Zeitschrift: Swiss bulletin für angewandte Geologie = Swiss bulletin pour la géologie appliquée = Swiss bulletin per la geologia applicata = Swiss bulletin for applied geology

Herausgeber: Schweizerische Vereinigung von Energie-Geowissenschaftern; Schweizerische Fachgruppe für Ingenieurgeologie

Band: 23 (2018)

Heft: 2

Rubrik: Report on SASEG's 85th annual convention, 16-18 June 2018, Chur

Swiss Bull. angew. Geol. Vol. 23/2, 2018 S. 109-123

Report on SASEG's 85th Annual Convention, 16-18 June 2018, Chur

Heinz M. Bürgisser[1]

Participants (85): Antognini, Marco; Bachmann, Bettina; Bachmann, Martin; Baumgartner, Walter; Bichsel, Matthias & Suzanne; Boulicault, Lise; Brumbaugh, William & Michele; Bürgisser, Heinz & Trudy; Cagienard, Pius; Carmalt, Sam; Carraro, Davide [StN]; Christe, Fabien [St]; de Groot, Kees & de Groot-Boodt, Julie, with de Groot, Christopher [N]; Eckardt, Peter & Buchmann, Johanna; Eichenberger, Urs; Felder, Theodor; Fiebig, Bernd; Fleckenstein, Martin; Fraenkl, Res & Katrin; Fricker, Peter & Marie-Louise; Graf, René; Grasmück, Kurt & Madlen; Gregorczyk, Lukasz; Gunzenhauser, Bernhard & Censier, Kathrin; Häring, Markus; Heinz, Roger [Sp]; Heitzmann, Peter; Hemsted, Tim; Kalbskopf, Reinhard [N]; Keller, Franz; Leu, Werner; Matter, Albert & Dora; Meier, Beat; Meylan, Benjamin; Mohler, Hanspeter & Dorothea; Moscariello, Andrea & Mondino, Fiammetta & Camilla; Müller-Merz, Edith & Hansjakob Müller; Müller, Werner; Oesterle, Hans & Christine; Omodeo-Salé, Silvia; Pfiffner, Adrian [E, Sp] & Anne-Marie; Reichetseder, Peter; Reinhard, Benedict & Eva; Rybach, Ladislaus & Ruth; Schmid, Stefan & Jacobs, Inge; Schmidt, Thomas; Scholz, David [StN]; Schwendener, Brigitte; Schwendener, Dario [N]; Stäuble, Albert & Tilda; Stäuble, Martin; Stumm, Fred & Margrit; Suana, Michael; Teyssen, Thomas & Irmtraud; von Poschinger, Andreas [E, Sp]; Wach, Hans [Sp]; Walde, Michel [StN]; Wannier, Mario; Wyss, Roland [E] & Wyss-Böhni, Kristina; Ziegler, Martin & Rosemarie.

[E] Excursion leaders 17 or 18 June; [N] Non-member (Guest); [Sp] Speakers 16 June; [St] Student member; [StN] New student member

Saturday 16 June: Administrative and Scientific Sessions (Hotel Chur), Partners' Programme, Cocktails and Dinner (Hotel Chur)

I General Assembly / Generalversammlung

(Protokollentwurf, zu genehmigen am 22. Juni 2019 an der GV in Genf)

Um 13.50 Uhr begrüsst Präsident Bernhard Gunzenhauser die 55 anwesenden Mitglieder auf Deutsch, mit einigen Worten auf Englisch.

Er informiert, dass er Entschuldigungen von den Vorstandsmitgliedern Christian Minnig und Ueli Seemann, vom Revisor Walter Frei sowie von den Mitgliedern Renate Bolliger, Jenny Burckhardt, Peter Diebold, Ruedi Eckert, Laura Endres, Martin Glaus, Wolfgang Herget, Marius Huber, Martin Jentsch, J.P. de Loriol, Roland Muggli, Jürg Neidhardt, Volkmar Pümpin, Peter Teumer und Jörg Uttinger erhalten hat.

Die Traktandenliste wurde den angemeldeten Mitgliedern gemailt; die GV-Teilnehmer akzeptieren die Traktandenliste. Als Stimmenzähler werden Beat Meier und Bernd Fiebig gewählt.

1 Genehmigung des Protokolls der GV vom 17. Juni 2017 in Ascona / Adoption of the Minutes of the General Assembly held on 17 June 2017 at Ascona

Der Protokollentwurf der letztjährigen Generalversammlung, publiziert im Swiss Bulletin für angewandte Geologie (Heft 22/2, S. 56-60) wird ohne Diskussion mit Handmehr ohne Gegenstimme genehmigt.

[1] Member of SASEG's management committee

2 Bericht des Präsidenten, Juni 2017 – Juni 2018 / President's Report, June 2017 – June 2018

B. Gunzenhauser ehrt zuerst fünf Mitglieder für ihre langjährige Mitgliedschaft: 65 Jahre dabei sind René Bertschi und James Büchi, 60 Jahre dabei sind Lukas Hauber und Albert Stäuble, 50 Jahre dabei ist Michel Petch. Dem anwesenden Albert Stäuble überreicht B. Gunzenhauser unter grossem Applaus die von ihm unterzeichnete Urkunde persönlich (Fig. 1).
Den anderen Jubilaren wird er die Urkunde zuschicken, mit einem persönlichen Begleitschreiben.

