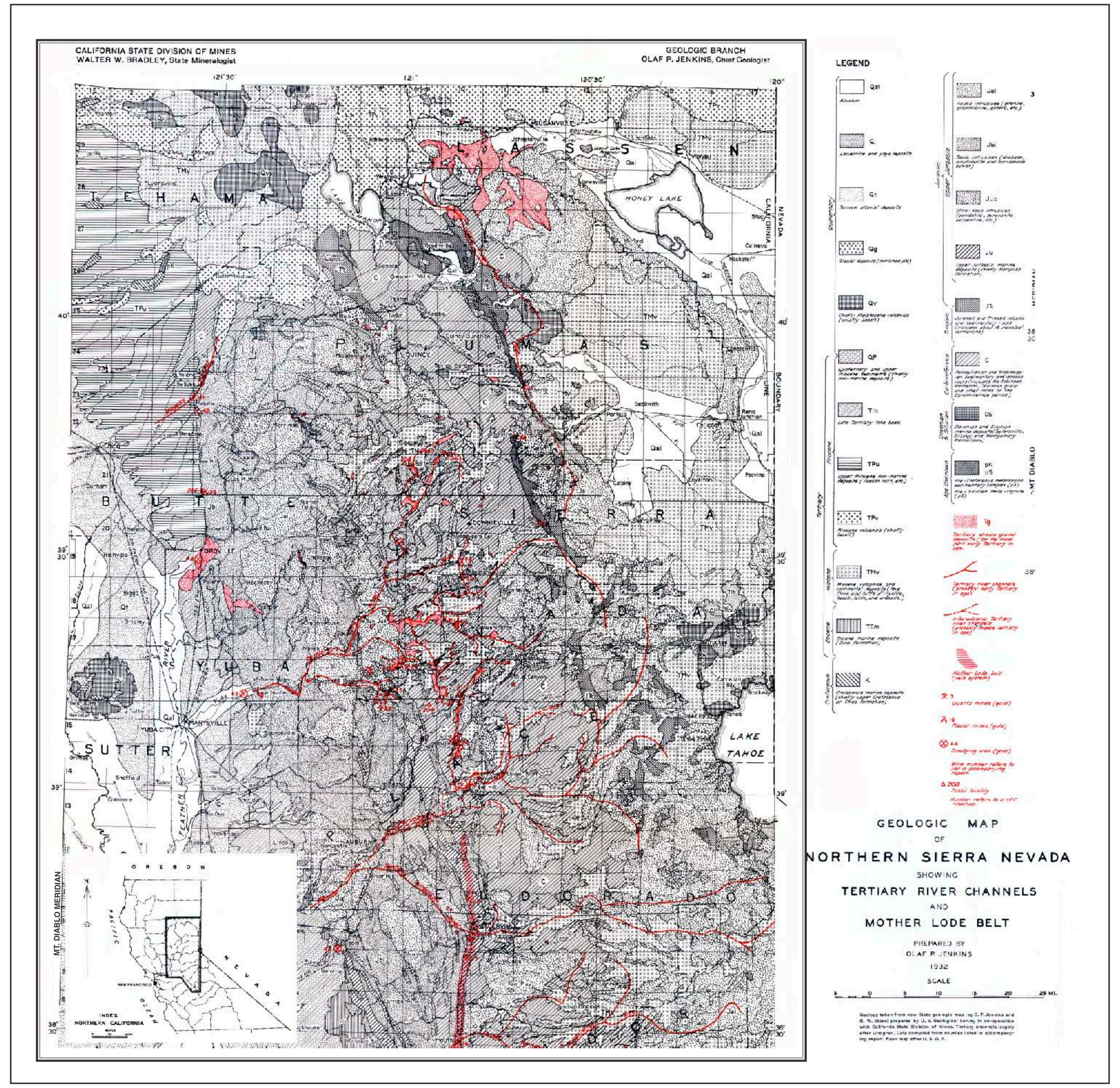
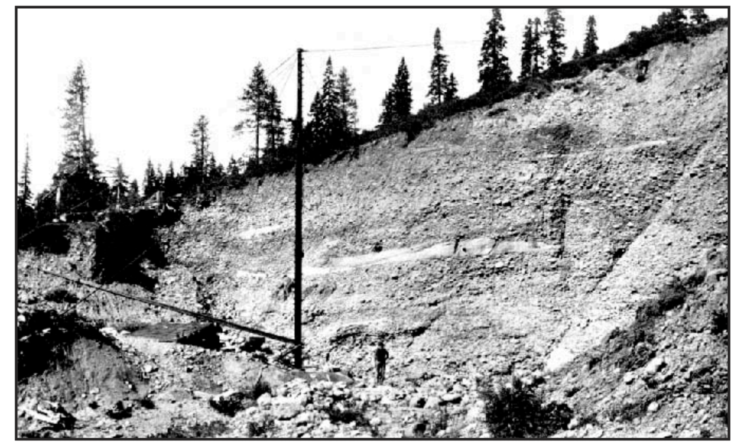


