AVALANCHE ACCIDENT - GLADIATOR RIDGE

SUBMITTED BY: Sawtooth National Forest Avalanche Center
LOCATION: 20 Miles Northwest of Sun Valley, ID
DATE: March 6, 2009
SUMMARY: 1 skier caught, buried and killed; 1 skier seriously injured

SYNOPSIS:

On March 6, 2009, a group of four backcountry skiers from Ketchum, ID, were backcountry skiing in a popular area near Galena Lodge, approximately 20 miles northwest of Ketchum. They chose to ski a west-northwest facing slope that was approximately 38-40 degrees in the start zone. After the first skier descended safely, the second and third skiers triggered an avalanche. One was buried and killed; the other seriously injured after hitting a tree. The SS-ASu-D2.5-R5 avalanche was 2-3 feet deep, over 1500 feet wide, and ran 400-500 vertical feet. The Sawtooth National Forest Avalanche Center (SNFAC) had rated the avalanche danger rating as considerable on the morning of the accident.

The coordinates for the accident:

N 43° 54' 31.7"
W 114° 40' 01.9"

AVALANCHE:

The avalanche was classified as a SS-ASu-D2.5-R5. It released on a west-northwest facing (290°) slope, broke 2-3 feet deep, and propagated over 1500 feet wide. The elevation of the crown was approximately 9050 feet, and the slide ran between 400 and 500 vertical feet. The slope was a wide, partially open slope about 300 vertical feet high below a lower-angled area of closely spaced trees. While not a defined avalanche path in the classic sense, nearly the entire slope avalanched, resulting in the R5 classification. The slope was 38-40 degrees in the start zone, sparsely treed, and had sporadic rock outcrops located across the upper portions of the slope and generally along the fracture line. Most of the rock bands were covered prior to the avalanche. The victim(s) triggered the avalanche on the south end of the path. The bottom of the path where the victims came to rest consisted a terrain trap of dense trees and a slope transition where the debris piled up to an estimated 8-12 feet deep. The north end of the path had a less dramatic transition at the base of the slope and the debris spread out further and less deeply.

WEATHER & SNOWPACK:

Weather data is taken from the Galena Summit SNOTEL and Titus Ridge weather stations, approximately three and a half and five miles southwest of the accident site.

After an extended dry spell lasting from early-January to mid-February, the snowpack in south-central Idaho was 75% of average. During this period, a variety of weak layers formed, and given the length of the dry weather, considerable variability developed in the snowpack. Many slopes had avalanched during an extensive avalanche cycle earlier in the season, leaving them with only a few feet of snow on them. Strong winds during this period also stripped many slopes down to shallow snow cover.

When snow began to fall again on February 13th, it buried a weak snow surface that became known as the "Friday the 13th Layer." It consisted of a fairly widespread, thin, facet layer or facet/crust matrix, but on slopes that were shallow due to prior avalanching or wind erosion, the weak layer was 1-2 feet of depth hoar. A series of snow storms occurred between Feb. 13 and the end of the month dropped 2" of water equivalent; strong winds accompanied these storms and contributed to a widespread avalanche cycle on the Friday the 13th layer. Several days of warm temperatures followed the storm cycle, and the instability

seemed to subside quickly as the facet layer gained strength. The next wave of precipitation occurred during the three days prior to the accident, March 3-5, and added another 1.6" of water equivalent that was also accompanied by moderate to strong westerly winds.

SNFAC Avalanche Advisory, March 6, 2009:
"Bottom Line: In the North Valley, Sawtooth Mountains and areas that have received more than a foot of snow in the past week, the avalanche danger is CONSIDERABLE at mid to upper elevations on steeper slopes. The main concerns, where it is possible to trigger a slide today, are for windloaded slopes and areas of weak underlying snow in steep, rocky terrain."