Dann wird stehend und schweigend den drei Mitgliedern gedacht, die in der Berichtsperiode verstarben:
- Heinz (Henri) Oertli (67 Jahre Mitglied)
- Frank Scherer (57 Jahre Mitglied, treuer Tagungsteilnehmer, hatte sich noch für Chur angemeldet)
- Elisabeth Wegmann (30 Jahre Mitglied nach dem Hinschied ihres Gatten)

B. Gunzenhauser erwähnt auch den Hinschied von Elizabeth Fränkl-Fischer, die jahrelang zusammen mit ihrem Mann und Mitglied Erdhart Fränkl an den Jahrestagungen teilgenommen hatte.

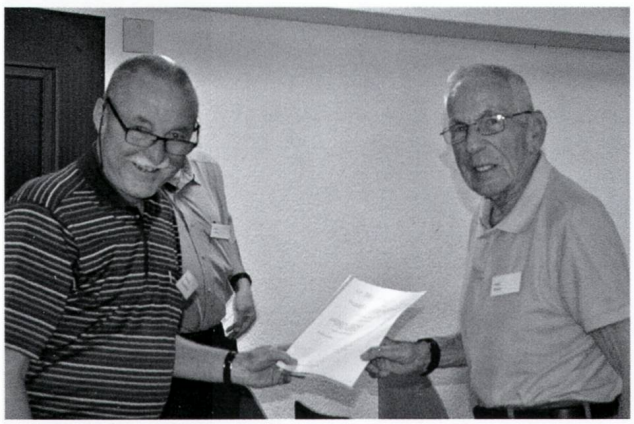

Fig. 1: President Bernhard Gunzenhauser presents to Dr. Albert Stäuble a certificate for 60 years of VSP/SASEG membership (Photo: B. Schwendener).

Danach verliest B. Gunzenhauser die Namen der 8 innerhalb der letzten 12 Monate zugetretenen persönlichen Mitglieder; 5 davon sind an der Jahrestagung dabei.

Membership changes within the past 12 months are as follows:

Membership as of 17 June 2017	315
Personal members joining (for comparison: previous 12 months: +10)	+ 9
Members Re-instated (previous 12 months: +2)	0
Members Resigning (previous 12 months: -19)	- 16
Membership Suspended (previous 12 months: -1)	- 2
Expulsions (previous 12 months: -13)	- 5
Deaths (previous 12 months: -5)	- 3
Membership as of 16 June 2018 (-17; previous 12 months: -26)	298

In the last 12 months membership reduced again noticeably, though the previous 12 months had an even greater reduction, mostly due to more expulsions (owing to non-payment of the membership fees for two years). As in previous years there were many reasons for the resignations. B. Gunzenhauser urges the G.A. participants to recruit new members by using their network.

B. Gunzenhauser verkündet mit Genugtuung, dass die beiden im Namen der SASEG organisierten Energie-Exkursionen eine gute Teilnahme zeigten: 27 Personen bei der Besichtigung des Kernkraftwerks Mühleberg (23. November 2017), 45 beim Besuch der Geothermie-Bohrung Satigny (23. Januar 2018), fast die Hälfte davon SASEG-Mitglieder.

Zum Schluss informiert der Präsident die

Mitglieder über die ersten Vergabungen des an der letzten GV angekündigten SASEG Student Grant Scheme. Bei der ersten Runde (Herbst 2017) gab es 5 Anmeldungen und 3 Preisträger (die je Fr. 600 bis 800 erhielten), bei der zweiten Runde (Frühling 2018) eine Anmeldung, die die maximale Zuwendung von Fr. 1000 erhielt.

3 Bericht des Kassiers: Finanzlage 2017 / Treasurer's Report: Financial Situation 2017

René Graf erinnert daran, dass die im Sommer 2015 eingeführte einfache Buchhaltung (prinzipiell ohne transitorische Beträge) weitergeführt worden ist, und zeigt dann deutlich Ertrag, Aufwand und Vermögensveränderung im Kalenderjahr 2017 (Table 1).

Obwohl angestrebt wurde, in 2017 das Vermögen etwas abzubauen, resultierte ein Einnahmenüberschuss von Fr. 2237. R. Graf erklärt das teilweise mit dem Verzicht auf transitorische Buchungen (z.B. wurden die Student Grants der ersten Runde (2017) und die Haftpflichtversicherung erst in 2018 bezahlt). Zudem fiel der Verlust der Tagung Ascona mit - Fr. 642 geringer als erwartet aus, und die Einzahlungen von Mitgliedern fürs Studentensponsoring übertrafen um fast Fr. 2000 die Auszahlungen für gesponserte Studenten.

Vermögen per 1. Januar 2017	Fr. 92'893
Einnahmenüberschuss 2017	Fr. 2'237
Vermögen per 31. Dezember 2017	Fr. 95'130

Peter Reichetseder meldet, dass er Erfahrung mit der Förderung von Studenten habe. Er offeriert, darüber mit dem SASEG-Vorstand zusammenzusitzen, was dankbar angenommen wird.

4 Bericht der Revisoren / Auditors' Report

Der von Revisorin D. Decrouez am 7. Juni 2018 und von Revisor W. Frei am 8. Juni 2018 unterzeichnete Bericht wird projiziert. B. Gunzenhauser liest den Antrag der Revisoren an die GV vor, dem Kassier unter Verdankung der geleisteten Dienste Décharge zu erteilen. Ohne Gegenstimme wird die Décharge erteilt und damit die Rechnung 2017 genehmigt sowie Kassier R. Graf entlastet.

