Zr. These variables typically show small but significant variation between flows, but only minor variation within flows. We are currently assessing other variation diagrams for their suitability in distinguishing flows.

BUTLER, T., CORNELL, D., HACKER, D., AND HOLM, D.

Progress report of geologic mapping and remote sensing analysis of the Pinto Quadrangle, Colorado Plateau transition zone, SW Utah.

The Pinto Quadrangle, located along the southern extension of the Antelope Range, remains one of the key unmapped areas in the eastern Caliente-Enterprise zone (Hudson et al., 1998 and Axen, 1998, GASP 323), a regional east-northeast trending transfer zone. Current detailed (1:16,000) geologic mapping in conjunction with LANDSAT imagery reconnaissance has revealed different structural elements in the study area related to Tertiary plutonism and crustal extension. Early structural features related to plutonism include laccolithic doming (Pinto Dome) and gravity slide sheets originating from the west (Bull Valley Mountains). These features dominate the southern portion of the quadrangle, and reflect Miocene (22-20 Ma) Iron Axis plutonism.

Sedimentary and volcanic stratigraphy in the central and northern portions of the quadrangle (see Cornell et al., 2001, this volume) are cross-cut by sinistral NW faults and by throughgoing E-W oblique-slip faults associated with mid-Miocene Basin and Range faulting. Field relations show that the NW faults terminate into and are offset by the E-W fault set. These fault sets reside within a footwall block unroofed by the late Miocene to Quaternary west-dipping Antelope Range Fault. LANDSAT imagery analysis is proving to be useful in interpreting important structural and geomorphic details (i.e., range-front alluvial fan development) throughout the study area. Here we illustrate the mid-Miocene to Quaternary fault pattern based upon field mapping data augmented by remote sensing technology.

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CHAPIN, CHARLES E.

Geologic History of the Eastern Margin of the Colorado Plateau

The east side of the Colorado Plateau follows a north-trending zone of weakness deformed during Proterozoic, Ancestral Rocky Mountain, Laramide, and late Cenozoic tectonism. Northward displacement of the Colorado Plateau during late Laramide flat-plate subduction (late Paleocene-middle Eocene) formed a broad zone of right-lateral faulting accompanied by an echelon series of strike-slip basins. A regional surface of relatively low relief developed across beveled Laramide uplifts and aggraded basins during a prolonged period of erosion and tectonic quiescence in late Eocene. Volcanism spread across the Southern Rocky Mountain-Colorado Plateau boundary as the subducted slab steepened and sank. The earliest calderas (37-33 Ma, central Colorado; 29 Ma, San Juan field; 36-32 Ma, Mogollon-Datil field) formed along the west edge of the incipient Rio Grande rift; the foci of ignimbrite volcanism then migrated westward.

As tensional stresses strengthened, the Rio Grande rift collapsed along the north-trending Colorado Plateau boundary previously weakened by multiple deformations and high heat flow. Several Laramide uplifts collapsed and became basin floors. Structural inversion and basin subsidence began at about 35 Ma, coincident with a change to bimodal volcanism. Local areas of extreme extension, with domino-style block rotation and low-angle normal faults formed above, or proximal to, batholithic intrusions in the Socorro (29-27 Ma) and Questa (26-25 Ma) areas. Apatite fission-track (AFT) cooling ages show strong uplift and denudation of ranges flanking rift basins beginning about 24 Ma. Basin subsidence was particularly rapid between about 16 and 10 Ma. Rifting began more or less concurrently along the Rio Grande rift but proceeded more rapidly in the south; estimates of total extension are: San Luis Basin 8-12%, Albuquerque Basin 17-28%, and Socorro 50%. Isotopic and trace element compositions of basalt flows indicate a change from lithospheric to asthenospheric sources beginning about 10 Ma south of Socorro and progressing northward to the Jemez Mountains by 2 Ma; source regions for magmas north of the Jemez lineament are all in the lithosphere. Changes to a wetter, stormier climate at about 7 Ma lead to integration of closed basins, regional incision of drainages, and development of the Rio Grande.

The physiographic eastern margin of the Colorado Plateau is actually an intra-plateau boundary separating elements of a broad orogenic plateau formed during the Laramide. Mapped and dated remnants of the late Eocene surface and similarities in post-Laramide tectonic, volcanic, and erosion history link together the High Plains, Southern Rocky Mountains, Colorado Plateau, and adjacent portions of the Basin and Range and Wyoming provinces. Key data are: 1) similar Laramide apatite fission-track cooling histories (80-45 Ma) for the Colorado Plateau and Front Range; 2) paleobotanical evidence that the 34.1 Ma Florissant lake beds were deposited at an elevation (2.2-3.3 km) on the Front Range similar to today (2.5 km); 3) lack of differential structural relief between the Front Range and High Plains since late Eocene as evidenced by preservation of old (>100 Ma) AFT cooling ages along the Range margin and lack of significant offset of the 37 Ma Wall Mountain Tuff deposited across the boundary; and 4) similar timing and magnitude of late Miocene-Recent excavation of basin-fill deposits and incision of drainages.

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Stratigraphy and Ar/Ar ages of volcanic rocks of the Pinto Quadrangle, Colorado Plateau Transition zone, SW Utah

Current detailed (1:16,000) geologic mapping along the southern extension of the Antelope Range is focusing on stratigraphy, 40Ar/39Ar dating and structural and remote-sensing analysis (see also Butler et al., 2001, this volume). East-dipping Cretaceous (Iron Springs Formation) and Tertiary (Claron Formation) sedimentary rocks are bounded to the west by the NE-SW striking Antelope Range Fault. However,