Radiocarbon Analysis and Stratigraphic Data

The fluvial stratigraphy in two natural exposures were described to provide information on the age and relative stability of the terraces along the Teton River. Bulk soil samples were collected from both sites and examined for datable material (see Puseman and Ruggiero, 1998; in this appendix). Site CC1 is located on a terrace adjacent to Canyon Creek at its confluence with the Teton River. At this site, a pre-Teton Dam terrace surface is buried by about 50-cm of well-sorted, silty sand (fig. I-1). The deposit is related to either reservoir sedimentation or deposition associated with the failure of landslides into the reservoir prior to the failure of the dam. A piece of *Alnus*-type charcoal was recovered from a buried soil just below the contact with the overlying silty sand and about a meter above the water surface of Canyon Creek. The charcoal yielded a calibrated radiocarbon age of 290-0 cal yrs B.P (see table I-1). This is consistent with the expected age of a low terrace in this position relative to river.

Figure I-1.—Weak soil developed on reservoir-related sediment at the mouth of Canyon Creek.

Site TR1 is located in a natural exposure in the right bank of the Teton River about 2000 feet downstream of the mouth of Canyon Creek. The bank is situated in the center of the canyon along the outside edge of an early Holocene or late Pleistocene terrace opposite a large landslide on the left canyon wall. As at site CC1, a pre-Teton Dam deposit at TR1 has been buried by a 10-cm-thick bed of reservoir-related sediment. Exposed in the bank is a 1-meter-thick section of interbedded clayey silt, organic-rich silt beds, sand, and gravel (fig. I-2). A piece of *Juniperus* charcoal was recovered from a buried organic bed about 50-cm below the round surface and about 50-cm above a fluvial gravel exposed at the base of the section. The charcoal yielded a calibrated radiocarbon age of 470-280 cal yrs B.P (see table I-1).