The accident slope had a snowpack that was extremely variable in depth and structure due to steep, rocky terrain, a windward aspect, and a natural avalanche that had occurred earlier in the season. We conducted two crown profiles in order to evaluate this variability. In the first profile, total depth was 180cm; the Friday the 13th facet layer was 90cm deep and consisted of a 10cm thick layer of 1.5mm rounded facets with a hardness of 4-Finger minus. The slab ranged from Fist-hard precipitation forms at the top to a 1-Finger-hard layer of broken particles and rounded grains at the base. Although the structure was poor, stability tests produced no significant results.

Another pit about 50 feet from the first one and above the avalanche crown gave very different results. Here, total depth was 130cm, and below the 75cm slab there was 55cm of 2-4mm of depth hoar; this layer had a hardness of Fist-plus. An Extended Column Test (ECT) failed on this layer, propagated column-wide and slid off the base on 22 taps, indicating the ability for both a fracture to initiate and propagate in this location. Forecasters skinning above the crown face during the investigation noted a weak underlying snowpack extending approximately 50 to 75 vertical feet up into the trees above the open slope. Higher up the slope, the snowpack layering improved.

While the fact that the slope had avalanched previously in the season may have played a contributory role, the generally shallow snow pack, the rockiness of the slope and the propensity for westerly aspects in this region to harbor weak, faceted snow seem to be more significant factors in the slope's instability. The trajectory of the deceased victim's ski track above the crown leads towards a rock outcrop that we suspect is the avalanche's trigger point. We believe the snowpack near the outcrop was weak, shallow, and similar to the snow in the second pit described above. Once the fracture initiated there, the structure was sufficiently poor even in deeper, stronger areas to propagate the slide for a very large distance. Recent loading over the days prior most likely increased the stress on the weak layers and increased the likelihood of propagating a fracture.

Later on the same day, a skier triggered another avalanche on Titus Ridge near the top of Galena Summit (SS-ASu-D2). Although the aspect was east, the snowpack was similar in structure. On the day after the accident, we observed a new natural avalanche (SS-N-D3-R1) on a high elevation, westerly aspect.3.25 miles to the southeast.

EVENTS LEADING UP TO THE ACCIDENT:

A group of four experienced, local backcountry skiers headed out the morning of March 6th. They had checked that morning's avalanche advisory and discussed conditions in relation to where they planned to ski. The SNFAC rated the avalanche danger as considerable for the area they planned to ski. The group skinned up Mushroom Ridge, a popular backcountry area on the east side of Highway 75 near the base of Galena Summit. They dropped down the east side into Westernhome Gulch and ascended the west shoulder of Gladiator Peak, where they reached a ridgeline at approximately 9200 feet elevation and continued up to approximately 9400 feet.

At this point they debated which of three slopes to ski back towards Westernhome Gulch: a south and west tending series of frequently skied ribs and gullies; a higher, northwest-facing, more alpine-like route further up the peak; or a route in between the first two that ran through ski-able trees and opened onto a

steeper, lightly-gladed slope. There was some discussion about the open area being steep, and one member reportedly stated it had avalanched earlier in the season.

The group chose to ski the treed, middle route and re-group at the top of the steep break-over. They descended spread apart vertically and regrouped while still in the trees and above the break-over. They could not see the break over or the open slope from this point. Skier 1 performed a hand pit and judged the stability to be good in the near-surface layering. Skier 1 then skied down through the trees, went out of sight of the other three, and veered slightly left, continued down the open slope, and stopped on a small moraine at the base of the slope.

Skier 2 began to descend an estimated 30 seconds or more after Skier 1. Skiers 3 and 4 followed Skier 2 after similar intervals.

Skier 2 entered the open slope and slowed momentarily due to some tight trees before veering to the left around a clump of trees. He later reported that upon entering the open area it did not feel right. Meanwhile, Skier 3 entered the open slope close to skier 2's tracks, veered right of the clump of trees and skied close to a rock outcropping.