Figure 1 Map of Tertiary auriferous river channels of the northern Sierra Nevada by Olaf Jenkins (1932), based in large part on Waldemar Lindgren's (1911) research. The stream courses illustrate Lindgren's view that the paleovalleys headed west of the present Sierra crest. Note the postulated Jura River east of that crest.



Working face of the Cascade Mine during operation; stiff-leg derrick in foreground (from Lindgren, 1911)

Columnar jointed 28.80 Ma ash-flow tuff (Tuff of Campbell Creek) exposed in a paleovalley near Black Mountain, Diamond Mountains.

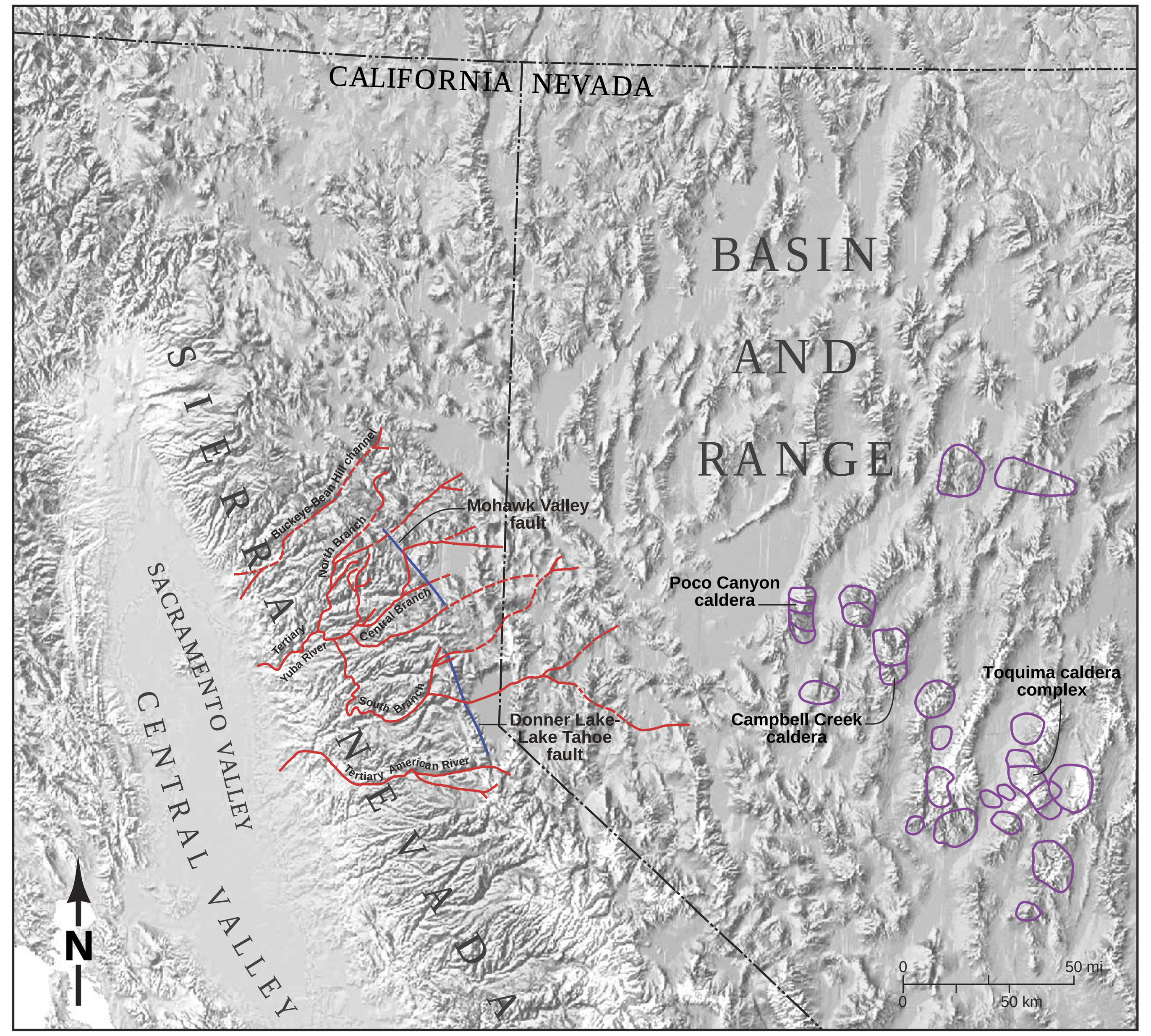


Figure 2 Known and speculative Eocene-Oligocene paleovalleys of northern California and western Nevada. Lower portions of channels from Lindgren (1911) and Lawler (1995). Some central Nevada calderas shown.

