SUBMERGED SHORELINES OF JACKSON LAKE, WYOMING: DO THEY EXIST AND DEFINE POSTGLACIAL DEFORMATION ON THE TETON FAULT?

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Objectives

The Teton fault is one of the most active normal faults in the world, as attested by the precipitous high front of the Teton Range. After deglaciation of northern Jackson Hole about 15,000 years ago (Porter and others, 1983), offset on the Teton fault southwest of Jackson Lake has totaled 60-80 feet (19-24 m) (Gilbert and others, 1983). In less than the last 9 million years, offset on the Teton fault has totaled 25,000-30,000 ft (7,500-9,000 m) (Love and Reed, 1971).

Downdropping on the Teton fault results in tilting of Jackson Hole towards the fault. Because the level of Jackson Lake is controlled by the fortuitous location well east of the fault of both the lake outlet and the low-gradient Oxbow Bend reach of the Snake River, submerged paleoshorelines of Jackson Lake may record this downdropping and tilt (for a more complete explanation, see last years report). Study of the subaerial part of the fault (Gilbert and others, 1982) has not permitted field definition of the amount of offset during individual faulting events. Consequently, the size and recurrence interval of associated earthquakes has not been determined based on the actual history and character of the Teton fault.

If paleoshorelines can be recognized and the lake outlet has been tectonically and erosionally stable, such paleoshorelines can be interpreted to define the age and size of offsets and associated earthquakes on the Teton fault over the last 15,000 years. Thus, the number and spacing of paleoshorelines may define the history of offsets and associated earthquakes on the Teton fault. Such information is of value to interpret the Teton landscape to Park visitors, to the design of engineering structures in the region, and to understanding of ongoing Basin and Range tectonism

Methods

The marine geophysical methods used in 1986 to locate paleoshorelines inferred to result from downdropping on the Teton fault are described in that year's report. Coring with "one-shot" 4-inch gravity corer in 1986 resulted in cores that did not penetrate through the lacustrine sediment into the paleoshoreline deposits, and thus were unsuitable for defining times of submergence. In 1987, cores were through the lake sediment mantle to and sometimes into the paleoshoreline deposits. These cores contain a stratigraphic record and carbon-14 samples that can be used to define the subsidence history of the upper samples 5(?) paleoshorelines. Increasingly older, deeper paleoshorelines are expected to be mantled with a increasingly longer record of lacustrine sedimentation.

In 1987, lake-margin cores were taken from a platform built of plywood lashed onto two 17 foot canoes. The platform was held in position by 4 heavy anchors. A 2-inch Livingston corer was used to take cores up to 3 ft long, and core increments were extruded and inspected just after they were taken, and then wrapped in plastic cling wrap and aluminum foil. For cores longer than 3 ft, casing was emplaced from the platform down to the lake bottom and multiple core increments taken.

Results

As described in last years report, about 10 paleoshorelines are apparent from the marine geophysical records and may represent a comparable number of major post-glacial earthquakes on the Teton fault.

Field work in 1987 concentrated on obtaining cores down through the sediment to paleoshoreline deposits. The stratigraphy, carbon samples, and altitudes of paleoshorelines in these cores are being used to define and date the times of submergence and hence to construct the post-glacial history of downdropping on the Teton fault. Coring sites were selected on the basis of the marine geophysical records obtained in summer of 1986. Two areas were cored: Spaulding Bay (13 cores) and Bearpaw Bay (20 cores). The cores were taken where paleoshorelines were no deeper than 18 feet, and no more than the last half of the post-glacial history of the Teton fault is expected to be defined from the 1987 coring. If the younger record of movement on the Teton fault can be defined and dated from these cores, attempts will be made in 1988 to take longer cores in deeper water to define the older part of the post-glacial record (about 6,000 to 15,000 years ago).

Two types (facies) of lake sediment were cored. (1) Gray sand with a fine-grained matrix. This cohesive sand occurs at sites in shallow water with moderate protection from storm waves. This sand contains zones of laterlogged wood quite suitable for carbon-14 dating. (2) Olive mud with grass-like ribbons of vascular plants and probably rich in diatoms occurs in more protected or deeper water sites. Most cores were taken through about 1-3 feet of cohesive sand facies that mantles paleoshoreline deposits less than 12 feet below the pre-reservoir level of Jackson Lake. Five cores were taken in the olive mud facies as much as 10 feet thick that mantles paleoshoreline(?) deposits as much as 18 feet below the pre-reservoir level of Jackson Lake.

The cores have been described and sampled for carbon-14 dating. Most of the samples are wood, only 2 of which contain enough carbon for a conventional carbon-14 analysis, but which should provide excellent material for accelerator carbon-14 analysis. Eleven samples were selected and submitted to Meyer Rubin at the USGS laboratory in Reston, VA. He can run conventional dates on two of the wood samples, and plans to prepare the samples and run the other samples on the TAMS facility at the University of Arizona.

One core contained volcanic ash at the base of an olive mud section. This ash has been submitted for identification by the USGS lab in Menlo Park.

To date, one provision carbon-14 age from a core in Bearpaw Bay suggests 5 feet of submergence in the last 1100 years. The results of the other submitted carbon-14 samples is needed to evaluate this preliminary results, but stratigraphic relations in the core suggest this submergence may have resulted from 2 offsets on the Teton fault.

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