Der Kompetenzkontrast zwischen der Wustkogel-Formation und der Schwarzschiefer der Bündnerschiefer ist sehr groß. Die Bündnerschiefer dürften daher während D_2 und vor allem während D_3 einen großen Teil der sinistralen Scherung aufgenommen haben.

Quartär und Massenbewegungen

Quartäre Sedimente (fluviatiles und fluvioglaziales Sediment, Sand, Kies, Blockwerk) des Kasererbachs überlagern die Festgesteine im Tuxerbachtal. Der Tuxbach ist hauptsächlich in Hangschutt und Blockwerk (z.T. alte relikte Massenbewegungen) eingeschnitten. Zwischen Inneraue und Außeraue sind die tiefer liegenden Hangbereiche von einem Schwemmfächer bedeckt, der nach unten an rezente bis subrezente Alluvionen (Kies, Sand, Ton) des Tuxerbaches anschließt.

Spät-postglaziale End- und Seitenmoränen gibt es bei der Grieralm, auf der Löschbodenalm, zwischen Kreuzjoch und Elsalm (bis zu mehrere 10er-m hoch) westlich der Eggalm und unmittelbar westlich vom Nigglasbach (östlich vom Lattenalm). Außer dem Bereich Klausboden und Umgebung, wo Hangschutt dominant ist, sind Grundmoränen die dominanten Quartärablagerungen.

Folgende größere Massenbewegungen wurden kartiert:

(1) Am Flach: Bergzerreißung mit Zerrspalten in der Wustkogel-Formation. Große Zerrgräben, Auflockerung und eine deutlich erkennbare Umorientierung in den großen Festgesteinsmassen wurden beobachtet. Es gibt drei vorherrschende Zerrspaltrichtungen, Nord-einfallend, WNW-einfallend und SW-einfallend. Die Letzte setzt sich in Richtung Tettensjoch fort. Bis in eine Höhe von etwa 1950 m ist der Berg nordwestlich des Gipfels in Bewegung.

(2) Am Kamm zwischen Am Flach und Tettensjoch: Doppelgratbildungen, inaktiver Talzuschub in Gesteinen der Wustkogel-Formation, die sich vor allem in südöstlicher Richtung bewegen. Ähnlich gibt es am Gipfel bei der Marke 2151 m, nordwestlich des Tettensjoches, Doppelgratbildungen und Bergzerreißungen. Die Gesteinsmassen sind in Richtung Nordwest abgesetzt.

(3) Nordöstlich von Ochsenleger zwischen 1700 und 1800 m Höhe: Bergzerreißung ($\approx 0{,}8–1{,}0 \cdot 10^6$ m^3) mit Zerrspalten in der Wustkogel-Formation und den Bündnerschiefern. Diese große tiefgreifende Massenbewegung hat eine Auflockerung und eine deutlich erkennbare Umorientierung in Festgesteinsmassen (bis in den Zehnermeter-Maßstab reichend) verursacht.

(4) Nordwestlich und oberhalb von Lanersbach, im Bereich des Grabens südwestlich der Eggalm. Eine Häufung größerer Massenbewegungen tritt in den sehr rutschungsgefährdeten Schwarzschiefern der Bündnerschiefergruppe auf. Zerrspalten und Abrisskanten dieser Rutschungen haben zwei dominante Richtungen, NNW-SSE- und NE-SW-streichend. Es sind dies mehrere wiederholt aktive Massenbewegungen unterschiedlichen Alters, die sich gegenseitig versetzten.

Kleinere Massenbewegungen sind über das ganze Gebiet, aber vor allem in den Bündnerschiefern, kartiert worden. Generell ist zu beachten, dass im gesamten Gebiet Hangbewegungen sehr häufig sind und Strukturmessungen nur eine bedingte Genauigkeit haben.

Bericht 2009 über geologische Aufnahmen der quartären Sedimente im Weertal, Nafingtal und im Bereich der Sagalm und Pfundsalm auf Blatt 149 Lanersbach

JANUSZ MAGIERA
(Auswärtiger Mitarbeiter)

The Sagalm area

Only the uppermost part of the Sagbach valley lies on the Lanersbach map sheet. The valley floor is covered with a blanket of a ground moraine, probably up to 3 m thick, of Wűrmian (Lateglacial?) age. The prominent ridge (5 to 20 m high) of a left lateral moraine from a Lateglacial glacier tongue is preserved on the left side of the Sagbach valley.

The north-east and east facing slopes of the valley (beneath the Sagspitze and Poferer Jöchl peaks) carry remnants of several stone glaciers, which were probably active during the Lateglacial to Early Holocene. Some of them may also have been active during the Little Ice Age, as can be inferred from the very fresh shapes of glacial tongues and surface features. Of similar age were the small cirque glaciers that left curved end moraine ridges in the vicinity of Grauer Kopf.

The north-west facing slope (Sagmähder) is covered by extensive colluvial deposits that probably also developed during the Lateglacial to Early Holocene, when the valley glacier disappeared and the permafrost thawed. There appear to have been two generations of landslides here: an older and much more extensive phase that was probably related to the main deglaciation, and a second phase with more concentrated, long narrow landslides, which was probably a result of subsequent warming during the Early Holocene.

Holocene to recent alluvia form rather narrow river channel fills and small fans that become broader close to creek junctions and above those areas with thicker moraine accumulations in the vicinity of Grauer Kopf.