5 Bericht des Redaktors / Editor's Report

Roger Heinz informiert, dass er vor wenigen Tagen die 14 Beiträge für Bulletin 23/1 (150-170 Seiten) an die Druckerei geschickt hat. Dann stellt er kurz die 11 für Bulletin 23/2 geplanten Beiträge sowie die Pläne für Artikel im Bulletin 24/1 vor. Es werden keine Fragen zum Bulletin gestellt. B. Gunzenhauser sagt, dass Roger Heinz seine Arbeit als Redaktor fantastisch mache; «das Bulletin lebt».

6 Décharge des Vorstandes / Discharge of the members of the management committee

Die anwesenden Mitglieder erteilen dem Gesamtvorstand Décharge ohne Gegenstimme und sprechen damit dem Vorstand ihr Vertrauen aus. Die Wahl des Vorstandes steht an der nächsten GV an.

7 Verabschiedung eines Vorstandsmitglieds / Farewell to one management committee member

Präsident B. Gunzenhauser würdigt Ueli Seemann, der am 22. Juni 2009 dem Vorstand beitrat und per heute aus Gesundheitsgrün-

SASEG

Swiss Association of Energy Geoscientists
Schweizerische Vereinigung von Energie-Geowissenschaftern
Association suisse des géoscientifiques de l'énergie
Associazione svizzera geoscienzati dell'energia

		31.Dec.17	31.Dec.16
Assets	Cash balance	-30.58	56
	Visa Credit Card pre-paid balance	939	579
	Post Giro Account (stopped Dec. 2017)	-	10'800
	ZKB Account	94'221	99'191
	...Bulletin 2016 (paid 2017)	-	(16'140)
	...Website 2016 (paid 2017)	-	(1'593)
	Total Assets	**95'130**	**92'893**
	Change 17-16	2'237	
Income:	Annual Dues 2017:	21'437	27'896
	...for 2015	660	
	...for 2016	2'711	
	...for 2018	320	
	...for 2019	90	
	Student Sponsoring:		
	In Memoriam Werner Bolliger	-	1'950
	Members	2'814	1'756
	Annual Convention payments by participants	14'910	19'786
	Cash income	0	-
	Taxes pay-back	500	
	Total Income:	**43'442**	**51'388**
Expenditure	Convention 17 (see also separate Accunt)	12'242	22'825
	Convention 2017 pre-excursion		1'240
	Convention 2018 pre-excursion	1'748	
	Suport to Events (incl. Burri Kolloquium)	1'773	3'515
	Student Sponsoring	478	2'040
	Bulletin (share SASEG)	14'900	16'140
	Website SASEG	6'593	5'891
	Taxes	-	900
	Liability insurance	-	210
	Transfer to Visa Credit Card (€2'000)	2'162	
	Trasfer to Cash account	100	
	Admin. & Bank Costs	217	167
	Committee (meeting) expenses	991	460
	Total Expenditure	**41'205**	**53'387**
Gain/Loss	Total Income - Total Expenditure	2'237	
JB16	Unpaid Membership Fees 2016: 5	320	3'480
JB17	**Unpaid Membership Fees 2017: 18**	**1'240**	
Student Sponsoring 2017	Contributions 2017	2'814	3'706
	Expenditure	866	2'040
	Balance	**1'948**	**1'666**
Student Sponsoring Account			
	Balance 31.12.2016		8'942
	Additions 2017	1'948	
	Balance 31.12.2017	**10'890**	

Tab. 1: Balance sheet SASEG on 31 December 2017; profit and loss account 2017

den austritt. U. Seemann war nicht nur ein Querdenker während Vorstandssitzungen, er hielt auch Vorträge im Namen der SASEG und organisierte die drei ersten energiebezogenen Exkursionen der SASEG sowie die Symposia über Fracking (auf dem Gurten) und dasjenige in memoriam Peter Burri (an der Univ. Bern).

8 Wiederwahl der Rechnungsrevisoren / Re-election of auditors

Gemäss Statuten wählt die Generalversammlung auch die Rechnungsrevisoren; an der letzten GV wurde jedoch die Wahl nicht durchgeführt. Nun schlägt B. Gunzenhauser vor, die beiden Mitglieder, die die Abrechnung 2017 geprüft haben, retroaktiv für 2017 sowie für die Abrechnung 2018 zu wählen. Danielle Decrouez und Walter Frei werden daraufhin mit Handmehr als Revisoren wiedergewählt.

9 Tagung 2019, 22.-24. Juni, Genf / Annual Convention 2019, 22-24 June, Geneva

Die Ressourcen im Untergrund der Region Genf werden das Thema der Jahrestagung 2019 sein: Geothermie (mit Bohrungen des Pilotprojektes Geothermie2020), Ölaustritte, Bitumen in Sandsteinen.

10 Varia / A.O.B.

Vorstandsmitglied M. Suana erwähnt eine geplante Erfrischung des Vorstandes im Sommer 2019 und ruft zur Mitarbeit auf; er wiederholt seinen Aufruf auf Englisch. Interessierte sollen sich schon während dieser Tagung bei B. Gunzenhauser melden.

Keine weiteren Beiträge zum Traktandum Varia, sodass B. Gunzenhauser die Generalversammlung kurz nach 14.30 Uhr schliesst.

II Scientific Presentations

These were attended by about 60 participants and followed the General Assembly straight away, with a 30-minutes break after the second presentation. Whereas the first two talks were on Swiss energy themes (deep geothermal resources; natural gas market), the last two presentations related to the topics of Sunday's and Monday's excursion, respectively.