Skier 2 reported that while he was moving left and continuing downhill, the entire slope avalanched and carried him further downhill. He came to rest near the base of the slope, wrapped around a tree with his head out, his good leg caught in his buried ski with the Dynafit binding toe in climbing mode. On his other leg he had sustained a broken femur; that leg had come loose from his other ski.

Skier 4 reports coming to the edge of the trees, seeing the opening and stopping to look ahead. At that point, he saw the open slope 15 or 20 feet below him fracturing and, further downhill, large blocks of snow moving and breaking up, disappearing out of sight as the slope steepened.

The avalanche ran close to but did not reach Skier 1, who from her position had not been able to see any of the other skiers on the slope. At this point the initial rescue began.

SEARCH AND RESCUE:

Skier 1 simultaneously put skins on her skis and hollered to establish who was where. The injured and partially buried Skier 2 yelled from his position. Skier 4 had stopped in trees about fifty feet above the fracture line and he was yelling down to Skiers 1 and 2.

Skier 1 proceeded almost directly uphill to Skier 2. Skier 4 reported later that he believed he had made voice contact with Skier 1 and that he had informed her that he was planning to climb upslope and take an alternate route to the base of the slope; however, Skier 1 had not understood Skier 4 and Skier 1 believed that Skier 4 was buried along with Skier 2.

Skier 4 reported later that he had been afraid if he traveled directly down to the bed surface from his position above the fracture line that he would dislodge the "hang fire" snow located between the fracture line and him and that the hang fire snow might affect Skiers 1 and 2.

Skier 1 meanwhile reached Skier 2 in an estimated 10 minutes and then spent five minutes extricating him, from the tree he had hit. Skier 1 then moved on to search for Skier 3 and Skier 4 (whom she believed was buried). Skier 1 located the completely buried Skier 3 in an estimated three minutes by following her beacon signal and by visually seeing a small portion of one of Skier 3's ski tips sticking out of the snow. Skier 1 then began digging down into the snow to Skier 3.

Meanwhile, a group of four skiers directly across the canyon on Mushroom Ridge had removed their climbing skins and prepared to descend into Westernhome Gulch. They observed the new fracture line within moments of the slide. They heard yelling and responded by yelling, but did not make contact with

the first party. After devising a quick plan, they skied safely to the bottom of the canyon, replaced their skins and climbed to the accident site.

When the four rescuers arrived at the debris, Rescuer 1 reached injured Skier 2 first, recognized a life threatening injury, and immediately attended to Skier 2 while Rescuers 2, 3, and 4 continued on to help Skier 1.

Rescuer 1 remained with Skier 2, performing first aid and stabilizing the victim's injuries. Rescuers 2 and 3 heard Skier 1 and hurried to where she was digging Skier 3 out of the debris. Skier 1 told Rescuers 2 and 3 that one other person was buried and she believed he was buried nearby. Rescuer 2 began a beacon search for Skier 4 and Rescuer 3 began to immediately assist Skier 1 extricating Skier 3 and then began team CPR. Skier 1 estimates it took ten minutes to uncover and extricate Skier 3. Rescuer 2 continued searching for Skier 4 and was joined by Rescuer 4 who had stopped to assist Rescuer 1 with the injured Skier 2.

An estimated thirty minutes elapsed from the time of the avalanche to the time the Skier 3 was extricated and her airway opened. She was uncovered face down with her head approximately two feet deep and feet approximately four feet deep. Her head was downhill and her feet uphill with both skis still on her feet. The victim's Dynafit bindings were set with the toe lever up in the climbing non-release position. One knee was flexed with the ski tail downhill and partly protruding uphill out of the snow, the other leg rested in a straighter position. The victim had no pulse or respirations. The rescuers maintained CPR for approximately 1 and one half hours. The coroner's report indicated the victim died from traumatic asphyxiation, described as compressive trauma incurred during the avalanche and burial by debris.

Approximately fifty minutes after the avalanche occurred and twenty minutes after extricating skier 3, the rescuers continued performing CPR on skier 3 and had stabilized injured Skier 2 including setting up traction for his injured leg.

