PS Using Size and Shape Characteristics to Differentiate Between Beach and Fluvial Conglomerates in Cenozoic Tecuya and Kern River Formations, Southern San Joaquin Valley, CA*

Samuel McKinney[1], Jeffrey Buehler[2], Kenneth Watson[3], and David Miller[3]

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[1]Department of Geological Sciences, California State University, Bakersfield, CA (Smckinney4@csub.edu)
[2]California Well Sample Repository, Bakersfield, CA
[3]Department of Geological Sciences, California State University, Bakersfield, CA

Abstract

The size and shape of clasts in conglomerates can be used to infer paleohydrologic conditions, distance to source, and depositional settings. As part of a regional study of late Cretaceous-Cenozoic fluvial conglomerates, clast characteristics were evaluated in the late Eocene(?)-early Miocene Tecuya Formation (Ttc) and the late Miocene Kern River Formation (Tkr). Ttc and Tkr are age equivalent to hydrocarbon reservoir sands in the southern San Joaquin Valley, California. Tkr conglomerates were deposited in a braid plain/delta. Ttc conglomerates were deposited in a beach/fluvial environment but the location of the marine/non-marine transition in the study area is unclear. Mixed fluvial and beach conglomerates are common along the margin of the southern San Joaquin Valley and are difficult to distinguish in the field and core.

Based on published data, quartzite clasts in beach conglomerates tend to be more oblate while quartzite clasts in fluvial conglomerates are more prolate and they will plot in separate fields on a Zingg diagram. In order to distinguish beach and fluvial conglomerates, shape data (long, intermediate, short axes) were measured from 1500 quartzite clasts collected from Ttc and from 220 quartzite clasts collected within Tkr. Shape comparisons were made between quartzite clasts because of their resistance to weathering and lack of anisotropies effecting clast shape. Weathered and/or insitu fractured clasts of volcanic, plutonic, and metamorphic materials were not analyzed for shape studies.

Tkr data plot in the fluvial field as expected. Sample data from central and western exposures of Ttc plot in the beach field. Those from eastern exposures of Ttc plot in both fluvial and beach fields. We interpret the data to indicate that the paleoshoreline was present within eastern exposures of Ttc and paleoslope was to the west. This interpretation is supported by a decrease in clast size to the west, WNW flowing paleocurrents, and facies analysis of sediments. Clast size measurements can be an effective way to distinguish fluvial from beach conglomerates if a statistical approach is used.

References Cited

Howard, J.L., 1993, The Statistics of Counting Clasts in Rudites: A Review, With Examples from the Upper Palaeogene Of Southern California: Sedimentology, v. 40, p. 157-174.

Howard, J.L., 1992, An Evaluation of Shape Indices as Palaeoenvironmental Indicators Using Quartzite and Metavolcanic Clasts in Upper Cretaceous to Palaeogene Beach, River, and Submarine Fan Conglomerates: Sedimentology, v. 39, p. 471-486.

Jennings, C.W., R.G. Strand, and T.H. Rogers, 1977, Geologic Map of California: California Division of Mines and Geology, Sacramento, CA, Map Scale 1:750,000.

USING SIZE AND SHAPE CHARACTERISTICS TO DIFFERENTIATE BETWEEN BEACH AND FLUVIAL CONGLOMERATES IN CENOZOIC TECUYA AND KERN RIVER FORMATIONS, SOUTHERN SAN JOAQUIN VALLEY, CA.

Samuel McKinney; Jeffrey Buehler; Kenneth Watson; David Miller
Dept. of Geological Sciences, California State University, Bakersfield Ca 93313 Smckinney4@csub.edu

Minority Science and Engineering Improvement Program

Louis Stokes Alliances for Minority Participation (LSAMP)