- Roger Heinz for Erich Büsser (Head of the Office for Energy and Transport, canton Graubünden): *Potenzialstudie zur hydrothermalen Tiefengeothermie im Churer Rheintal* (in German; Study on the potential of deep hydro-geothermal energy in the Chur Rhine valley).
  E. Büsser obtained, on short notice, orders for another assignment on this day; fortunately, Bulletin editor Roger Heinz volunteered to give the talk; he had contributed to the 2013-2015 study himself. For the contents of this talk please see the article published elsewhere in this Bulletin.

- Hans Wach (CEO of Gasverbund Mittelland; SASEG member): *Outlook European Gas Market.*
  Also this stimulating talk is published in this Bulletin (Wach 2018).

- Prof. Dr. O. Adrian Pfiffner (Prof. em. Univ. Bern, SASEG member): *Geologic structure and landscapes of the Penninic-Helvetic boundary in northern Graubünden* (topic of both the Sunday and Monday excursions).
  Pfiffner started his talk on «The nicest geology of Switzerland» with the Helvetic tectonic zone, exposing, in the vicinity of the excursion area, basement rocks (Vättis «window») and mostly sediments deposited from the Carboniferous to the Early Eocene. Some notes on the oldest rocks of this sequence: The Carboniferous is proven in Grisons in an oil pipeline tunnel

near Domat/Ems and east of Ilanz. The Permian Verrucano continental sediments and volcanics formed in rift basins with limited E-W extent. Verrucano is present today immediately above the main Helvetic thrust (Glarus Thrust), overlies also the Tavetsch Massif and furthermore occurs as a separate unit (Ilanz Verrucano) further south. A subcrop and a supercrop map of the Glarus Thrust highlighted the inversion of the Verrucano rift and the entrapment of exotic strip sheets in its footwall.

The Penninic zone has delivered the alluvial fan sediments on which the wellknown vineyards of the Rhine Valley around Chur thrive. Structurally the Penninic zone is more complex than the Helvetics. Also its metamorphism is complex. An indicator of high pressures of 9-12 kbar and temperatures of only 350°C at the onset of nappe stakking is the mineral carpholite (German: Karpholith), a rare manganese aluminium silicate occurring as yellow clusters of slender prisms or needles in quartz veins in schists. Subsequent higher temperature metamorphism cut across nappe boundaries.

- Dr. Andreas von Poschinger (Bavarian Geological Survey): *The Flims Rockslide – A rockslide drama in several stages* (topic of the Sunday excursion).
  Albert Heim was the first, in 1878, to state that the Jurassic and Cretaceous limestones exposed in the gorge of the Anterior Rhine represent a huge rockslide. Since then the single event has been detailed in a «drama of several acts», and dating has proven that the drama unfolded much after the retreat of the glaciers at the end of the last Ice Age (which was assumed previously), i.e. during the warm Boreal period (von Poschinger 2006 – in VSP Bulletin! –, von Poschinger et al. 2006, Fleischmann 2016).

1st Act: Tamins rockslide from Säsagit mountain, volume 1.5 km^3. Anterior and Posterior Rhine valleys were dammed though no deposits of this Lake Bonaduz have been proven so far.

2nd Act: Main Flims rockslide. Gliding surfaces at several stratigraphic levels, dipping only 23°, a volume of 10-11 km^3 of Jurassic and Cretaceous limestones (of which around 9 km^3 preserved) fell into the lake of the 1st Act. Huge energy release (2 x 10^{17} J), inducing an earthquake of >M6. Was the slide itself also triggered by an earthquake?

3rd Act: Formation of the graded Bonaduz Gravel after a slurry induced by the rockslide impact came to a halt. This slurry consisted of lake sediments and rockslide material, with 'dumplings' of rock masses of preserved stratigraphy on top.

4th Act: Damming of the Anterior Rhine; a lake formed. It took about two years to fill up this lake to a level of 890 m asl.

5th Act: Breach of rockslide lake dam; level was lowered to 820 m asl where it stayed for a longer time. At least 18 m of fine-grained clastics and, at the sides, gravelly foresets were deposited in the lake.

The talk was followed by a lively 15-minutes Q&A session during which a dozen members fielded questions or told about own observations regarding the rockslide.

- Dr. Roland Wyss (SASEG Vice-President): Itinerary and logistics of the excursions.

The meeting closed at 6 p.m.

III Partners' Programme: Guided tour of the town of Chur

Whilst members convened for the General Assembly, thirteen partners of members explored with guide Hans Hürlimann the city of Chur. The walk was within the former city

centre and led from the shopping area through narrow medieval alleys uphill to the 800-years-old cathedral. However, as Switzerland's oldest city, Chur has also remains from the Late Palaeolithic to Roman times. The walk included a welcome tea break.

IV Evening

At 7 p.m. the cocktail reception started on the ground floor and terrace of Hotel Chur (Fig. 2/1). President Bernhard Gunzenhauser (Fig. 2/2) welcomed all; he reiterated some highlights already mentioned during the G.A. in his report: the good attendance of the guided tours of the Mühleberg nuclear power plant near Bern and of the geothermal well-site at Satigny near Geneva, as well as the successful sponsorship of SASEG's student grant programme. He voiced his concern on the dwindling number of members due to various reasons and urged all attendees to use their network for recruiting new members. He was particularly grateful to Roland Wyss GmbH, Frauenfeld, for sponsoring the cocktails. At the subsequent association dinner, the Convention's main social event, nearly 80 people enjoyed the four-course dinner served adjacent to the cocktail area (Fig. 2/3).