Rescuer 2 continued to look for Skier 4 whom all the Rescuers and Skiers 1 and 3 believed was buried. The Rescuer 2 and Skier 1 came to the conclusion that Skier 4's beacon had either malfunctioned or been damaged in the avalanche and that Rescuer 2 would climb up the steep bed surface and visually check behind trees and other potential impact areas and that Skier 1 would leave the scene and summon help. Their plan was for Skier 1 to climb Mushroom Ridge, which was almost entirely in sight of the rescue area, and to either utilize a cell phone as reception is accessible on the ridge, or exit to the road and drive to nearby Galena Lodge to alert 911. No members in the Rescue or Skier groups had a cell phone but the possibility existed that other skiers on Mushroom Ridge that day may have had one. If no phones were accessible, Skier 1 would quickly exit to the road and their parked cars by the up track or a lower angle west facing slope.

Moments after Rescuer 2 and Skier 1 parted, Skier 4 made voice contact from directly below the accident site. Skier 4 had traversed up hill through timber and unbroken snow until reaching the up track. He then descended along side the up track to reach the base of the slope.

After making positive voice contact with Skier 4, it was then quickly decided that Skier 1 and 4 would exit together. Rescuer 2 proceeded to Rescuer 3 and Skier 3 and relieved Rescuer 3 performing CPR.

Skier 1 and 4 skied out to the road, where they alerted passing Forest Service (FS) personnel of the accident. The FS personnel and the two skiers traveled to Galena Lodge to alert 911 (Blaine County Emergency Response) and provide details about the exact location and accessibility.

A well managed rescue operation in difficult conditions quickly ensued. It combined the efforts of many different groups in the area including Blaine County Sheriff and Search and Rescue, Sun Valley Ski Patrol, Galena Backcountry Patrol, all of the local fire departments - Ketchum, Sun Valley, Wood River, and Hailey and the Sun Valley Heli-Ski Company (SVHS). In addition, Life Flight sent a helicopter to the local hospital and the Air National Guard dispatched a large helicopter to the area. Difficult terrain, deep trail-breaking and heavy timber made access up Westernhome Gulch almost impossible for snow

machines. Snow squalls and extremely poor visibility created periods during which the Sun Valley Heli-Ski pilot had to shut down and wait while attempting to fly up to Galena Lodge from Ketchum, at Galena Lodge staging area and also at the accident site.

The SVHS helicopter placed guides and later paramedics on top of Gladiator Ridge with rescue sleds and gear. They descended onto the flank of the avalanche, reached the expertly attended patient, loaded him onto the sled and together with multiple rescuers moved him to the helicopter which had landed and shut down in an open area in Westernhome Gulch. The injured patient was transported by air to Galena Lodge, transferred to a waiting ambulance and driven 25 miles to the local hospital where he underwent successful surgery and was released two days later.

Meanwhile, other responders on skis continued to break trail into the accident site from the Galena Lodge nordic ski trails to assure access and egress in the event of the weather deteriorating further and preventing SVHS from continuing operations at the accident site.

Shortly after evacuating Skier 2 and just before dark a team of rescue workers transported the deceased victim to the staging area at Galena Lodge. All the rescuers were able to leave the site and reach the road or Galena Lodge by dark.

While this rescue operation was ongoing, a new 200 foot wide avalanche was reported from further up the highway on Titus Ridge. This slide was east-facing and visible from the road with tracks visible leading into it. It could not be determined from the road if tracks exited the slide. In difficult flying conditions, SVHS also placed two guides and an avalanche dog at the top of this slide; this team then searched the debris and determined no one was trapped in this avalanche.

IN CLOSING:
We write these reports to ensure accurate information is available and to assist others who may encounter themselves in similar situations in the future. The Sawtooth NF Avalanche Center would like to acknowledge the skills, expertise and professionalism of those involved in this rescue operation. They all deserve recognition, both public and private groups and individuals.