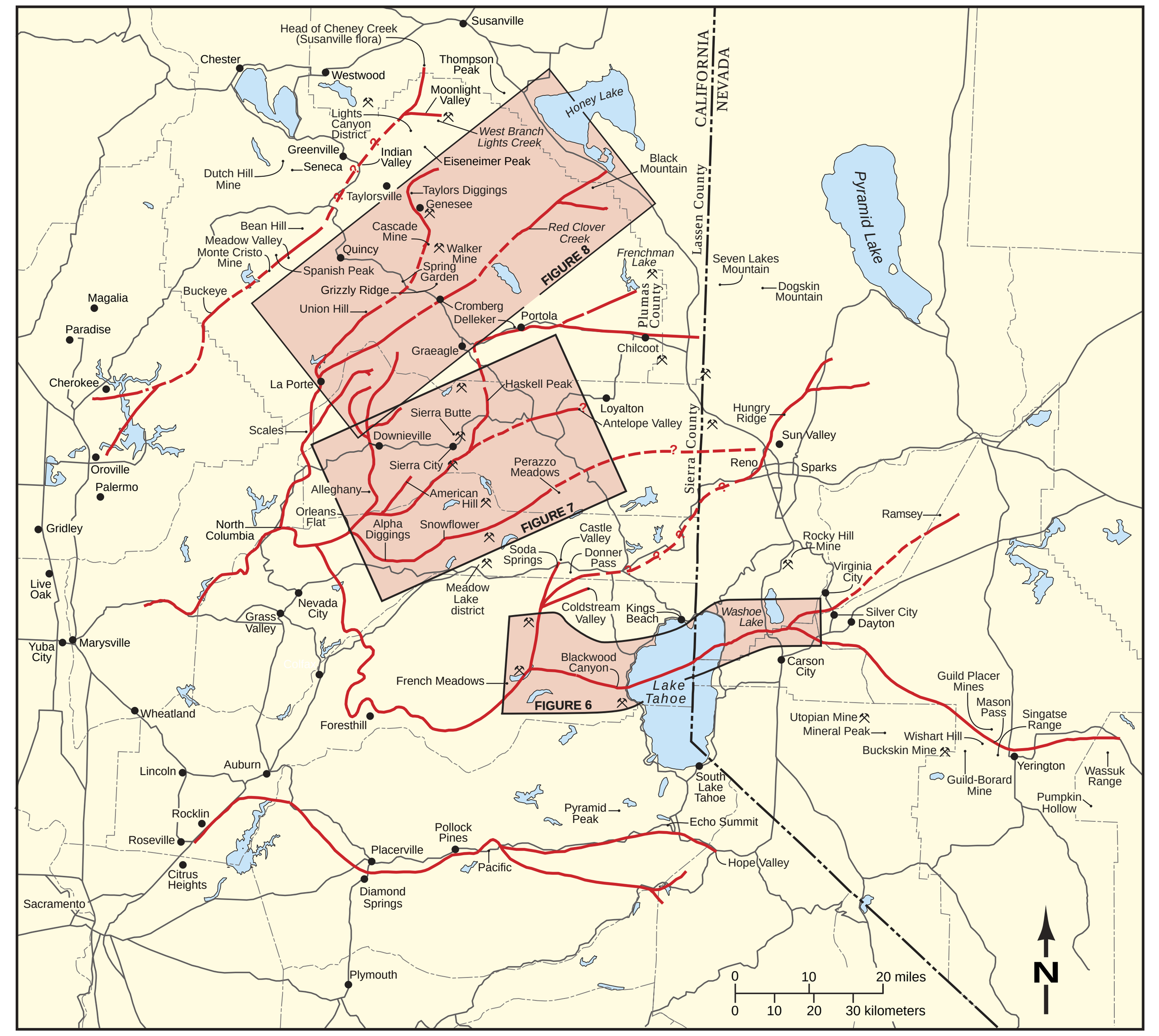


Figure 4 Map of known and speculative Eocene-Oligocene paleovalleys of northern California and western Nevada, showing the locations of more detailed figures. Lower portions of channels from Lindgren (1911, Plate 1) and Lawler (1995). Lines represent the general midcourse of the valleys and are dashed or queried in areas of uncertain projection. No consideration is given to Basin and Range extension. Mine symbols represent select, eastern California and western Nevada gold mines in pre-Tertiary rocks.

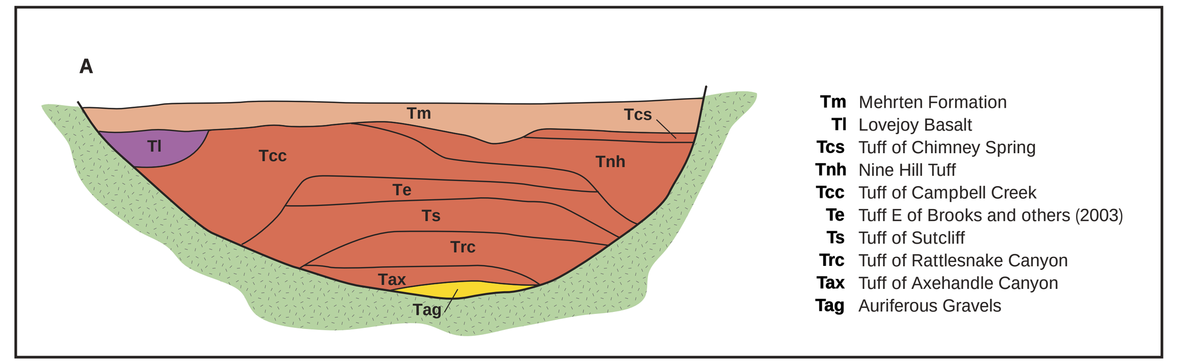


Figure 5a Composite diagrammatic cross section of northern California paleovalley, showing relationships of Auriferous Gravel, Oligocene ash-flow tuffs, and Miocene basaltic and andesitic rocks. A single paleovalley site may have one or more Tertiary units present. At Haskell Peak, gravels underlie most tuff units (Brooks et al., 2003).