CSUB, Dept. of Geological Sciences

FLUVIAL CONGLOMERATES OF THE KERN RIVER AND TECUYA FORMATION

Quartzite clasts in modern fluvial gravels tend to plot in the prolate/sphere field on a Zingg diagram (Howard, 1992). The average of 218 quartzite clasts from a single location in Miocene fluvial conglomerates of the Kern River Formation (QTkr) plot in the prolate/sphere field as expected but close to the boundary of the disc field. We attribute this to the large percentage of foliated micaceous metaquartzites in the QTkr that have anisotropies favorable for the creation of disc shaped clasts. Sediment recycling of eroded beach deposits is also a possibility in QTkr, but there is more evidence of sediment recycling of beach and nearshore deposits in Ttcq. We plan to test further locations in the QTkr, Quaternary Kern River terraces, and to subdivide the quartzites into orthoquartzite and metaquartzite subpopulations. The Oligocene Tecuya Formation (Ttcq) also has sedimentologic and facies evidence for deposition in a similar braided river system as the QTkr, but the quartzite population in fluvial conglomerates consists overwhelmingly of more isotropic orthoquartzite. Orthoquartzite from Ttcq plots (n= 444) squarely in the sphere field. We conclude that orthoquartzites are the preferable rock type to use when discriminating beach vs fluvial conglomerates.

Ophiomorpha and *Skolithos* burrows in beach and near shore deposits, Tecuya Fm

Interns collecting fluvial conglomerates at the type locality, Tecuya Fm

Prolate orthoquartzite boulder in fluvial conglomerates of the Tecuya Fm

Fluvial conglomerate in Tecuya Fm with predominantly sphere and prolate cobbles

Fluvial conglomerate in Tecuya Fm with predominantly sphere and prolate boulders

METHODS

We modified the methods described in Howard (1992, 1993). Approximately 400 clasts were counted or collected at each station. Clasts >2cm were counted in lab and by the area method at outcrop. At larger outcrops greater than approx. 100 sqm, at least 6 stations with counts or samples of 150 clasts each were used to calculate a mean value. In lab, samples were sieved and washed. Clasts were broken open to confirm identification. Long, intermediate, short dimensions of quartzite clasts were measured in lab prior to breaking. Howard's compilation of the shapes of clasts in modern beach, fluvial, and submarine fan environments were plotted on Zingg diagrams. Beach and fluvial clast shapes tend to plot in oblate and prolate fields respectively. We used this feature to create a discriminant plot on Zingg diagrams with a boundary between beach and fluvial defined by the distribution of shapes in modern environments

Howard, J. L., 1993, The statistics of counting clasts in rudites: A review, with examples from the Upper Palaeogene of southern California: Sedimentology, v. 40, p. 157-174.
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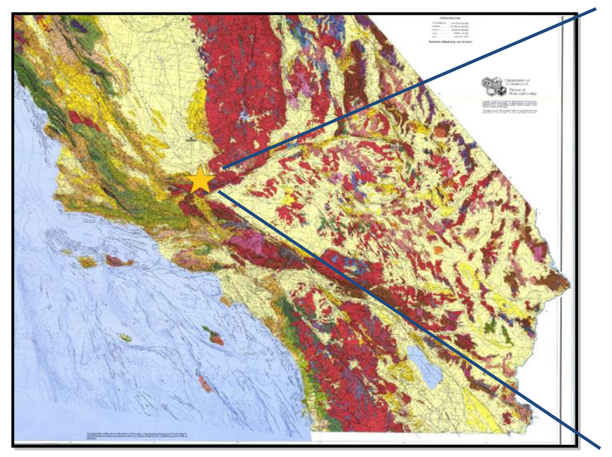
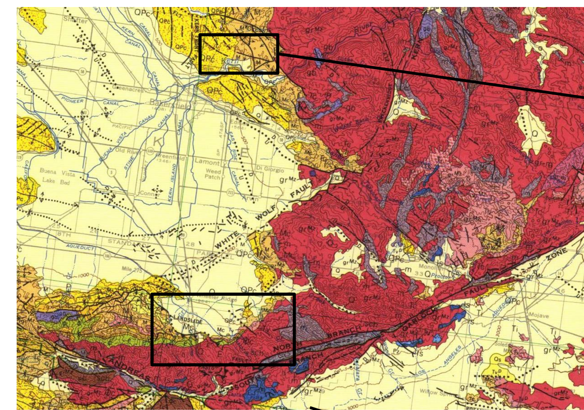
Study Area



Geologic map of Southern California

Jennings, C.W., Strand, R.G., and Rogers, T.H., 1977, Geologic map of California: California Division of Mines and Geology, scale 1:750,000.