MAP AND PHOTOS:

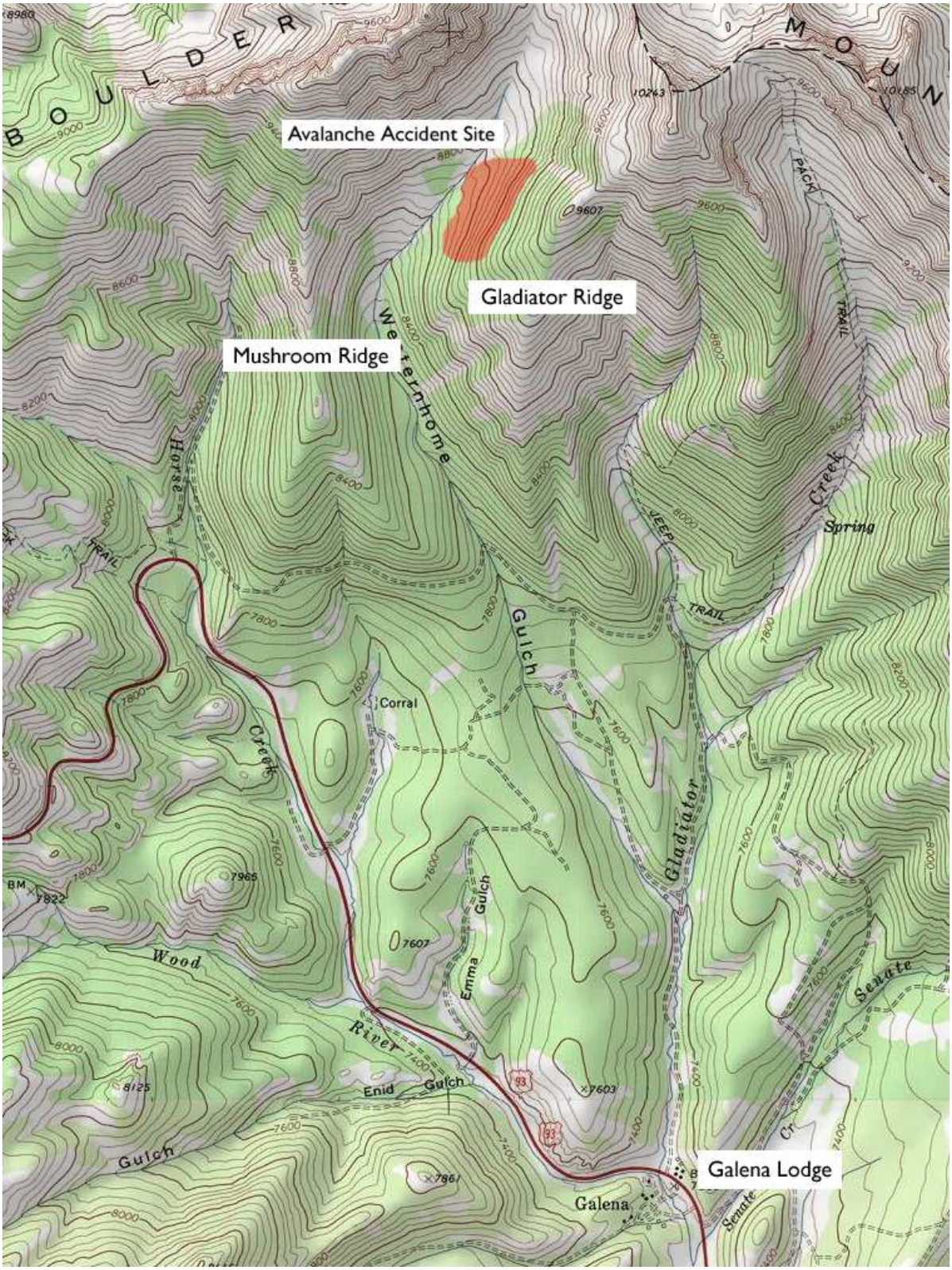

Figure 1: Map showing location of avalanche on the west-northwest aspect of Gladiator Ridge.

