

## SUPPLEMENTAL MATERIAL

### DESCRIPTIONS OF OTHER STRATIGRAPHIC SECTIONS

#### **Cherry Creek**

##### *Description*

In its middle reaches, Cherry Creek meanders between three paired terraces within a narrow bedrock valley. The highest is a strath terrace (T1) standing 10 m above the creek and capped by several meters of boulder gravel. The two lower terraces stand about 6m (T2) and 3 m (T3) above creek level and are composed mainly of gravel. Their treads are paired on both sides of the valley and are continuous for a distance of several kilometers down-valley. We described two sections along Cherry Creek that are separated by a distance of about 800 m. Upstream of section B, the furthest downstream, Cherry Creek drains an area of about 4 km<sup>2</sup>.

Section A exposes part of T3. It begins at creek level with 40 cm of crudely stratified cobbles and small boulders. Overlying this unit are 75 cm of silty clay containing scattered pebbles. Soil development occurred in the upper 20 cm of this unit as indicated by oxidation, chaotic orientations of pebbles suggesting disturbance by roots, the presence of carbonate-lined root casts, prismatic soil structure, and a concentration of clay. Charcoal fragments from 45 cm below this soil yielded an age of  $3700 \pm 40$  <sup>14</sup>C yr B.P. Thirty centimeters of pebble gravel with imbricated clasts overlies this soil above an erosional boundary. This unit fines upward into 30 cm of silty clay in which the modern soil is developing.

Section B exposes part of the T2 terrace. Near creek level, 50 cm of silty clay contains lenses of imbricated pebbles. There is no evidence for soil development. Charcoal from the lowest 15 cm of the basal clay unit dates to  $4880 \pm 40$  <sup>14</sup>C yr B.P. The upper 2.5 m of the section consists of pebble gravel alternating with layers of silty clay. The modern soil is developing in the uppermost meter of clay-rich sediment.

##### *Interpretation*

Based on their paired nature, down-valley continuity, and distinctly different accretion histories recorded by radiocarbon ages, T2 and T3 are fill-and-cut terraces and record two episodes of valley filling and incision. The aggradation creating the valley fill later incised to form T2 was underway at 4880 and ended before the 3700 <sup>14</sup>C yr B.P. The sediment inside T3 was accumulating at 3700 <sup>14</sup>C yr B.P. Sometime after this, incision occurred, isolating the terrace surface from overbank deposition long enough for a soil to develop there. Renewed aggradation then brought the channel base up to the level of the soil. The soil was eroded slightly and then buried as aggradation resumed.

#### **Wild Horse Arroyo, Jaw Section**

##### *Description*

The Jaw Section is located in the meandering reach of Wild Horse Arroyo downstream of the Folsom archaeological site. The watershed upstream covers an area of 7 km<sup>2</sup>. The

section begins at creek level with 50-60 cm of silty clay. Soil development is indicated by a concentration of clay, pebbles with chaotic orientations, lenses of organic silt, and carbonate-cemented root casts. The upper boundary of this buried-soil unit is erosional. The overlying unit is composed of between 50 to 140 cm of silty clay containing beds of imbricated pebbles. Charcoal from this unit dates to  $5080 \pm 40$   $^{14}\text{C}$  yr B.P. Above another erosive contact lies another unit of silty, sandy clay 1-1.2 m thick and containing beds of imbricated pebbles and a bison mandible. Charcoal from this unit dates to  $5470 \pm 40$   $^{14}\text{C}$  yr B.P. Above another erosional contact, another unit of silty clay with beds of imbricated, shale pebbles has the modern soil developing on its surface.

### ***Interpretation***

The Jaw Section exposes at least four fining-upward sequences that record episodes of point bar point-bar deposition and channel infilling. Reworking of charcoal from older deposits upstream probably accounts for the reversal in the radiocarbon ages. The 5080  $^{14}\text{C}$  yr date is likely to be the more accurate of the two because it is younger yet stratigraphically lower.