Outline of the study areas

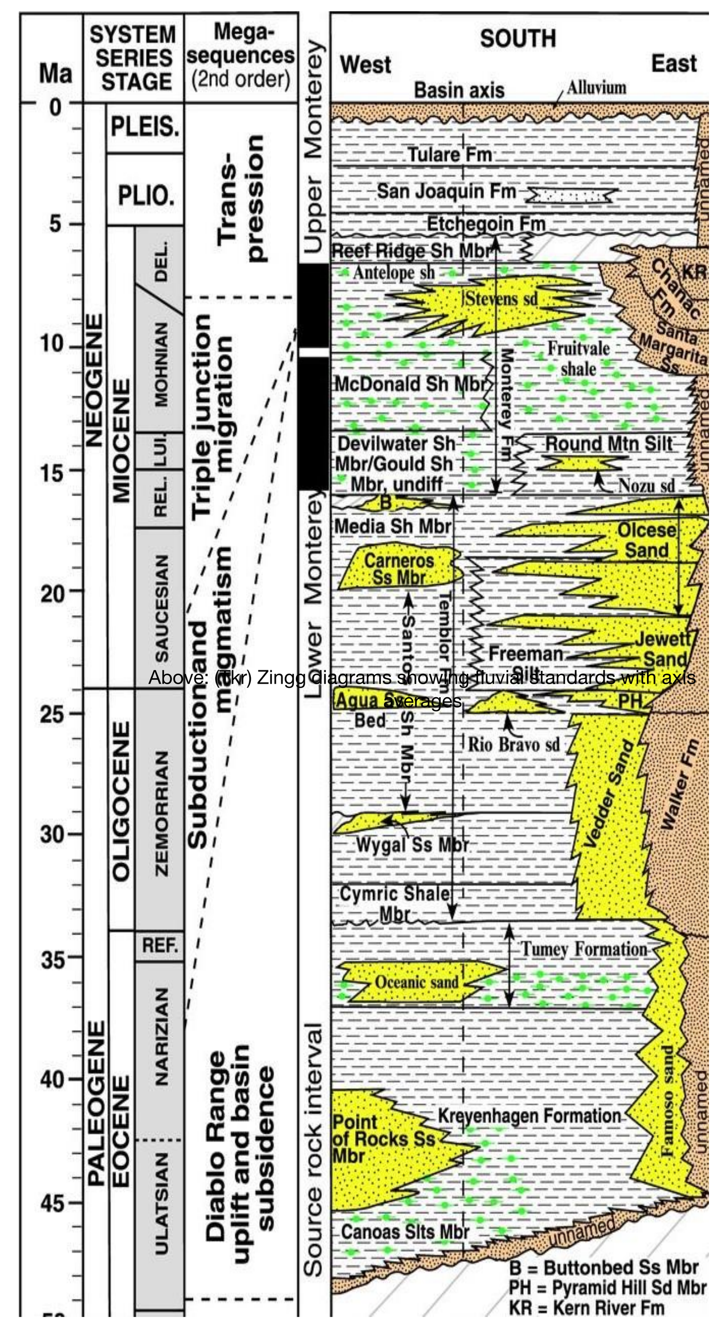
Interbedded conglomerate, sandstone, and siltstone in the fluvial Kern River Formation