Excursions

Excursion leaders prepared a 17-page handout containing 23 illustrations for both days, partly from Pfiffner (2014) and von Poschinger (2006). In the following, technical data are from these illustrations as well as from notes

Fig. 2: Selected photographs of Saturday's cocktail reception and dinner (all by B. Schwendener). 1] At the cocktail reception, participants listen attentively to 2] B. Gunzenhauser's address on SASEG's successes and concerns in the past 12 months. 3] During the association dinner many thoughts and news were exchanged.

made by the author during explanations in the field.

Sunday 17 June: Coach excursion: The Flims Rockslide

Field guides: Dr. Andreas von Poschinger, Prof. Dr. Adrian Pfiffner

At 8 a.m. 80 participants boarded two yellow postal coaches («Postauto») for a 25-minute drive to the first stop, a viewpoint along the main village road of Flims. A. von Poschinger explained where the Flims rokkslide started. He pointed out several, relatively low-angle sliding planes and emphasized that the trigger of the slide remains unknown. Then A. Pfiffner explained the Helvetic geology and tectonics. The Glarus Main Thrust, key feature of the UNESCO World Heritage site Swiss Tectonic Arena Sardona was, on this sunny morning, well visible below the Tschingelhörner peaks.

Thereafter Urs Eichenberger presented a rockslide-related case history of applied geology that was added late to the excursion program and is not illustrated in the handout (Fig. 4/1). A summary is worth to be included in this excursion report (see box).

We continued to drive westward and crossed the Anterior Rhine at Ilanz, the 'first town along the Rhine river' (town defined as a settlement with historic city and/or market rights). Shortly afterwards the coaches drove straight into the *Sevgein gravel pit*, our next stop. A. von Poschinger explained the steep gravelly foresets exposed in the pit as a Gilbert-type delta of a local stream that entered Lake Ilanz, which was dammed by the Flims rockslide. With a lake level at 820 m asl, Lake Ilanz was about 100 m deep; lake sediments underlie also Ilanz town. From a grassy hilltop just north of the pit A. Pfiffner pointed out the Verrucano dip slope north of the Rhine as well as the village of Andiast, situated on basement of the Tavetsch Zwischenmassiv. This gave Prof. Stefan Schmid the opportunity to state again that the rocks of the Helvetic nappes were partly deposited on Penninic basement (Simano nappe), therefore creating an issue with the traditional Alpine nomenclature – a theme he had already strongly advocated at Lavertezzo during the second excursion of SASEG's 2017 Convention (see Bürgisser 2017, p. 65).

The road to the third stop, *the Versam Islabord viewpoint*, was for most parts on the top surface of the Flims rockslide or at the boundary of rockslide and Penninic Bündnerschiefer and offered, already from the coaches, stunning views of the eroded rockslide deposits. From the viewpoint platform we enjoyed an even more spectacular view of the canyon that the Anterior Rhine had carved into the Flims rockslide deposits, which are here about 400 m thick. A. von Poschinger explained the possible sequence of events some 9500 years ago (Fig. 4/2); thereafter Urs Eichenberger took up the Flims tunnel theme again. He pointed out a weak stratification of the landslide mass on the northern canyon wall. The upper, more chaotic part with locally yellow colours corresponds to the Lake Cauma aquifer. At its base there are several small springs; the one at Conn was just visible from the platform. The average of the strongly varying flow rate of the Conn spring is estimated at several tens of L/s, which is the natural outflow rate of Lake Cauma.

Our fourth stop was *on a gravel bar of the Anterior Rhine river* (Fig. 4/3), which we reached by a short walk from the drop-off point at Versam railway station, a popular spot for river rafting and kayaking. Right across the river the Flims rockslide deposits towered above us impressively. For a near-vertical dyke-like feature several explanations were initially thought possible by us before the leader of a group of kayakers, on our request, paddled across the river to collect a

How the Flims bypass road tunnel has influenced the hydrology within and around the rockslide

(contribution by Urs Eichenberger, Swiss Institute for Speleology and Karst Studies (SISKA))

In order to free the resort of Flims from heavy transit traffic, the Canton of Grisons constructed, from 1998 to 2007, a 4.5-km long bypass that included a 2.9-km long tunnel passing underneath the village. The tunnel was mined in Jurassic and Cretaceous limestone underlying the Flims rockslide deposits (see Fig. 3). In 2002 an active phreatic conduit (30x60 cm) was hit during its construction, with a discharge of 150-1000 L/s.

The artificial drainage via the new tunnel lowered the local karst water level within the rockslide deposits as well as underneath them. Springs ceased to flow or flowed for a shorter period, water flow to turbines of a small local power plant was reduced in summer, temporary lakes on the landslide disappeared earlier, cellars of village buildings fell dry and the water level of Lake Cauma dropped.

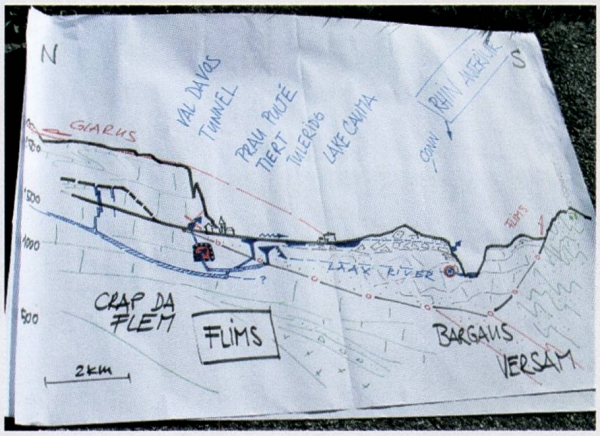

Fig. 3. N-S cross-section by U. Eichenberger illustrating how the road tunnel influences the hydrology within the rockfall area (Photo: B. Schwendener).