## **Wild Horse Side Arroyo**

### ***Description***

This informally named northern branch of the Wild Horse valley drains an area of about 1 km<sup>2</sup> and contains an arroyo that now heads in a bedrock chute. In section A, the lowest exposed sediment consists of one meter of horizontally stratified, boulder gravel that fines upwards into a meter of sand containing charcoal dating to 4570  $^{14}\text{C}$  yr B.P. Unconformably overlying this sand is fifty-centimeters of crudely stratified, pebble gravel, which grades rapidly upwards into 1.3 m of horizontally bedded, silty clay and sandy clay. This clay unit caps the valley fill into which the modern arroyo is incised. A mollic epipedon 30-50 cm thick is presently developing on the remnant valley floor. It contains carbonate root casts and small nodules in its B/C horizon, has a pronounced prismatic structure with clay coatings.

Ninety-five meters downstream in section B, 50 cm of massive, shale gravel is exposed at stream level. This is overlain by 50 cm of horizontally bedded sand containing charcoal dating to 4800  $^{14}\text{C}$  yr B.P. This unit is overlain by 1.5 m of alternating boulder and pebble gravel. Three meters above stream level, this crudely stratified gravel grades into a 30-cm thick unit of pebbly, sandy silt. Above a conformable boundary are 1.5 m of horizontally bedded, silty clay and sandy clay in which the modern soil is developing.

### ***Interpretation***

Wild Horse Side Arroyo downcut to within 1-2 m of its present elevation some time before 4800  $^{14}\text{C}$  yr B.P. Aggradation was underway at 4800 and 4500  $^{14}\text{C}$  yr B.P. The pedogenesis now occurring at the top of these sections provides a good example of how arroyo development coincides with soil development on remnant surfaces of valley fills.

## **Upper Dry Cimarron River, Section A**

### ***Description***

Section A is the furthest upstream section along the Dry Cimarron River. In the vicinity of this section, the river flows over ledges of shale between steep valley walls that are blanketed with bouldery colluvium and support a dense forest of mixed conifers and Gambel oak. At creek level, 60-70 cm of imbricated, boulder gravel contain charcoal fragments dating to 3410  $^{14}\text{C}$  yr B.P. The gravel fines upward into a unit of massive sand 50-cm thick and containing lenses of water-worn pebbles and bone fragments. A diffuse boundary separates these sands from an overlying wedge of silty colluvium that is 2.2 m thick and contains abundant, angular shale pebbles and occasional boulders. Charcoal near the base of this colluvium dates to 3490  $^{14}\text{C}$  yr B.P.

### ***Interpretation***

The Dry Cimarron River had downcut to bedrock here prior to 3490  $^{14}\text{C}$  yr B.P. It then aggraded until at least 3410  $^{14}\text{C}$  yr B.P. At the same time, colluvium was building outwards onto the surface of the valley fill.

## **Upper Dry Cimarron, Bull Pasture Section**

### ***Description***

A terrace several hectares in extent borders the northern side of the Dry Cimarron River where it enters a steep-walled valley on the lower slopes of Johnson Mesa. This terrace stands 6-8 m above the modern stream, which here flows over bedrock ledges between vegetated bars covered with large, basaltic boulders. At stream level, the Bull Pasture section reveals 2 m of clast-supported, boulder gravel. This is overlain by 1.1-1.6 m of horizontally bedded, silty clay containing lenses of water-worn pebbles and sand. We found charcoal dating to 3640  $^{14}\text{C}$  yr B.P. immediately above the clay/boulder boundary. The modern soil caps the section.

### ***Interpretation***

The Dry Cimarron had downcut to bedrock here some time before 3640  $^{14}\text{C}$  yr B.P., by which time it was aggrading.

