University of North Texas **GEOGRAPHY 4350/5350 GEOMORPHOLOGY** H. Williams

Dallas Geomorphology Field Trip

DATE: Saturday March 29. Bus will depart parking lot behind ENV at 8.30 a.m. sharp and return approx. 5 p.m.

INTRODUCTION: The purpose of this field trip is to familiarize you with some of the major large-scale geomorphological features in Dallas County.

OVERVIEW OF DALLAS GEOLOGY: The rocks underlying the Dallas area are all Upper Cretaceous (~ 100 million years old) and of marine origin, consisting of limestones, shales or gradations between (marls), which formed when Cretaceous seas covered North Texas.

These rocks are exposed within 3 major bands striking approximately north-south through the Dallas region (See geology map). The beds dip slightly to the east, so that the youngest rocks are exposed to the east and the rocks become progressively older to the west (See geology map). Given the lack of large faults or folds and the relatively simple outcrop pattern, the geomorphology of Dallas County consists of:

1. The formation of consequent and subsequent streams of the Trinity River.

2. Differential erosion of inclined strata forming a cuesta on the Austin Chalk (with a prominent dipslope and escarpment – The White Rock Escarpment).

3. The prominent strike valley formed in the Eagle Ford Shale (Mountain Creek valley).

4. The modern floodplain of the Trinity River and numerous Quaternary terraces.

5. Variations in the width of the Trinity River valley caused by different bedrocks.

6. Many smaller-scale highs and lows in the landscape caused by stream valleys and interfluves.

7. Drainage patterns related to local factors e.g. a parallel pattern on the dipslope of the Austin Chalk, a trellis pattern in the Mountain Creek strike valley.

Taylor Marl: Marl is calcareous (calcium carbonate-rich) shale. Like all shales, the clay particles tend to be parallel, giving the rock a platy structure and the property of fissility - the ability to split into thin sheets or plates. Breakdown of the rock is enhanced by wetting and drying (slaking), since the clays swell and shrink. This, together with the tendency of the calcium carbonate to dissolve in soil moisture, makes marl a relatively weak rock. This low resistance to erosion is reflected in generally low elevations, subdued relief and wide river valleys.

Austin Chalk: The Austin Chalk consists mainly of calcium carbonate with clay-rich marl interbeds. Although a relatively soluble rock, the Austin Chalk is stronger than surrounding rocks so that it forms a large cuesta, the dipslope of which forms an elevated slope across Dallas

County and the escarpment of which forms the White Rock escarpment to the west. The Austin Chalk is dissected by many small streams, which, especially in the more elevated west, form relatively deep, narrow steep-sided valleys. A major part of the Dallas area lies on Austin Chalk. Like the Taylor Marl, Austin Chalk forms poorly-drained, expansive clay-rich soils.

Eagle Ford Shale: This weak rock has been preferentially eroded forming a low-lying strike valley. The valley is occupied by Mountain Creek, a subsequent stream and tributary of Trinity River, and two large reservoirs (See geology map). The shale forms clayey, waterlogged soils.

FIELD TRIP ROUTE

Enroute: Travelling down I35E from Denton, the highway passes over the modern floodplain of the Elm Fork Trinity River in the vicinity of Northwest Highway, Regal Row and Mockingbird Lane - note the flat low-lying topography, mainly to the west of the highway. From I35E take Mockingbird Lane east to Oakbrook, turn left (north) on Oakbrook, turn left (west) at the first intersection (Prudential). Stop around the 1400 block Prudential. Access the Elm Fork Trinity between buildings to the west.

STOP 1: **Modern floodplain and channel of Elm Fork Trinity River**. Note flat topography and mud-sand sediments of modern floodplain. (Note: much of the river flow is now diverted through the Trinity Diversion Channel to the west). Note the edge of Quaternary terrace deposits approximately 500 feet to the east (rising ground).

