

Metabasalts and Metagabbros from the Llano Uplift, Texas: Petrologic and Geochemical Characterization with Emphasis on Tectonic Setting

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Abstract. The 1.0–1.2 b.y. old rocks of the southeastern Llano Uplift, Texas include a 7 km thick sequence of amphibolite-grade, stratified, mafic metasedimentary rock (Packsaddle Schist) which is intruded by a varied suite of syntectonic and late-kinematic intrusions. The metasediments contain large blocks of serpentinized peridotite (Coal Creek serpentinite) and coarse hornblendite and metagabbro. Prior to the end of maximum deformation, the sequence was intruded by low- to medium-K₂O tholeiitic basalts (0.40–0.72% K₂O). Late-kinematic low-K₂O tholeiitic basalts (0.38–0.40% K₂O) were intruded as dikes into the folded rocks. The Coal Creek serpentinite contains both syntectonic and late-kinematic low-K₂O tholeiitic metabasalts (0.13–0.36% K₂O). The Llano metabasalts and metagabbros are characterized by low Cr (67–378 ppm) and Ni (36–170 ppm), variable Rb (1.5–14.7 ppm), Sr (140–1229 ppm), TiO₂ (0.40–2.20%), P (568–2707 ppm), and Zr (18–230 ppm), and Y (16–45 ppm), Co (40–57 ppm), and Sc (36–49 ppm) similar to modern MORB. The metabasalts have La abundances from 7 to 39 times chondritic and exhibit light REE enrichment with $|La/Sm|_N$ from 1.13 to 1.45 and $|La/Yb|_N$ from 1.12 to 2.99. The metabasalts show a strong correlation of increasing Zr, Ti, and Y and decreasing Eu/Eu* (1.56–1.00), CaO/TiO₂, Al₂O₃/TiO₂, and MgO/MgO+FeO* with increasing REE enrichment (La_N). The Llano metabasalts and metagabbros have initial $^{87}Sr/^{86}Sr=0.7029 \pm 0.0001$. A likely petrogenetic model for these metabasalts is an island arc in which events from early arc development to final late-kinematic intrusion were dominated by tholeiitic volcanism and intrusion. The chemical systematics of the Llano mafic metagneous rocks suggest they are products of fractionation of olivine, clinopyroxene, and plagioclase from more primitive basaltic magmas generated beneath the island arc complex.