The context between all of above was initially, when the municipality of Flims demanded a repair from the Canton, poorly understood. The summer of 2003 was one of the hottest and driest on record, and water levels were low all over. Specialized in the matter *and* far from local interest, the Swiss Institute for Speleology and Karst research in La Chaux-de-Fonds (abbreviated ISSKA in French - Institut Suisse de Spéléologie et de Karstologie) was asked to investigate and to quantify the loss to the municipality caused by the Canton by hitting the conduit during tunnel construction. A measurement and data collection campaign allowed ISSKA to construct a hydrogeological model of the wider Flims area. The tunnel spring could not be held back; however, a pressure wall was built that allowed monitoring flow rates and conducting pressure tests while measuring spring flow rates and lake levels on the rockslide surface. The results clearly demonstrated the link between the tunnel spring pressure and the discharge of several surface springs. Based on ISSKA's results, a payment of CHF 3.75 million was made to the local power plant company.

A second issue was the effect on Lake Cauma, one of the main tourist attractions of Flims. It owns its beautiful turquoise colour to clean karst water free of organic matter but charged with minute calcite crystals that reflect the sunlight at depth. The lake is a window of the groundwater table within the Flims rockslide that fluctuates yearly about 4 m. In order to maintain the lake level, a pipeline from the Plattalva karstic spring was laid, to feed appropriate amounts of water into the overflow of Lake Pulté, an important infiltration spot to the groundwater around Lake Cauma. The natural overflow is active during snow melting. ISSKA's hydrological model allowed to calculate, on a yearly basis, estimates of the additional water needed in springtime in order to maintain the lake at the pre-2002 average level. For 2018 ISSKA advised not to add any water to the Pulté overflow because a lot of snow had fallen during the 2017-18 winter season.

Fig. 4: Selected photographs of Sunday's excursion with the Flims rockfall as the main theme. 1] Flims viewpoint: In front of Flimserstein with the rockfall scar, Urs Eichenberger explains the story of the bypass road tunnel affecting the local hydrology (Photo: H.M. Bürgisser); 2] Versam Islabord: With the canyon through the rockfall deposits in the background, Andreas von Poschinger presents the possible sequence of events some 9500 years ago (Photo: P. Reichetseder); 3] Gravel bar of the Anterior Rhine River near Versam railway station (Photo: B. Schwendener); 4]5] Tuma Pardisla: 4] In view of the active Bonaduz Gravel pit, Roland Wyss makes a point on the origin of the deposit; Ortenstein Castle in the background (Photo: B. Gunzenhauser); 5] «Summit meeting» (Photo: P. Reichetseder).

sample. It consisted of monomict small angular clasts in a matrix, suggesting a tectonic kakirite rather than an injection dyke with alluvial material from the riverbed or an extensional crack filled with rockslide material.

We had sufficient time for an additional short stop at a second viewing platform along the winding road. This gave us the opportunity to examine the rockslide from another locality; however, the viewing had to occur in batches because of the small size of the platform. The roadside outcrop of the rockslide clearly showed bedding.

After lunch at Hotel Weiss Kreuz in Thusis (1-3 p.m., exactly as scheduled) we reached after 15 minutes *Tuma Pardisla*, an isolated hill south-west of the village of Tomils in the Domleschg, the valley of the Posterior Rhine north of Thusis. We spent 1½ hours at this locality, to examine the Bonaduz Gravel that forms the plain underlying the hill, and the composition of the hill itself.
The active quarry in the Bonaduz Gravel, to the north-east of the Tuma, revealed some 60 m (40% of the maximum thickness of 150 m) of the completely unstructured though graded (from 10 cm near the bottom to 1 cm near the top) gravel deposit (Fig. 4/4), vertical pipes and a lake sediment raft at one spot; elsewhere, elongate pebbles are standing vertically in the deposit. These observations are consistent with transport of the Gravel as a slurry; the vertical pipes acted as drainage conduits just after the slurry had come to a halt. Clasts include several types of granite that could have originated from the south (Penninic) OR the north (Helvetic). However, the characteristic Punteglias Granite only occurs north of the Anterior Rhine. The slurry moved therefore from north to south, for at least 7 km (to Tuma Pardisla) and probably for 12 km (to Thusis). It is therefore thought to have been induced by the Flims rockslide impact and comprises rockslide material and lake sediments.
The 40 m high, steep hill itself consists, like other tumas further to the north, of known Helvetic stratigraphy; von Poschinger (2006) described outcrops of two Triassic Helvetic formations (Röti dolostone and Quarten Formation) in a former quarry at the Tuma. A. von Poschinger explained the tumas not as erosive features, but as having been transported as 'dumplings' on top of (or in a few instances inside) the Bonaduz Gravel slurry.
From the top of Tuma Pardisla (Fig. 4/5) Dr. Roland Wyss introduced some tectonic units to be visited during the excursion on the subsequent day. The Lower Penninic Tomül nappe underlies the Heinzenberg dip slope (dip 20-25° to the east). R. Wyss emphasized the significance of the Nolla Shale (at the base of the Tomül nappe) for the local population: (1) Most mass movements on the Heinzenberg dip slope have occurred within the Nolla Shale; (2) The Nolla river erodes the Nolla Shale; Nolla river water was used to flood the fields on the Domleschg plain, whereby the mineral-rich Nolla mud, a natural fertilizer, was deposited. The Viamala Gorge has been cut into a unique quartz sandstone within the Nolla Shale; this sandstone is interpreted as a submarine channel complex.