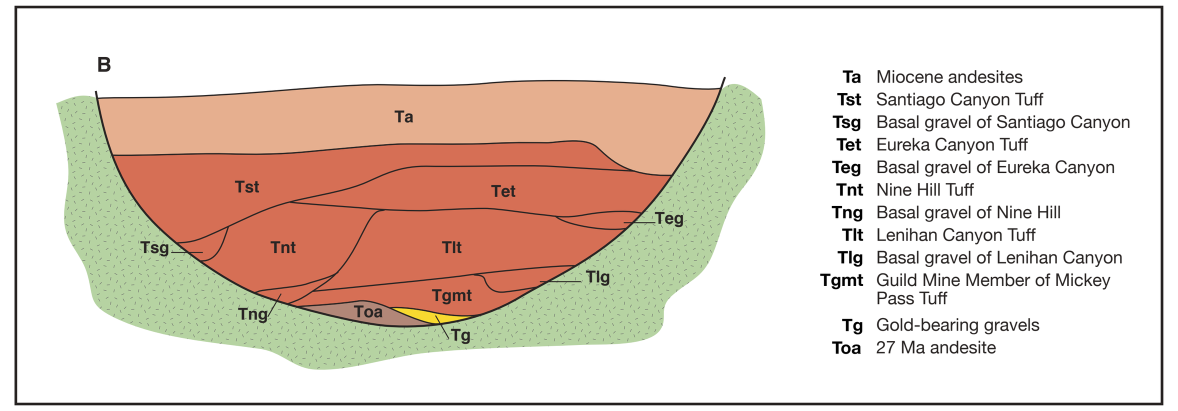


Figure 5b Composite diagrammatic cross section of paleovalley, Virginia City-Lake Tahoe, showing relationships of Oligocene andesite flow breccia, Oligocene-Miocene ash-flow tuffs and underlying gravels, and Miocene andesites.