Taking a break to capture panoramic view of the Tunis Graben

Oblate disc and bladed clasts in nearshore deposits of the Tecuya Formation

Outcrop counting and collecting of conglomerates in type locality

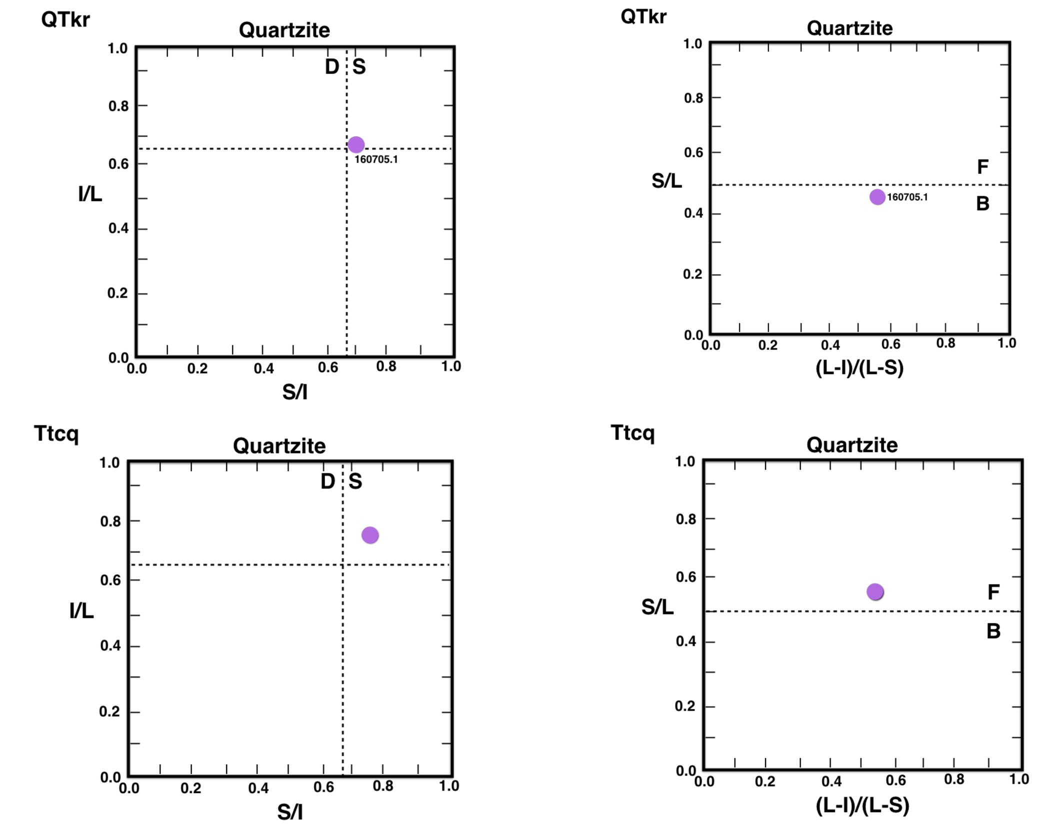
Sampling conglomerates on Tejon Ranch

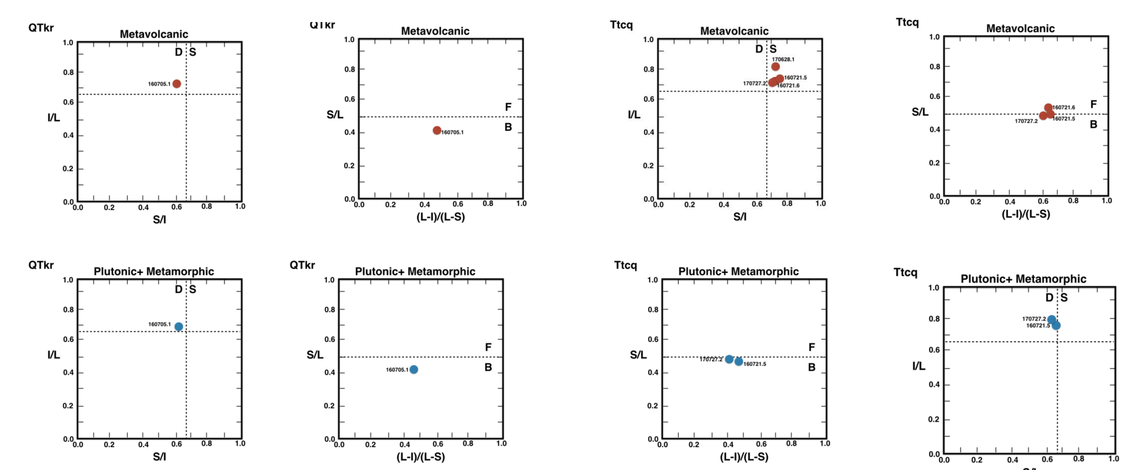


Cenozoic stratigraphic column of the Southern San Joaquin Valley. Late Eocene to early Miocene tectonics gave rise to many homogenous arkosic sandstone deposits creating prosperous oil, gas, and water reservoirs that stimulate California's economic wealth.