Enroute: Take Mockingbird Lane east; the road begins to climb the Quaternary terrace after Hawes St. and reaches the top of the terrace just after Harry Hines. This surface is approximately 60-70 feet above the modern Trinity River floodplain. Note that the terrace surface is generally quite flat, but is dissected by streams in places, causing minor undulations. Continue until Maple (on the right, a few blocks before the entrance to Love Field), turn right (south), turn right on Bomar Ave. and park on side of road (adjacent to open field on right).

STOP 2: **Hickory Creek Terrace** gravel pit. The Quaternary terrace, named the Hickory Creek Terrace by Dr. Ferring, Geography UNT, is exposed in an old gravel pit at this site. Note character of alluvium from which terrace is formed. Note gully initiation on sides of pit. Eagle Ford Shale bedrock is exposed in the bottom of the pit. The alluvium is sandy and gravelly, and has been transported in from upstream; the local Eagle Ford Shale bedrock has no sand or gravel, only clay.

Enroute: Take Mockingbird Lane 1 block east, turn left (north) on Denton Drive (alongside the airport). Drive approximately 0.5 miles, park in gas station. This excursion is made only to view the extensive flat surface of the terrace at Love Field (See geology map). This is one of only a few places where buildings do not completely obstruct the view across the terrace surface.

Enroute: Go back to Mockingbird and turn right (west) and go back to Harry Hines, turn south (towards downtown - you loop under the overpass) on Harry Hines and follow the road approximately 3 miles to Pike Park (just after Randall, on right). Park in the parking lot of Pike Park.

STOP 3: **Trinity River Valley; Austin Chalk**. Pike Park overlooks the floodplain of the Trinity at its narrowest point in Dallas County - where it passes through the resistant Austin Chalk (See geology map). The river follows the regional slope to the southeast, and so can be classified as a consequent stream. The floodplain here is approximately 2 miles wide. The river bluff eroded into the Austin Chalk can be seen to the west. The Austin Chalk is exposed at the back of Pike Park Recreation Center. A possible remnant of a Quaternary terrace underlies the baseball diamond and forms benches between the park and the modern floodplain (these may be built on by now – there has been a lot of development in the area e.g. AAC).

Enroute: Take Harry Hines south to Harwood (Harwood curves around to the left from Harry Hines, approximately 1/3 mile from Pike Park; follow Harwood across McKinney to Woodall Rodgers Freeway (may be construction/park – work around – turn right at freeway until you find a way across to other side), turn left (east) on the freeway and enter I45-South just after Pearl. Follow I45 approximately 10 miles to the Hutchins area (beware of exit-only lanes!). Note enroute: near Fair Park, note the view of Austin Chalk across the floodplain to the west (right). The highway soon drops down from Austin Chalk onto Quaternary terrace deposits and then onto the modern Trinity floodplain - the floodplain is recognized by swampy conditions and dense vegetation. I45 climbs back onto a Quaternary terrace by the Loop 12 intersection - note the change from flat, muddy, swampy conditions to drier, sandier soils and higher, hummocky topography (the terrace is dissected by streams). I45 drops down to the modern floodplain again, just before I20; it then climbs up onto Austin Chalk at the I20 intersection - note the increased elevation and the heavily-treed modern floodplain to the east (left). The highway then drops down slightly as it passes onto Taylor Marl in the vicinity of Pleasant Run Road (See geology map) - note the increase in grassland and reduction in number of trees. Turn left (east) on Pleasant Run Road; the road noticeably drops down about 1/2 mile from I45 as it passes back onto Quaternary terrace deposits - note the flat topography; approximately 1/2 mile further there are large sand mounds to the left of the road - pull over in pull-off to the right.

STOP 4: **Quaternary Terrace** gravel pit; a Quaternary terrace is exposed in a gravel pit at this site. Note character of alluvium from which terrace is formed. Note the prominent river bluff in Taylor Marl to the west and north. As at Stop 2, the alluvium is sandy and gravelly, and has been transported in from upstream; the local Taylor Marl bedrock has no sand or gravel, only clay.

Enroute: Continue along Pleasant Run Road; the road begins to drop down to the modern floodplain just before Post Oak Road. Turn right (south) on Post Oak Road; the road drops down to the modern floodplain just before Belt Line Road - note swampy, heavily-treed floodplain. Turn left (east) on Belt Line and travel across the modern Trinity floodplain; we can't stop on the

bridge but as you drive over it you can see the raised levees on either side of the river (covered in trees), the channel of the Trinity and its eroded banks; pull off on right side of road just after the bridge over the Trinity River.