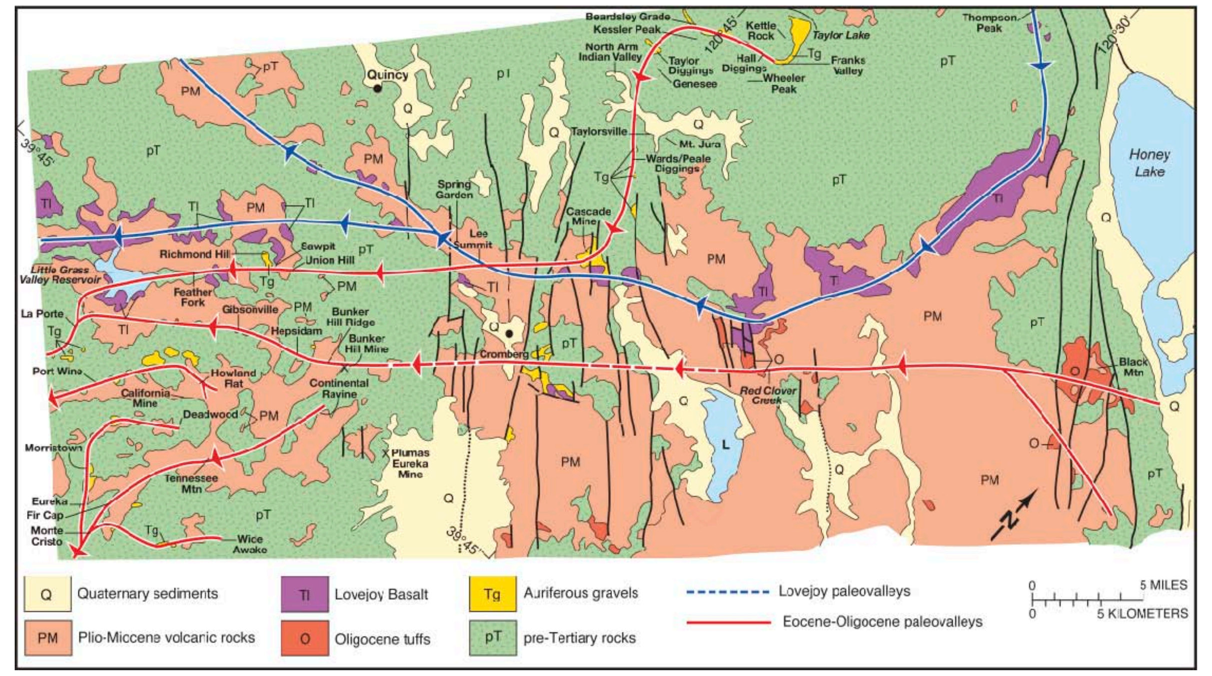


Figure 8 Geologic map of paleovalleys in a part of Plumas and Sierra Counties, California. Contacts generalized from Saucedo and Wagner (1992) and Grose et al. (1990). Map location shown on Figure 4.