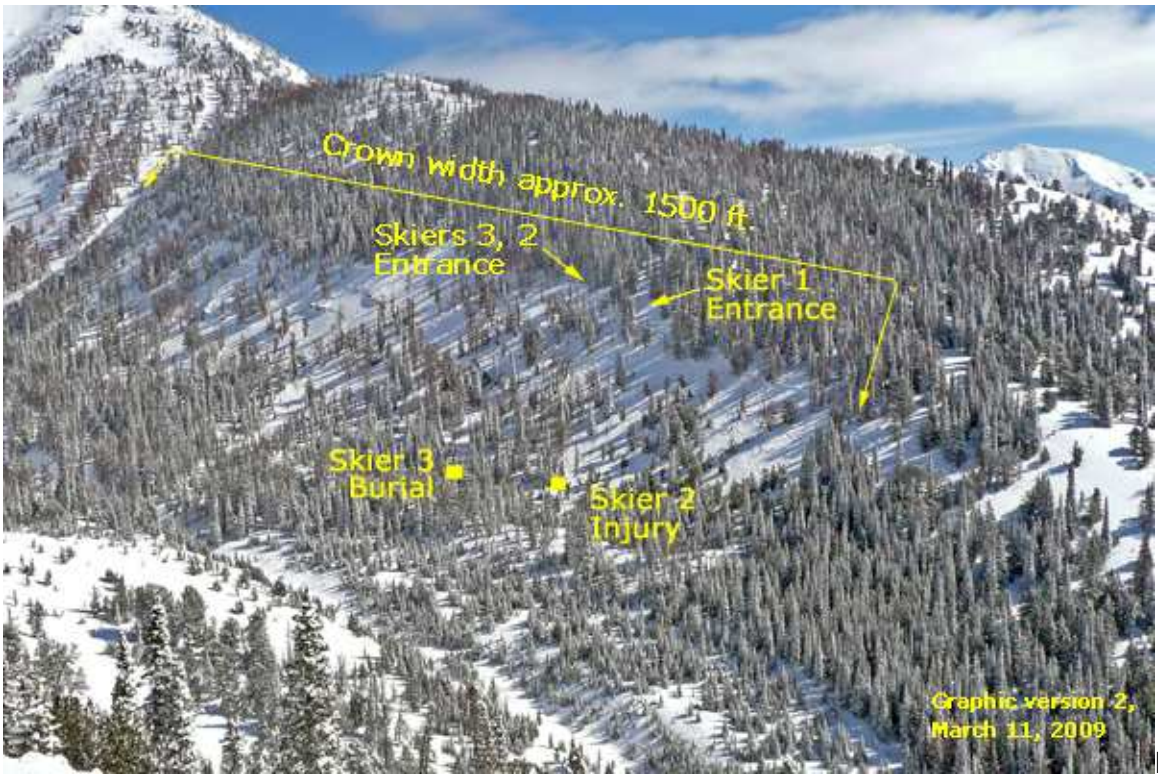

Figure 2: Overview of accident site showing approximate locations of avalanche crown, skiers' entries onto the slope, and burial positions of the two victims.