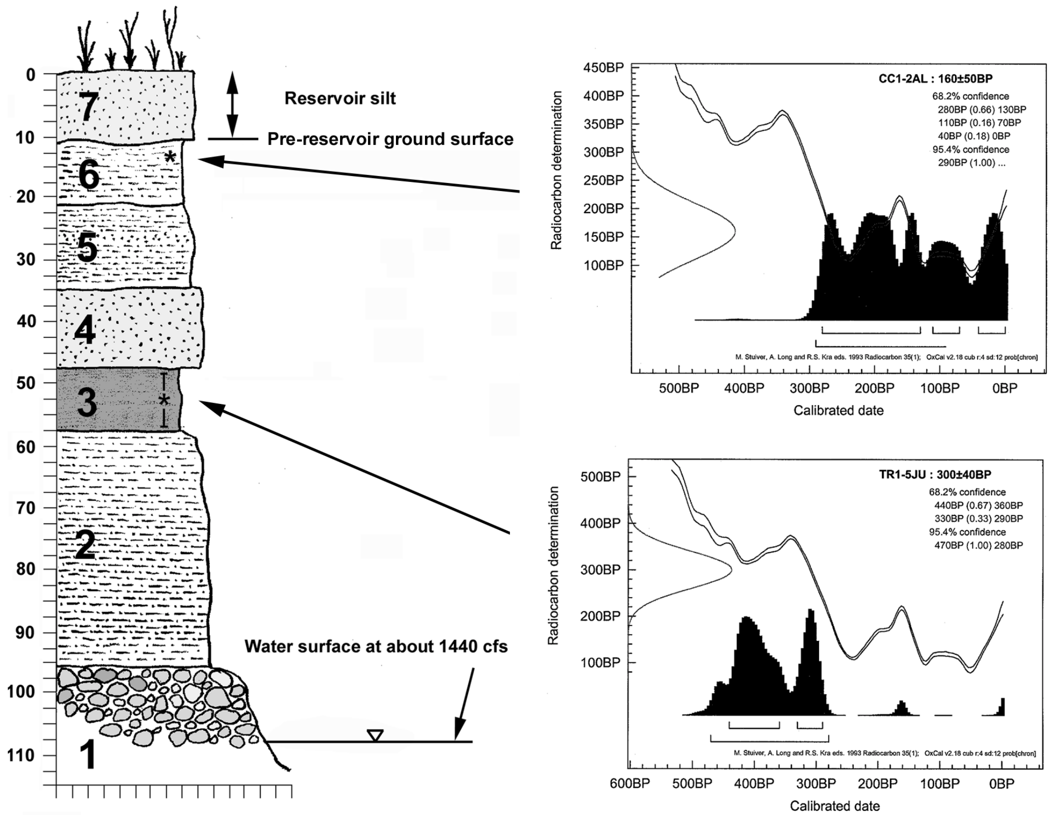

Figure I-2.—Generalized stratigraphic section and radiocarbon age determinations for fluvial deposits exposed in natural exposure downstream of Canyon Creek. Unit 1; well-rounded, well-sorted granitic and metamorphic gravel. Unit 2; light brown to gray clayey silt, thin beds up to 10 cm thick. Unit 3; dark organic-rich bed. Unit 4 medium- to fine-grained, well-sorted sand. Unit 5; clayey silt contains a thin fine-grained sand bed. Unit 6; clayey silt, sampled for radiocarbon analysis at the mouth of Canyon Creek. Unit 7; fine-grained massive silty sand (reservoir related deposit).

Due to the position of the terrace in the canyon, the post-dam deposit is believed to be the distal fine-grained facies of the large landslide on the opposite canyon wall that failed into the reservoir (i.e. turbidity flow). This interpretation is supported by observations throughout the Teton River Canyon of a general sorting of the landslide debris in a downslope direction. The coarsest material (boulders and cobbles) was deposited on the adjacent terraces or on the canyon walls just downslope of the headscarp. Finer-grained material was deposited either into the channel or completely across the channel and onto the terrace surfaces on the opposite bank.

In addition, the exposed section in the bank indicates that the terrace at this location has been relatively stable for at least the last several hundred years (470-280 cal yrs B.P.). The gravel at the bottom of the section represents an older bar deposited by the Teton River that was subsequently buried by finer-grained fluvial sediment. The character of interbedded silty sand, sand, and organic-rich beds indicates that the terrace has been slowly accreting, probably the result of shallow inundation by large floods.

Table I-1.—Radiocarbon Analysis Results for Teton River Restoration Study

Site	Field Sample Number	Laboratory Sample Number	Type of Material	Sample Weight (grams)	Radiocarbon Age (14C yrs B.P.)	Calibrated Age (cal yrs B.P.)
TR1	TR1-5JU	Beta-121553	*Juniperus* charcoal	0.122	300±40	470-280
CC1	CC1-2AL	Beta-121554	*Alnus* charcoal	0.007	160±50	290-0

EXAMINATION OF BULK SOIL FROM THE TETON RIVER, IDAHO

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Introduction

Bulk soil samples were recovered from natural exposures in stream terraces adjacent to the Teton River near the Idaho-Wyoming state line in Idaho. Botanic components and detrital charcoal were identified, and potentially radiocarbon datable material was separated.

Methods

The samples were floated using a modification of the procedures outlined by Matthews (1979). Each sample was added to approximately 3 gallons of water. The sample was stirred until a strong vortex formed, which was allowed to slow before pouring the light fraction through a 150 micron mesh sieve. Additional water was added and the process repeated until all visible macrofloral material was removed from the sample (a minimum of 5 times). The material which remained in the bottom (heavy fraction) was poured through a 0.5 mm mesh screen. The floated portions were allowed to dry.

The light fractions were weighed, then passed through a series of graduated screens (US Standard Sieves with 4 mm, 2 mm, 1 mm, 0.5 mm and 0.25 mm openings to separate charcoal debris and to initially sort the remains. The contents of each screen were then examined. Charcoal pieces larger than 1 mm in diameter were broken to expose a fresh cross-section and examined under a binocular microscope at magnifications up to 140x. The remaining light fraction in the 4 mm, 2 mm, 1 mm, 0.5 mm, and 0.25 mm sieves was scanned under a binocular stereo microscope at a magnification of 10x, with some identifications requiring magnifications of up to 70x. The material which passed through the 0.25 mm screen was not examined. The coarse or heavy fractions also were screened and examined for the presence of botanic remains.