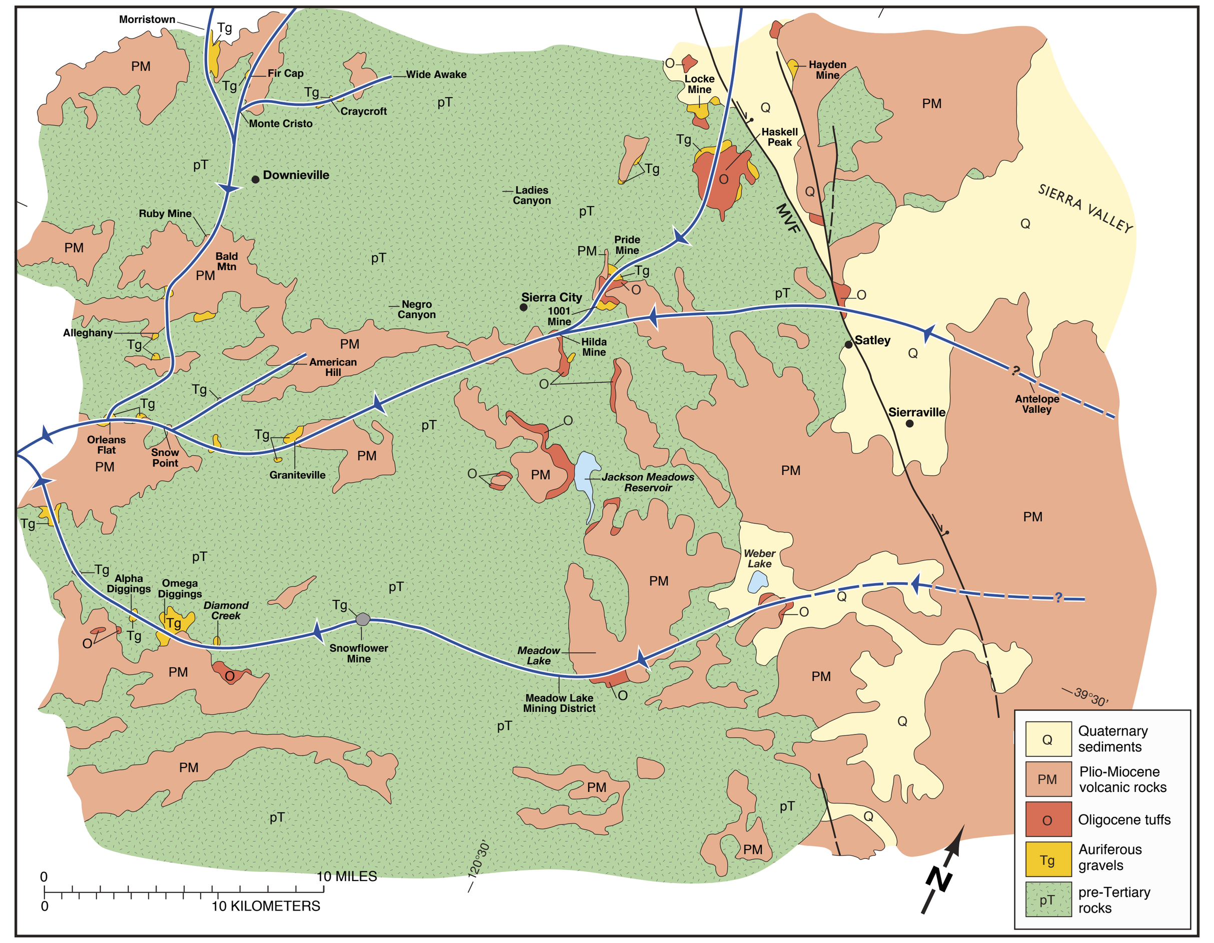


Figure 7 Geologic map of a part of the paleovalleys of the central Tertiary Yuba River. Contacts generalized and slightly