Two excursion participants supplemented additional information at this stop:
On Ortenstein Castle, towering on a rock precipice above the Bonaduz Gravel plain: Dr. Peter Eckardt, on behalf of the previous castle owners D. and S. Linder, used to check the overhanging rock wall (bi)annually for 25 years, by using reference points in solid rock 40 m away from the wall; once he let himself down along the wall using a rope and measured an overhang of as much as 12 metres! During all these years he did not detect an increasing tilt of the castle rock towards the valley. He also examined the rock wall with the "Swiss hammer" method and photographed it; by comparing the photographs from year to year and recor-

ding new boulders on the scree slope below he could determine the quantitative degradation of the rock wall.
On Schams, the section of the Posterior Rhine valley upstream of the Viamala Gorge: Dr. Ben Reinhardt informed that this area contains rich pasture lands; however, because in the Middle Ages these were inaccessible to transhumance upstream from Thusis because of the Viamala Gorge, the peripheral parts of the Schams were settled in the 14th century by German-speaking Walser people from the south (Valais, Ticino) instead.

We left Pardisla hill at 4:40 p.m. and reached the coach stopping place near Hotel Chur at 5 p.m., again as scheduled. Participants who stayed also for the third convention day enjoyed their dinner in one of the restaurants in the old town or at Hotel Chur.

Monday 18 June: Coach excursion: Helvetic nappes and Scopi zone, Lower Penninic nappes, Lugnez landslide, Valser mineral water springs

Field guides: Prof. Dr. Adrian Pfiffner, Dr. Roland Wyss

Again at 8 a.m., 61 participants left Chur by means of two postal coaches. At the first stop, *on a plateau south of Reichenau*, sun and morning mist accompanied us (Fig. 5/6). Adrian Pfiffner explained first the Tamins rockslide and the geology of the visible tumas. Then he told us how the main drainage system was very different from today's only half a million years ago, due to the average uplift of this area by 1.5 mm/year and associated erosion (Fig. 5/7). The valley floor of the Posterior Rhine was 700 m higher than at present; the river flowed straight north over what is now the Kunkelspass, where a dry valley testifies to this ancient Posterior Rhine. Concurrently, the Albula Rhine flowed north across Lenzerheide (the Schyn gorge did not yet exist), passed the sites of Chur and Maienfeld and joined the previously mentioned Rhine branch at Bad Ragaz.
A. Pfiffner also explained, using two cross-sections in the handout, the structure of the Helvetic nappes east and west of the Kunkelspass.

At the following stop, along the *old main road west of Tamins*, we examined Helvetic Permian volcanics and Triassic (this stop was not in the handout):

- At the waterfall of the Lavoi stream on the mountainside of the road, epidote-bearing albite-chlorite schists were interpreted as metamorphosed (epizone) basalts that extruded into the clastic sequence of a Permian continental trough ('Verrucano' facies) (Fig. 5/8). The volcanics occur at the northern end of the trough; in the Vättis window, further north, they are absent.
- Along the road west of Lavoi stream we examined steeply dipping Triassic dolomite. The visible (though poorly developed) cleavage is not associated with the overall large fold because of its orientation; it must have formed later than the fold.

We bypassed Flims by means of the tunnel (see the previous day's excursion), descended towards *Ilanz* and stopped for 15 minutes ahead of the bridge over the Rhine (Stop 2 of the handout). We examined at a roadside outcrop conglomerates with highly deformed clasts that are attributed to the Ilanz Verrucano, occurring in a separate tectonic unit overlying parts of the Tavetscher Zwischenmassiv.

We entered the Lugnez valley and stopped three times before reaching Vals (stops 3-5 of the handout). The outcrop *opposite the building of Mulin da Pitasch* (mill of Pitasch) comprised the youngest part of the Scopi Zone of the Gotthard Massif: inverted Liassic, partly sandy calcareous shales with some echinoids and oolites.

Fig. 5: Selected photographs of Monday's excursion. 6]7] Plateau south of Reichenau: 6] Sun and morning mist greets our group at this first stop (Photo: K. Censier); 7] Adrian Pfiffner indicates the former courses of the Rhine in this zone of strong Alpine uplift (Photo: P. Reichetseder); 8] Lavoi stream west of Tamins: We examine metamorphosed basalts of the volcanism of the Permian Verrucano trough (Photo: B. Schwendener); 9] Uors: Bridge with adjustable part to accommodate movements of the Lugnez landslide (toe of slide is just across the stream) (Photo: H.M. Bürgisser); 10] Road to Vals north of Lunschania: Roland Wyss explains the Zone Piz Terri-Lunschania of the Lower Penninic nappes (Photo: P. Reichetseder); 11] Vals: Roland Wyss introduces the borehole for Valser mineral water before we descend into the cellar (Photo: H.M. Bürgisser).

While driving further south we passed the Peiden imbricate zone, with thin, yellow Triassic sediments that separate the individual slices.