## **Archuleta Creek, Upper Archuleta A**

### ***Description***

Upstream of this section, Archuleta Creek drains an area of approximately 3 km<sup>2</sup>. In summer it flows intermittently within a sinuous channel incised into a gravelly valley fill densely vegetated with Gambel oak. At creek level in section A, a gravel unit 45 cm thick contains charcoal fragments dating to 460  $^{14}\text{C}$  yr B.P. This gravel fines upwards into sandy, pebbly, silty clay in which the modern soil is developing.

### ***Interpretation***

When the dated charcoal was deposited, the floodplain of Archuleta Creek was aggrading, and incision has occurred since then.

## **Archuleta Creek, Upper Archuleta B Section**

### ***Description***

Section B exposes part of an extensive valley fill in the basin upstream of Prudencio Canyon. The section starts at creek level with 60 cm of horizontally bedded silt and clay.

The dark color of this clay-rich unit, its prismatic ped structure, the presence of diffuse secondary carbonates, and the chaotic arrangement of pebbles provide evidence of soil development. The upper portions of this buried soil are truncated by an erosional contact. It is overlain by 10-40 cm of imbricated, cobble gravel containing charcoal fragments dating to 3180  $^{14}\text{C}$  yr B.P. This gravel unit is conformably overlain by 70-90 cm of sandy, silty clay containing charcoal dating to 3230  $^{14}\text{C}$  yr B.P. The modern soil is developing in the upper 30 cm of this unit.

### ***Interpretation***

Section B records incision that truncated an older soil near modern stream level. Aggradation started before 3180  $^{14}\text{C}$  yr B.P. and continued after 3230  $^{14}\text{C}$  yr B.P. Some time later, the creek downcut to its present level.

## **Archuleta Creek, Section C**

### ***Description***

Section C cuts into the same terrace exposed in section B. At creek level, deposits of sandy gravel 60-200 cm thick are arranged in epsilon cross-beds and contain charcoal dating to 3600  $^{14}\text{C}$  yr B.P. This gravel fines upwards into a 25-75 cm-thick unit of slightly oxidized, sandy, silty clay containing root casts, diffuse secondary carbonate, and prismatic soil peds. This unit appears to be the B horizon of a truncated soil. Charcoal from the lower part of this buried soil dates to 3600  $^{14}\text{C}$  yr B.P. Along an erosional boundary, this buried soil is overlain by 5-20 cm of imbricated, cobble gravel. This gravel fines upward into 140-150 cm of silty clay with vague horizontal bedding. Charcoal 15 cm above the upper surface of the buried soil and 120 cm below the ground surface dates to 3330  $^{14}\text{C}$  yr B.P. The modern soil is developing in the upper 50 cm of this clay unit.

### ***Interpretation***

Rapid aggradation in the floodplain of a meandering stream was occurring at 3600  $^{14}\text{C}$  yr B.P. Some time between ca. 3600 and 3300  $^{14}\text{C}$  yr B.P., the creek probably incised its floodplain, allowing a soil to develop. Aggradation had resumed by 3300  $^{14}\text{C}$  yr B.P., and channel scour truncated the buried soil before the soil was buried by overbank silt and clay.

## **Archuleta Creek, Clam Lake Section**

### ***Description***

Upstream of this section, Archuleta Creek drains an area of approximately 35 km<sup>2</sup>. Slumping deposits of clay are exposed along the east side of Archuleta Creek near its confluence with the Dry Cimarron River. This clay originates from a deposit of laminated lake sediments five to ten meters thick that is exposed in several outcrops above creek level. This deposit contains the mineralized valves of a large, unidentified bivalve and is overlain by a lava flow. Clay from this "Clam Lake" deposit has been reworked into the Holocene valley fills of lower Archuleta Creek. The Clam Lake section is a poorly exposed bank of crudely stratified clay, basaltic boulders, and pods of water-rounded gravel. A piece of charcoal 2.5 m above creek level dates to 2530  $^{14}\text{C}$  yr B.P.

***Interpretation***

Archuleta Creek was aggrading its floodplain here ca. 2530  $^{14}\text{C}$  yr B.P.