Macrofloral remains, including charcoal, were identified using manuals (Core et al. 1976; Martin and Barkley 1973; Panshin and Zeeuw 1980; Petrides and Petrides 1992) and by comparison with modern and archaeological references. The term "seed" is used to represent seeds, achenes, caryopses, and other disseminules. Remains from both the light and heavy fractions were recorded as charred and/or uncharred, whole and/or fragments. Because charcoal and possibly other botanic remains were to be sent for radiocarbon dating, clean laboratory conditions were used during the flotation and identification to avoid contamination. All instruments were washed between samples, and samples were protected from contact with modern charcoal.

Discussion

The sampled stream terraces were located adjacent to the Teton River where it flows through a narrow canyon on the eastern edge of the Snake River plain at an elevation between 5200 and 5400 feet. Vegetation on the south-facing slopes in the canyon is dominated by juniper (Juniperus) and sagebrush (Artemisia), while the north-facing slopes contain pine (Pinus), aspen (Populus), and ir (Abies). The canyon bottom supports a thin riparian corridor with cottonwood (Populus), hawthorn (Crataegus), chokecherry (Prunus virginiana), and willow (Salix). Four bulk samples were recovered from the study.

Sample TR1-5 was collected from a depth of 48-58 cm (Table 1). This sample contained two charred Juniperus seed fragments, five small, charred, unidentifiable seed fragments, and a piece of charred PET fruity tissue that may represent a fleshy fruit or berry that burned (Tables 2 and 3). Uncharred seeds and rootlets represent modern plants. A few sclerotia also were present. Sclerotia are commonly called "carbon balls". They are small, black, solid or hollow balls that range from 0.5 to 4mm in size. Sclerotia are associated with mycorrhizae fungi, such as Cenococcum graniforme, that have a mutualistic relationship with tree roots. Sclerotia are the resting structures of the fungus, identified by Dr. Kristiina Vogt, Professor of Ecology in the School of Forestry and Environmental Studies at Yale University. Many trees are noted to depend heavily on mycorrhizae and may not be successful without them. "The mycelial strands of these fungi grow into the roots and take some of the sugary compounds produced by the tree during photosynthesis. However, mycorrhizal fungi benefit the tree because they take in minerals from the soil, which are then used by the tree" (Kricher and Morrison 1988:285). Sclerotia appear to be ubiquitous and are found with coniferous and deciduous trees including Abies (fir), Juniperus communis (common juniper), Larix (larch), Picea (spruce), Pinus (pine), Pseudotsuga (Douglas fir), Acer pseudoplatanus (sycamore maple), Alnus (alder), Betula (birch), Carpinus caroliniana (American hornbeam), Carya (hickory), Castanea dentata (American chestnut), Corylus (hazelnut), Crataegus monogyna (hawthorn), Fagus (beech), Populus (poplar, cottonwood, aspen), Quercus (oak), Rhamnus fragula (alder bush), Salix (willow), Sorbus (chokecherry), and Tilia (linden) (McWeeney 1989:229-130; Trappe 1962).

Several datable charcoal and wood types were present in sample TR1-5. The charcoal record was dominated by Juniperus, with a smaller amount of Salicaceae charcoal present. Pieces of uncharred Juniperus wood also were present, as well as possible Prunus and conifer wood. Non-floral remains included small pieces of uncharred bone, a fish scale, insect fragments, snails, and rock/gravel.

Sample TR4-2 represents the B horizon at a depth of 25-50 cm, and sample TR4-3 represents the B horizon at a depth of 50-78 cm. Neither of these samples contained any datable material. Uncharred rootlets from modern plants, insect fragments, and rock/gravel were the only remains recovered in each of these two samples.

Sample CC1-2 was taken from a buried soil at a depth of 50 cm below the surface. A charred Poaceae seed fragment represents grass that burned. Uncharred seeds and rootlets again represent modern plants. Sufficient quantity of Alnus-type charcoal was recovered for AMS dating. Pieces of Betula-type, Salicaceae, and small, unidentifiable charcoal also were present. Since alder and birch are not noted in the immediate study area, these charcoal pieces may have been carried down from riparian habitats found upriver of the study area. Pieces of uncharred Salicaceae wood also were present. Sclerotia, insect fragments, snails, and rock/gravel complete the record.

Summary and Conclusions

Flotation of four samples from terraces adjacent to the Teton River near the Idaho-Wyoming state line resulted in recovery of charcoal and wood that may be sent for radiocarbon dating. Charred and uncharred plant remains represent plants found in the immediate study area as well as habitats found upriver of the Teton River, possibly from the Teton Range to the east.