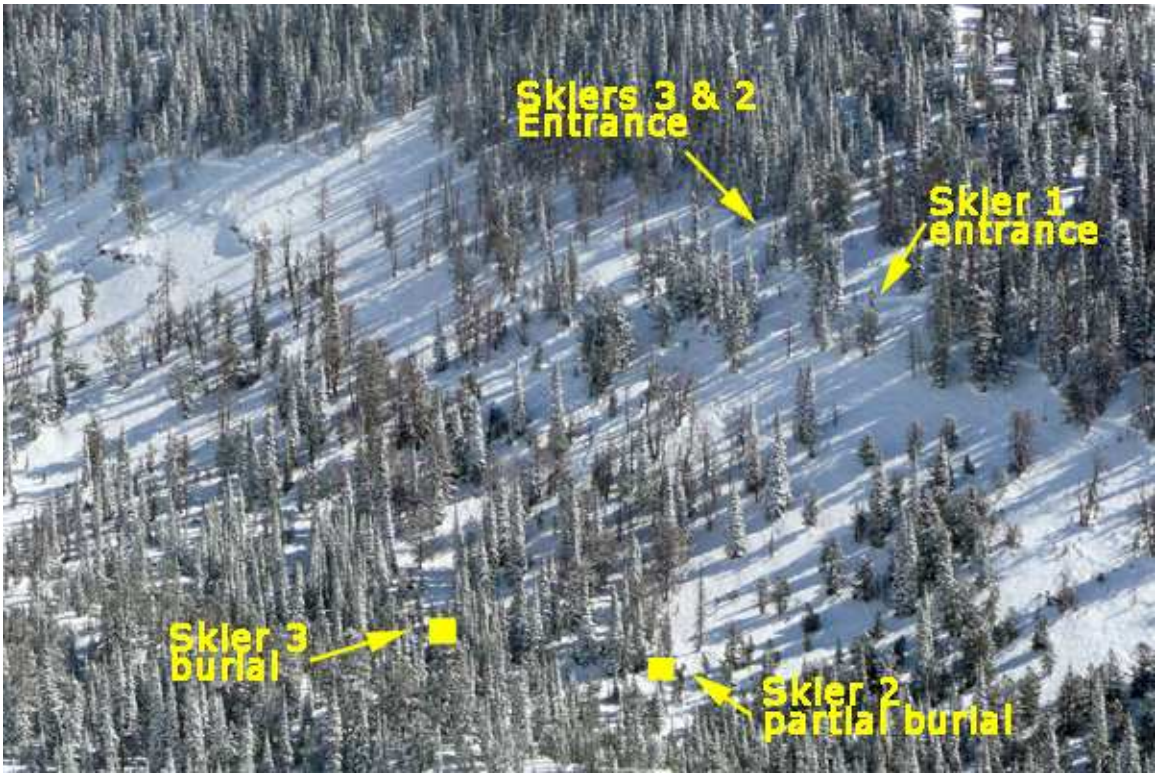

Figure 2: Closer view of area where skiers entered slope and were buried.

Figure 4: View of crown showing tracks from skiers 2 and 3 in undisturbed area.

Figure 5: View looking up from near where skier 3 was buried showing crown above rock outcrop near suspected trigger point.