**Oak Creek Section B*****Description***

This section consists of a 60-m long cut bank that exposes the lowest and most extensive terrace in the middle reaches of Oak Creek Canyon. Section B begins at creek level with 30-60 cm of cobble and boulder gravel that is crudely stratified in epsilon cross-beds. This unit fines upward into 20-30 cm of pebbly, silty clay with evidence for pedogenesis in the form of carbonate root casts and prismatic soil peds. Charcoal fragments near the base of this clay unit date to 5700  $^{14}\text{C}$  yr B.P. Overlying the buried soil along an erosional contact are 40-60 cm of crudely stratified gravel arranged in epsilon cross beds. Charcoal from this upper gravel unit dates to 4450  $^{14}\text{C}$  yr B.P. The gravel fines upward into 40 cm of silty clay, in which the modern soil is developing.

***Interpretation***

The Oak Creek B section indicates that Oak Creek had incised to near or below its modern level some time before 5700  $^{14}\text{C}$  yr B.P. At that time, overbank sediment was accumulating on the floodplain of a meandering channel. The development of a soil in these fine-grained sediments suggests the creek may have then incised. Aggradation was again in progress ca. 4450  $^{14}\text{C}$  yr B.P.

**Toll Gate Canyon Arroyo, Section A*****Description***

This arroyo is incised in a low-gradient alluvial fan at the mouth of Toll Gate Canyon. The watershed upstream covers an area of 8 km<sup>2</sup>. The arroyo is about 400 m long, and its retreating headcut exposes a 4-m high section. At the base of this section is a meter-thick lag of large boulders overlain conformably by 1.3 m of horizontally bedded silty clays and sands. The remaining 1.7 m of the section consists of alternating beds of clay-rich sediment and boulder gravel. At 2.5 m above the section's base, charcoal fragments date to 1640  $^{14}\text{C}$  yr B.P.

***Interpretation***

The history of the Toll Gate Canyon fan is undoubtedly much more complicated and interesting than the single section described here. Section A indicates that an older arroyo existed in this fan sometime before 1640  $^{14}\text{C}$  yr B.P. was being infilled around this time.

**Hector Arroyo*****Description***

Several headcuts are currently active in this informally named arroyo, despite the presence of sets of rusting bed springs. We described two sections here. Section 1 is a 360-cm high headcut. Starting from its base, there is 150 cm of strongly imbricated, angular, shale pebble gravel with interbeds of sandy clay 2-10 cm thick. Charcoal 260 cm below the ground surface dates to 4700  $^{14}\text{C}$  yr B.P. Charcoal from the same unit but 205

cm below the ground surface dates to 4570  $^{14}\text{C}$  yr B.P. Overlying the basal gravel along a conformable boundary are 155 cm of massive, pebbly clay. An unidentified bone fragment 3 cm below the upper surface of this clay unit dates to 140  $^{14}\text{C}$  yr B.P. The clay unit is overlain along an erosive contact by 55 cm of crudely stratified, angular, shale pebbles interbedded with sandy clays that have a distinct platy structure.

Section 2 is approximately 40 m from Section 2 and closer to the hill slope. Starting at its base, the shale bedrock is overlain by 55 cm of angular, shale pebbles interbedded with stringers of sandy clay. A lens of fire-cracked and oxidized shale lying on the surface of the bedrock contains charcoal dating to 4540  $^{14}\text{C}$  yr B.P. The shale gravel is overlain conformably by 200 cm of massive, silty clay. This clay unit is overlain along an erosive contact by 35 cm of clay-rich gravel.

### ***Interpretation***

An ancestral Hector Arroyo had downcut to near its present level before 4700  $^{14}\text{C}$  yr B.P. in section 1 and to bedrock near section 2 before 4540  $^{14}\text{C}$  yr B.P. Aggradation occurred at section 1 between 4700 and 4570  $^{14}\text{C}$  yr B.P.

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