STOP 5: **Trinity River Valley; Taylor Marl**. Due to the heavy vegetation cover and low elevation at this site, little of the surrounding topography is visible; however, the bluff in Taylor Marl on the east side of the floodplain may just be visible to the southeast. The floodplain of the Trinity at this point is approximately 4 miles wide - a significant contrast to the size of the valley through the more resistant Austin Chalk (See geology map).

Enroute: Do a U-turn and head back along Belt Line to I45. Note the abrupt climb up onto Taylor Marl after Geller Road (the Quaternary terrace is very narrow or absent along Belt Line Road). Turn right (north) on I45, take the Pleasant Run Road exit - go left (west) on Pleasant Run Road (Note: there may be a brief stop to collect rock samples just before Pleasant Run Road).

STOP 6: **Taylor Marl outcrop**: Cross the Southern Pacific railway line, turn south on Miller's Ferry Road and go about 0.5 miles to the road bridge. Taylor Marl is exposed in a stream cut. Note: this site changes frequently because of repair work designed to stop erosion under the bridge – we will try to find some local Taylor Marl bedrock to look at.

Enroute: Go back to Pleasant Run Road and continue west; the road climbs up onto Austin Chalk between Sunrise Road and Pinto Road (note the increased elevation). Note the generally gently-sloping topography, clayey soils, grasslands. The road now crosses the Austin Chalk Plateau (the elevated dipslope of the Austin Chalk cuesta). There is some undulation of this surface, because the plateau is dissected by resequent streams in the east and obsequent streams in the west (because the plateau is higher in the west (900 feet, as opposed to 500 feet in the east), the valleys are deeper, narrower and steeper in the west). Continue several miles, passing through Lancaster - there will be a brief **lunch stop** at the strip mall just past I35E, on the right side of Pleasant Run Road. Continue along Pleasant Run Road until approximately 2 miles west of I35E in DeSoto, turn right (north) on Townsend (just after Townsend Square on right side of Pleasant Run Road); park in church parking lot on corner.

STOP 7: **Austin Chalk outcrop**: Austin Chalk is exposed in the valley cut by Tenmile Creek (we may climb down under road bridge). Note the differential erosion of chalk and interbedded marl; signs of seepage; erosion; pyrite nodules; micro-faults; undercutting of soil; slumping; fossils; floodplain, attempts to stop large gully forming, damage to bridge supports.

Enroute: Continue west on Pleasant Run Road to junction with I-1382 (the end of Pleasant Run Road); travel north on I-1382 (towards Grand Prairie) along and down the **White Rock escarpment** - note prominent cliffs formed by escarpment to right (east) and Lake Joe Pool to left (west). Drive down into the strike valley formed in the Eagle Ford Shale (See geology map). The escarpment formed by the Austin Chalk becomes more visible to the right (note houses

perched precariously on top of escarpment!). Route crosses Mountain Creek floodplain by I20 - note swampy conditions, flat topography and abundant trees. There is a good view of the escarpment to the right rear just after I20. Turn right (east) on Spur 303 (Pioneer Parkway), across Mountain Creek Lake, continue past Spur 408, climb up escarpment - take the first left at top of hill (Ledbetter Road) - park in pull-off at corner. Walk back down hill to stop 8 (approximately 200 yards downhill).

STOP 8: **Contact of Austin Chalk and Eagle Ford Shale**: This contact is exposed in a large road cut. Note the Austin Chalk (white) overlying the Eagle Ford Shale (gray) and examine the character of the rocks. There is a view of the strike valley in the Eagle Ford Shale to the west. Note slaking of shale, undercutting, jointing, root wedging and rockfalls of Austin Chalk.

Return Route to Campus: go back down the hill and turn right (east) on Spur 408, follow Spur 408 onto Loop 12, follow Loop 12 onto I35E and follow I35E to Denton.