Table 1.— Provenance Data for Samples From the Teton River, Idaho

Sample No.	Depth below surface	Description
TR1-5	48-58 cm	Bulk sediment, Bed 5
TR4-2	25-50 cm	Bulk sediment from the upper half of the B horizon
TR4-3	50-78 cm	Bulk sediment from the lower half of the B horizon
CC1-2	50 cm	Bulk sediment from buried soil below dam debris at the mouth of the canyon creek

Table 2.—Macrofloral Remains From the Teton River, Idaho

Sample			Charred		Uncharred		Weights/
No.	Identification	Part	W	F	W	F	Comments
TR1-5	Liters Floated						1.8 L
48-58	Light Fraction Weight						5.10 g
cm	FLORAL REMAINS:						
	Juniperus	Seed		2			0.004 g
	Unidentified	Seed		5			0.004 g
	PET Fruity	Tissue		1			<0.001 g
	Asteraceae	Seed			2		
	Carex	Seed			11		
	Chenopodium	Seed			5		
	Scrophulariaceae	Seed			1		
	Rootlets					X	Numerous
	Sclerotia				X		Few
	CHARCOAL/WOOD:						
	Juniperus	Charcoal		36			0.122 g
	Salicaceae	Charcoal		5			0.030 g
	Unidentified	Charcoal		X			0.028 g
	Conifer	Wood				1	<0.001 g
	Juniperus	Wood				8	0.050 g
	cf. Prunus	Wood				4	0.201 g
	NON-FLORAL REMAINS:						
	Bone					21	0.008 g
	Fish scale				1		
	Insect	Chitin				39	
	Rock/Gravel					X	Moderate
	Snail				X	X	0.184 g
TR4-2	Liters Floated						1.0 L
25-50	Light Fraction Weight						2.67 g
cm	FLORAL REMAINS:						
	Rootlets					X	Numerous
	NON-FLORAL REMAINS:						
	Insect	Chitin				10	
	Rock/Gravel					X	Moderate

Table 2 (continued)

Sample			Charred		Uncharred		Weights/
No.	Identification	Part	W	F	W	F	Comments
TR4-3	Liters Floated						1.0 L
50-78	Light Fraction Weight						1.95 g
cm	FLORAL REMAINS:						
	Rootlets					X	Numerous
	NON-FLORAL REMAINS:						
	Insect	Chitin				13	
	Rock/Gravel					X	Moderate
CC1-2	Liters Floated						0.8 L
50 cm	Light Fraction Weight						5.88 g
	FLORAL REMAINS:						
	Poaceae	Seed		1			<0.001 g
	Cheno-am	Embryo			3		
	Chenopodium	Seed			12	49	
	Cirsium	Seed				4	
	Cyperaceae	Seed			2		
	Rootlets					X	Numerous
	Sclerotia				X		Few
	CHARCOAL/WOOD:						
	Alnus-type	Charcoal		3			0.007 g
	Betula-type	Charcoal		2			0.001 g
	Salicaceae	Charcoal		1			<0.001 g
	Unidentifiable (small)	Charcoal		X			0.002 g
	Salicaceae	Wood				10	0.444 g
	Unidentified	Wood				X	0.329 g
	NON-FLORAL REMAINS:						
	Insect	Chitin				9	
	Rock/Gravel					X	Few
	Snail				2	67	

W = Whole
F = Fragment
X = Presence noted in sample
g = grams

Table 3.—Index of Macrofloral Remains Recovered From Along the Teton River, Idaho

Scientific Name	Common Name
FLORAL REMAINS:	
Asteraceae	Sunflower family
Cirsium	Thistle
Cheno-am	Includes goosefoot and amaranth families
Chenopodium	Goosefoot
Poaceae	Grass family
Scrophulariaceae	Figwort family
PET Fruity	Fruity epithelioid tissues; resemble sugar-laden fruit or berry tissue without the seeds
CHARCOAL/WOOD:	
Alnus-type	Alder
Betula-type	Birch
Conifer	Cone-bearing, gymnospermous trees and shrubs, mostly evergreens, including the pine, spruce, fir, juniper, cedar, yew, and cypress
Juniperus	Juniper
cf. Prunus	Plum, Cherry
Salicaceae	Willow family; includes willow, cottonwood, aspen

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