modified from Saucedo and Wagner (1992). Map location shown on Figure 3.

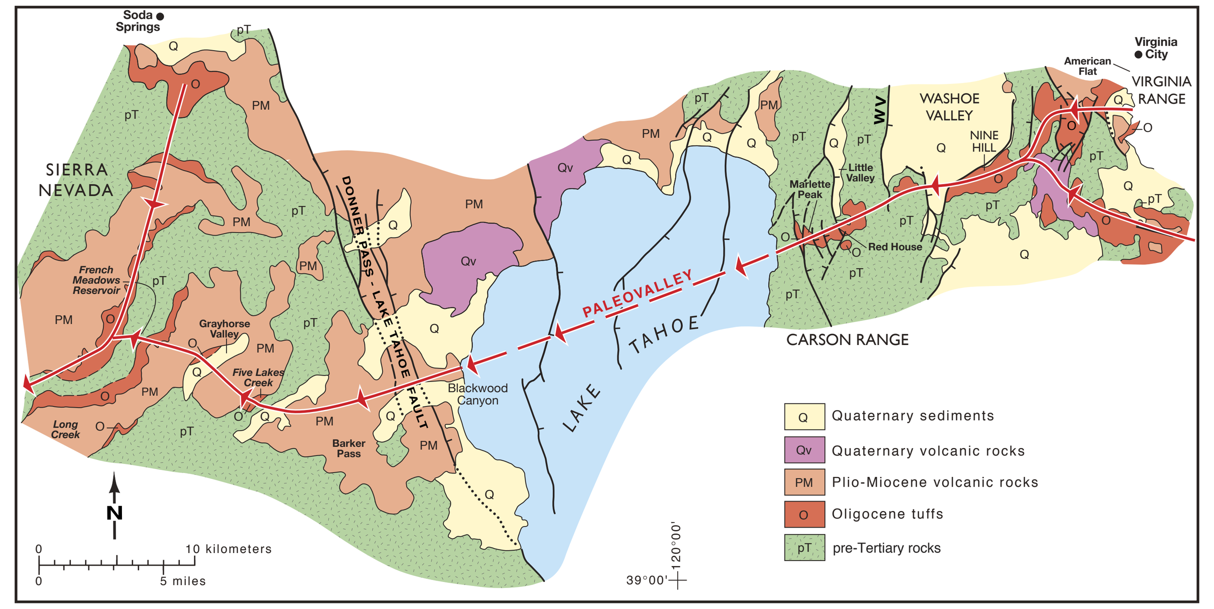
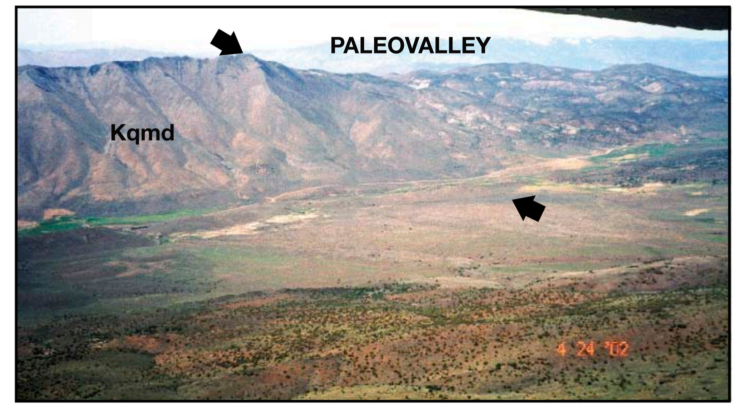