Sphere/prolate boulders from fluvial conglomerate in Tecuya Fm

Boulder quartzites with parallel laminations during sedimentation





Zingg diagrams and S/L vs (L-I)/(L-S) plots of quartzite, metavolcanic, and plutonic+metamorphic clasts in fluvial conglomerates in the Kern River Formation (QTkr) and Tecuya Formation (Ttcq); D=disc, S=sphere, B = beach, F= fluvial; (L-I)/(L-S) plots from Howard (1992)

ABSTRACT

The size and shape of clasts in conglomerates can be used to infer paleohydrologic conditions, distance to source, and depositional settings. As part of a regional study of late Cretaceous-Cenozoic fluvial conglomerates, clast characteristics were evaluated in the late Eocene(?)-early Miocene Tecuya Formation (Ttc) and the late Miocene Kern River Formation (Tkr). Ttc and Tkr are age equivalent to hydrocarbon reservoir sands in the southern San Joaquin Valley, California. Tkr conglomerates were deposited in a braid plain/delta. Ttc conglomerates were deposited in a beach/fluvial environment but the location of the marine/non-marine transition in the study area is unclear. Mixed fluvial and beach conglomerates are common along the margin of the southern San Joaquin Valley and are difficult to distinguish in the field and core.

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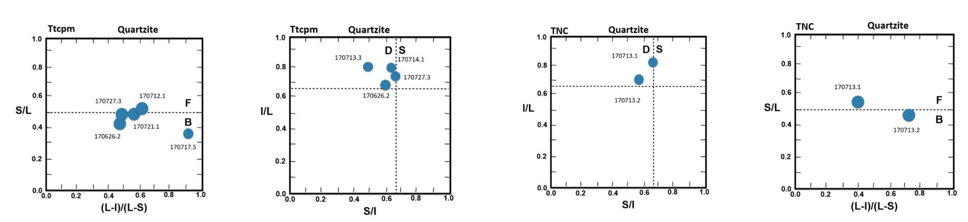
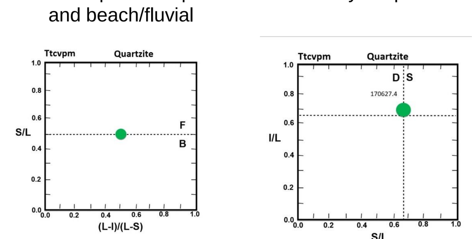
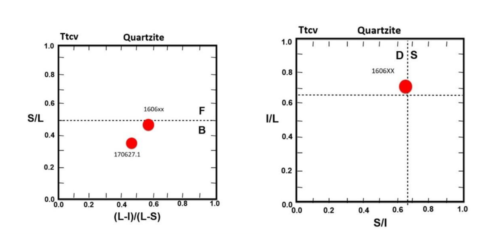
Upper Tecuya unit Ttcpm
orthoquartzites plot in disc field, beach field, or beach/fluvial line



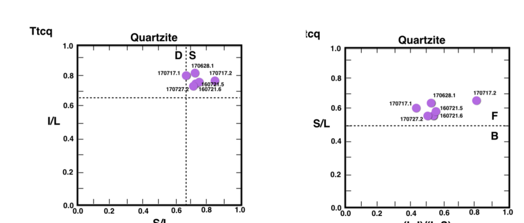
The Nameless Conglomerate
orthoquartzites plot in disc field, beach field, or beach/fluvial line

Western Tecuya Fm
orthoquartzites plot on the boundary of sphere/disc and beach/fluvial

