

Fortress Cliff Quadrangle, Palo Duro Canyon State Park

(1:24,000)

QUATERNARY

Holocene

Qal—Alluvium. Sand, silt, gravel, and mud along drainageways. Includes some undivided low terrace deposits and some local bedrock outcrops.

Qp—Playa deposits. Mud, silt, and some fine sand. Local deposits on High Plains.

Ql—Landslide, slump, and slope-wash debris and blocks. Mostly consists of Triassic Dockum strata and lesser amounts of Permian Quartermaster and Tertiary Ogallala rocks that have slid as large rotated blocks and as smaller debris deposits.

Holocene and Pleistocene

Qa—High alluvium. Sand, silt, less common pebbles. Local deposits on flat ridges within canyons. Thickness as much as 5 ft.

Pleistocene

Qbd—Blackwater Draw Formation. Sand, silt, and sandy mud. Thickness up to ~70 ft.

TERTIARY TO QUATERNARY

Pliocene and Pleistocene

QTc—Cita Canyon lake beds, undivided. Mud, silt, and sand. Consists of lower Blancan (Pliocene to early Pleistocene) lacustrine deposits overlain by Pleistocene lacustrine deposits that are interstratified with eolian sand, silt, and mud (Johnston and Savage, 1955; Hood, 1977a). The upper sequence contains Pearlette ash (Johnston and Savage, 1955; Hood, 1977a; Izett and Wilcox, 1982)

TERTIARY

Pliocene and Miocene

To—Ogallala Formation. Sand, silt, gravel, mud, and caliche. Thickness in map area as much as ~70 ft. Upper caliche is massive to laminated and has a stage V morphology.

TRIASSIC

TRdu—Cooper Canyon and Trujillo Formations, undivided, of the Dockum Group.

Sandstone, conglomerate, and lesser mudstone. Sandstone is gray and contains common cross-beds. Mudstones are red, maroon, and gray. Thickness is up to ~200 ft.

TRdl—Tecovas and Santa Rosa Formations, undivided, undivided of the Dockum Group.

Mudstone and lesser siltstone and sandstone. Lavender, gray, maroon, orange, and white.

Concretions, geodes, and silicified wood common. Thickness is less than 200 ft.

PERMIAN

Pq—Quartermaster Formation. Sandstone, siltstone, mudstone. Gypsum veins common in lower part. Reddish color. Ash beds (Fracasso and Kolker, 1985a, b). Minor folds due to subsurface evaporite dissolution and associated subsidence of lower Quartermaster strata. Thickness is ~220 ft.

Pwh—Whitehorse and Cloud Chief Formations, undivided. Sandstone, siltstone, mudstone, and gypsum beds. Gypsum veins common. Minor folds due to subsurface evaporite dissolution and associated subsidence of strata. Some small-scale folds of gypsum beds due to conversion of anhydrite to gypsum. Only upper part of unit exposed.

MAP SYMBOLS

	Strike and dip of beds.
	Horizontal to nearly horizontal beds; beds dipping $<2^\circ$.
	Minor anticline.
	Minor syncline.
	Ash in Permian Quartermaster Formation.
	Ash in upper part of Cita Canyon Lake deposits.