Figure 6 Geologic map of a portion of the middle Tertiary paleovalley between French Meadows, California, and the Virginia Range, Nevada. Contacts generalized and slightly modified from Saucedo and Wagner (1992) and Stewart (1999). Map location shown on Figure 3.



Dogskin Mountain, Nevada paleovalley filled with Oligocene ash-flow tuffs; looking west across northern Warm Springs Valley. **Kqmd**, Cretaceous quartz monzodiorite.

Columnar jointed 28.80 Ma tuff of Campbell Creek lying above nonwelded "Tuff E" in a road cut along California Highway 20 near Skillman Flat (about 10 miles west of Interstate 80 and Emigrant Gap). About 260 km west of its source caldera in the southern Desatoya Mountains.

CONCLUSIONS

- Ash-flow tuffs from Central Nevada calderas can be tracked in paleovalleys across western Nevada and into the auriferous gold channels of the northern Sierra Nevada.
- The southwest decrease in age of Nevada calderas is reflected in the paleovalley stratigraphy; basal and youngest ash-flow tuffs in northern paleovalleys are older than those to the south.
- The paleovalleys of western Nevada can be used as piercing lines to estimate dextral offset across the Walker Lane (Faulds 2005).
- Most gold in Tertiary paleochannels was derived from mesothermal quartz veins, but high-temperature, polymetallic veins were potential sources in easternmost California and western Nevada.

ACKNOWLEDGMENTS

Much of the field work and library research on the California area paleovalleys by one of us (LJG) was accomplished during a sabbatical supported by the University and Community College System of Nevada. Support was also supplied by grants from the National Science Foundation (grant EAR0124869) and the U.S. Geological Survey STATEMAP Program. Discussions with Howard Schorn and Bob Pease were very helpful. Ron Hess provided base maps for the figures, and Kris Pizarro very ably drafted them.

REFERENCES

Brooks, E.R., Wood, M.M., Boehme, D.R., Potter, K.L., and Marcus, B.I., 2003, Geologic map of the Haskell Peak area, Sierra County, California: California Geological Survey Map Sheet 55.

Faulds, J.E., Henry, C.D., and Hinz, N.H., 2005, Kinematics of the northern Walker Lane: An incipient transform fault along the Pacific-North American plate boundary: Geology, v. 33. p 505-508.

Grose, T.L.T., Saucedo, G.J. and Wagner, D.L., 1990, Geologic map of the Susanville Quadrangle, Lassen and Plumas counties, California: California Division of Mines and Geology Open--File Report 91 1, scale 1:100,000.

Jenkins, O.P., 1932, Geologic map of northern Sierra Nevada showing Tertiary river channels and Mother Lode chapter.

Lawler, D.A., 1995, Ancestral Yuba River gold map: Northern California: California Gold, 48 Shattuck Square, Suite 108, Berkeley, California, 94704.

Lindgren, W., 1911, The Tertiary gravels of the Sierra Nevada of California: U.S. Geological Survey Professional Paper 73, 226 p.

Saucedo, G.J., and Wagner, D.L., 1992, Geologic map of the Chico Quadrangle, California, 1:250,000: California Division of Mines and Geology Regional Geologic Map Series, Map No. 7A.

Stewart, J.H., 1999, Geologic map of the Carson City 30 x 60 minute quadrangle, Nevada: Nevada Bureau of Mines and Geology Map 118, scale 1:100,000.