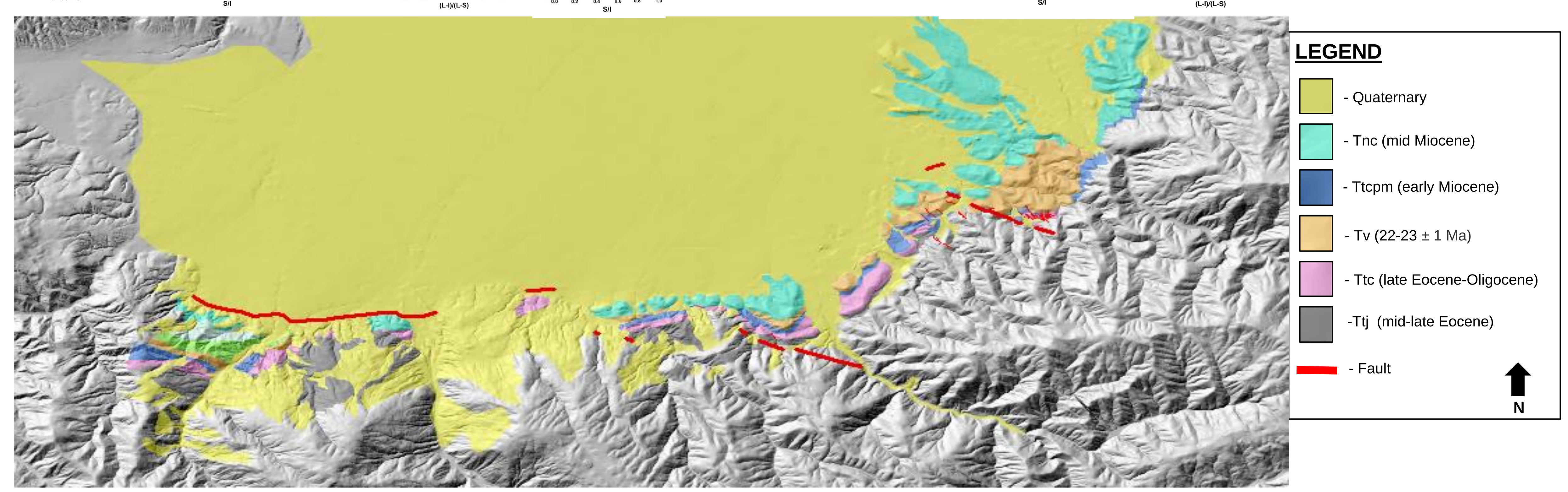




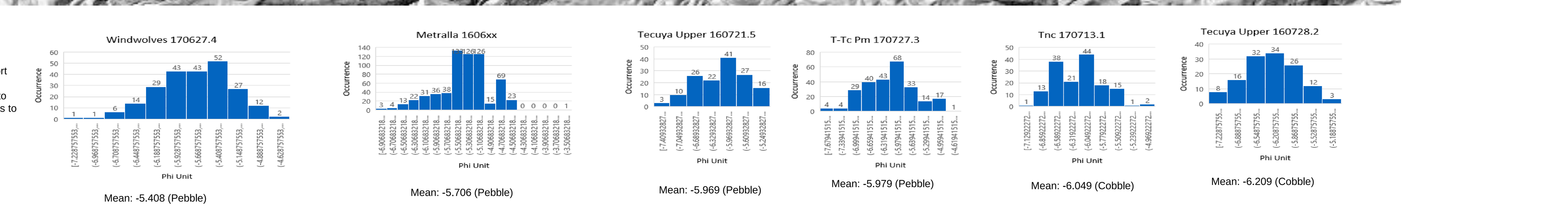
Central Tecuya Fm
orthoquartzites plot on the border of disc and sphere field and in the beach or near the line of beach/ fluvial field



Eastern Tecuya Fm
orthoquartzites plot in sphere/prolate and fluvial fields



Right: East to West transport indicating the eastern most cobble samples are closer to source terrain. Paleoslope is to the west.



ACKNOWLEDGEMENTS

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