Weerbach valley (Weertal)

This relatively long valley bears numerous traces of extensive landslides along most slopes, which tend to conceal other sediments and features that may be present. Glacial sediments saturated with water, and debris resulting from the weathering of bedrock, were the main subjects of these landslides. As at Sagalm, there are again two generations of landslides. The older, deeper, and more extensive landslides occur particularly on the west facing slopes below the Rosslaufspitze peak and on the northern slope down from Hobarjoch peak, below Untersberg. Less extensive but probably of a similar age are landslides on the east facing slopes in the vicinity of Tagetlahnalm. Further south along the same slope there are several narrow but deep landslides (north of the Grafennsalm homestead and east of the Grafennsspitze peak). Their large depths (bedrock is exposed in their source depressions) and the thickness of their colluvia (up to 30 m in the valley floor) suggests that they may be related to the phase of intensive landsliding that occurred at the end of the Wűrm glaciation. Apparently younger are the landslides that occur within a very large landslide to the west of the Rosslaufspi-

tze peak. They are relatively narrow and short – their colluvia do not reach the valley floor – and probably developed during the warm, moist phase of the Early Holocene.

Apart from colluvium, ground moraine is the main sediment type covering the lower slopes of the valley. It is well preserved, particularly in the northern part of the valley (within Lanersbach map sheet), north of the junction with the Nafingbach tributary. There are very few remnants of end or lateral moraines within the valley but a right lateral moraine is well preserved as a narrow, high ridge at the mouth of the Johannistal tributary valley. The long, narrow, and almost flat tongue of a ground and ablation moraine was left by a glacier flowing north-east from the Hippoldspitze peak at the head of the valley. The low ridge of an end moraine marks a Holocene cirque glacier northwest of the Almkogel peak. Remnants of stone glacier tongues are present north-east of Grafennsspitze, north of Almkogel,and west of Hobarjoch. All of these were probably active during the Holocene and some of them (those located high on the valley slopes) also during the Little Ice Age.

The alluvial valley floor is relatively well developed, and is broader (up to 150 m wide) above the Nafingbach tributary than it is below the junction. Large mixed alluvial and debris fans developed at the mouths of almost every lateral valley and gorge on the west facing slopes of the Weerbach valley, but only few small fans occur on the opposite slope. The largest fan (which is fluvioglacial in origin) developed on the eastern side of the Weerbach valley at the confluence of the Nafingbach tributary. This fan is nearly 1 km long, up to 250 m wide, and forms a step (or terrace) 5 to 15 m above the present-day alluvial plain. A periodically active gravel pit provides an insight into the internal structure of this fan.

The section of the Weerbach valley below the Nafingbach tributary is narrow and deeply incised, and therefore contains little in the way of alluvial sediments.

The Nafingbach valley (Nafingtal)

As in the Weerbach valley, large and extensive landslides have shaped both slopes of the Nafingbach valley. These landslides probably developed on a thick layer of unconsolidated ground and ablation moraine during the Lateglacial as a result of a permafrost thawing. On west facing slopes landslides continue southwards from the western slopes of the Weerbach valley, as far as Nafingalm. On the opposite side of the valley two large and deep landslides developed to the north-east of the Hobarjoch peak.

Remnants from the Holocene glaciers are only preserved in a few locations, e.g.: north-east and east of Hobarjoch and west of Halslspitze. These are in the form of well developed single or multiple end moraine ridges. A ridge of left lateral moraine, which is probably part of a deep U-shaped end moraine, is preserved to the north of the Nafingalm homestead.

The deepest part of the terminal depression is still occupied by a small lake. The melting of this glacier probably resulted in the formation of the long fluvioglacial fan with the gravel pit that was mentioned previously, at the mouth of the Nafingbach in the Weerbach valley.

Above the Nafingalm homestead the Nafingbach valley is less steep and its floor is relatively wide, while below it the valley is incised, narrow, and steep.

Structured soils, occurring as deep U-shaped lobes, resulting from contemporary solifluction phenomena, can be seen on the northern slopes below Geiseljoch and Hobarjoch.

Nurpensbach valley (Nurpenstal)

In the Nurpensbach valley Lateglacial to Early Holocene landslides again dominate the landscape. Both sides of the valley are shaped by very large landslides extending as far south as Haglhűtte. The main material that slid was probably ground moraine and weathered bedrock debris. Two generations of landslides can again be discerned, particularly on the western slope of the valley (around Untere Nurpesalm) and west of the Pfundsjoch pass. There are no remnants of recessional end moraines from either the Wűrm or the Early Holocene within the valley, only a few end moraine ridges marking small Late Holocene glaciers (south and south-east of Hoher Kopf, above and around Haglhűtte, and north-east of Untere Nurpensalm). Vast debris and block fields west of the Rosskopf peak are probably remnants of rock glaciers. A similar but smaller debris field occurs north-east of the Halslspitze peak.

The valley is incised and steep; its floor is therefore narrow and contains little alluvium.

The Pfundsalm area

The slopes at Pfundsalm are covered with thick glacial sediments (probably up to 5 m) consisting of ground and ablation moraines, but no remnants of end moraines have been found on the valley floor. Small but well preserved ridges of end moraines mark the extent of small Holocene glaciers in the uppermost part of the Finsingbach valley (north-east of Rosskopf, east of Kleiner Gilfert, and east of Pfaffenbichl). Landslides occurred in uncosolidated glacial sediments and weathered bedrock but were far less extensive than in previously described valleys. Large mixed alluvial and debris fans developed on east facing slopes during the postglacial period.

The valley floor in the upper part of the Finsingbach valley is relatively narrow and moderately seep. It broadens further downstream leaving more room for alluvium to accumulate.

Lamargalm (Lamarkalm)

Only upper part of the Lamarkbach valley falls within Lanersbach map sheet. The area has been strongly modified for a ski-station: only few areas have been left in their natural condition, with small ridges of lateral moraines of the Holocene age.