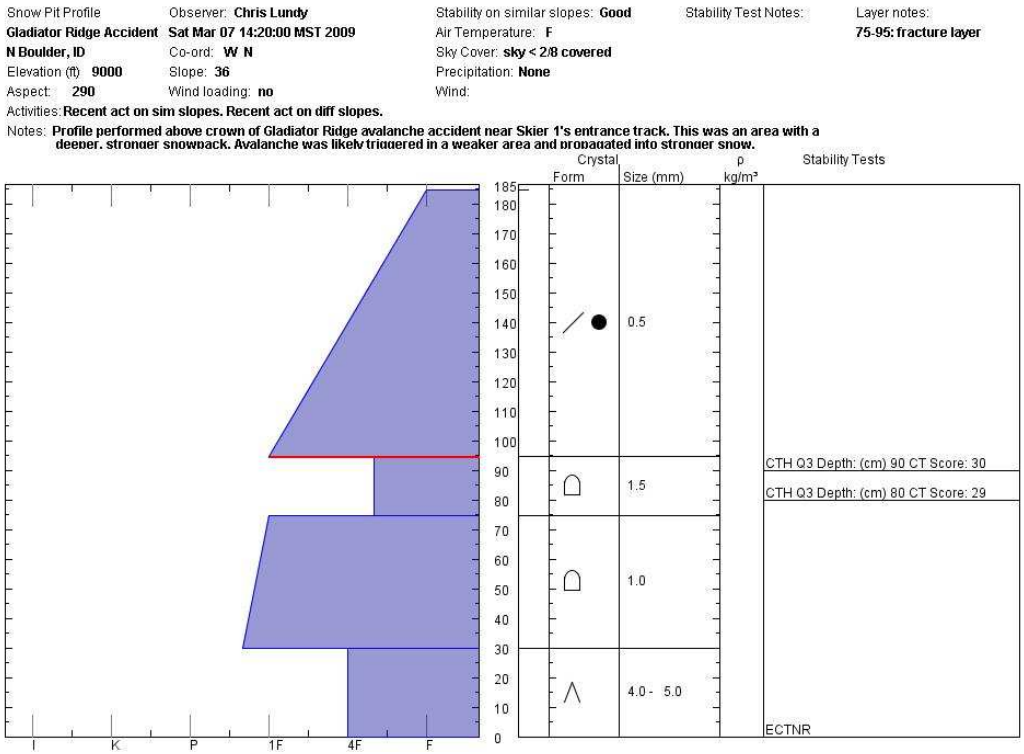

Figure 6: Profile performed above crown of avalanche near Skier 1's entrance track. This was an area of deeper, stronger snow.

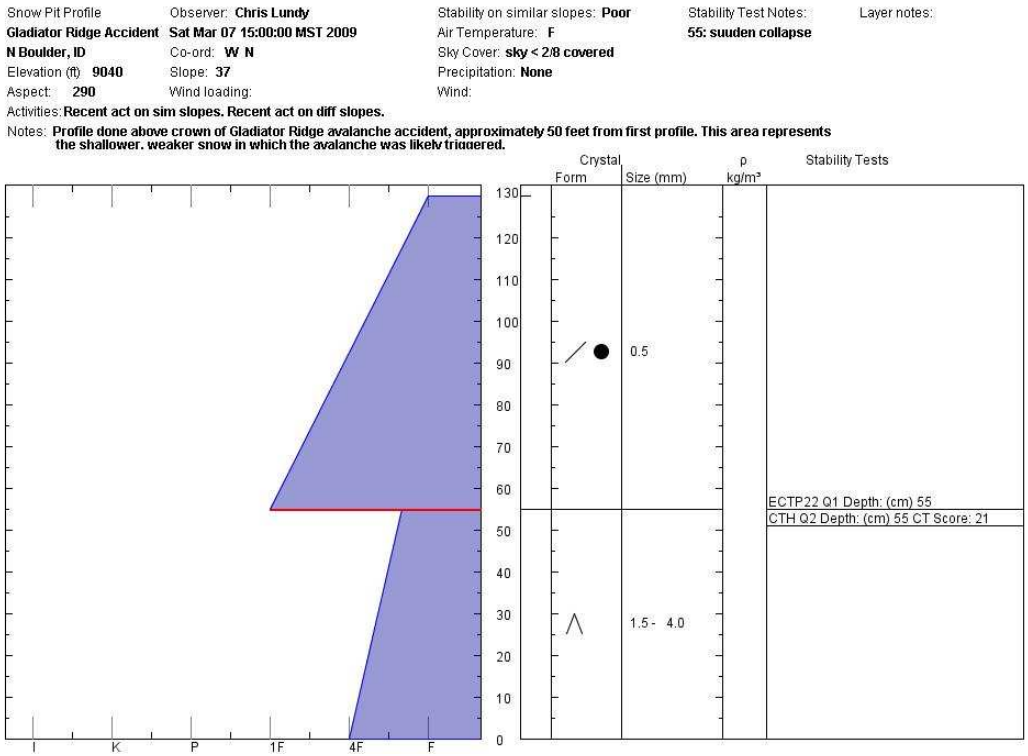

Figure 7: Crown profile performed approximately 50 feet from profile in Figure 6. This profile represents the shallower, weaker snowpack in which the avalanche was likely triggered.