A stop for more than an hour was at *Uors*, to examine the currently active, huge Lugnez landslide on the western side of the valley. R. Wyss introduced it by showing a map of yearly movements (up to 10 cm/year, as a function of rainfall) and a map of differential movements. Total downward movement is up to 200 metres (the church of Peiden has moved 20 m in about 100 years; houses were breached and doors had to be shifted. We walked to the front of the landslide, crossing two bridges; the second one was anchored on one side only (Fig. 5/9). Some of us met the voluntary guard of this bridge. Up to a year ago he had to check the bridge and lower or rise the movable end several times a week; after an extension to the bridge had been added, his workload has been reduced considerably. The toe of the slide is characterized by dark claystones and many dead shrubs and trees.
An outcrop of such dark claystones along our hiking path was sampled by two University of Geneva participants. Raman spectroscopy (a spectroscopic technique used to observe vibrational, rotational, and other low-frequency modes in a system) was to be tried on this possibly low-temperature source rock to determine maturity, and wood structures examined.
Some participants visited the churchyard of the St. Laurentius church, Surcasti/Uors. The former tomb of a well-known Swiss geologist and his father is no longer present; however, there was his plate in the churchyard's wall: Moritz Blumenthal (born 1886), from a family with medieval roots at Surcasti, completed his Ph.D. at ETH Zürich under Albert Heim in 1911 and then worked for Royal Dutch/Shell for about 15 years (Cadisch 1969). He then did pioneering research on the Spanish Betic Cordillera and on other Mediterranean orogens including the mountain ranges of Asia Minor (he worked for the Turkish government for more than a decade), and made a fortune through shares in mainly Middle East oil ventures. At his death in 1967 he bequeathed several million Swiss Francs to the Bündner Naturmuseum in Chur, which enabled construction of a new building where all collections could be exhibited and housed under one roof. One excursion participant knew M. Blumenthal personally and worked for the Naturmuseum for some time!

A 10-minutes' drive brought us to the last geological stop before lunch, along the *valley road to Vals north of Lunschania* (Fig. 5/10). Quartzitic schists and decimetre-thick bedded quartz sandstones form the roadside outcrop. It belongs to the Zone Piz Terri-Lunschania of the Lower Penninic nappes, which forms a large antiform here.

After lunch at Hotel Rovanada in Vals the coaches brought us at 2 p.m., exactly as scheduled, to the entrance of the huge, active Adula gneiss quarry at the *southern end of Vals (Vals-Valé)*. We did not, however, visit the quarry on this working day, but inspected instead a variety of cut products stored in the open air near the entrance. The quarry provided stones e.g. for the Bundesplatz, the square in front of the parliament building in Bern, and for the remodeled Sechseläutenplatz in Zürich.
R. Wyss explained the regional geology and also the large pressure difference between the northern and southern ends of the Adula nappe complex, which is caused by four internal thrusts through which the original extent of the nappe was much larger.

The themes of the last stop were the *Valser mineral water* and the associated hydrogeology, on which we spent 1 hour and 40 minutes and split up into two groups:

- R. Wyss led one group into the clinically clean cellar (Swiss Ordinance on food-

stuffs applies here!) of the youngest of the three mineral water wells, situated on the valley floor close to the bottling plant (Fig. 5/11). The well penetrated 50 m of unconsolidated alluvium, 0.5 m of lake sediments and then Bündnerschiefer. Casing was set at 60 m, in bedrock. Triassic sucrosic dolomite with a flow rate of 18 m^3/min was encountered at 130 m. After this water could be discharged by a flow line to the stream, the well was drilled to 135 m, a production casing with packer set and the annulus cemented. Whereas the wellhead pressures of the first two wells, on the valley flanks, are 0.4 bar, the wellhead pressure of this well is approx. 10 bar (truly an artesian well). One well at the valley flanks contains some oxygen, causing iron fallout in the well. The de-ironization of this water is the only treatment allowed by the Swiss Ordinance on foodstuffs.

- The other group enjoyed a slide presentation by plant manager Peter Cadonau in the visitor centre and then viewed the bottling plant, where a glass and a PET production line produce the original Valser mineral water and also many other varieties of Valser-based drinks at a rate of 17-38 k bottles per hour in two or three shifts. And of course we could sample different products!

President B. Gunzenhauser thanked the field guides and Convention organizers for making this Convention a success and expressed his hope to see again many members next June in Geneva. At 4.25 p.m. we boarded the coaches, had again the thrill of driving the narrow, winding road via Versam to view the Flims rockslide deposits, and reached the coach stopping place near Hotel Chur and the Chur railway station at 5:45 and 5:55 p.m., respectively.

Acknowledgments

Sincere thanks to Peter Eckardt, Urs Eichenberger, Bernhard Gunzenhauser, Adrian Pfiffner, Andreas von Poschinger, Ben Reinhardt and Roland Wyss for improving parts of the report.

References

Bürgisser, H.M. 2017: Report on SASEG's 84th Annual Convention, 17-19 June 2017, at Monte Verità, Ascona. Swiss Bull. angew. Geol. 22/2, 55-67.

Büsser, E. & Heinz, R. 2018: Potenzialstudie hydrothermalen Tiefengeothermie im Churer und Sarganser Rheintal bis zum Walensee. Swiss Bull. angew. Geol. 23/2, 129-141.

Cadisch, J. 1969: Moritz Blumenthal 1886-1967. Bull. Ver. schweiz. Petrol.-Geol. u. -Ing. 35/88, 31-32.

Fleischmann, S. 2016: The former Lake Ilanz; Radiocarbon dating and Sedimentology. Unpubl. B.Sc. thesis ETH-Zürich, 44 pp.

Pfiffner, O.A. 2014: Geology of the Alps. Wiley Blackwell, 376 pp.

Poschinger, A. v. 2006: Weitere Erkenntnisse und weitere Fragen zum Flimser Bergsturz. Swiss Bull. angew. Geol. 11/2, 35-43.

Poschinger, A. v., Wassmer, P. & Maisch, M. 2006: The Flims Rock Slide; History of Interpretation and New Insights. In: Evans, S.G., Scarascia-Mugnozza, G., Strom, A. & Hermanns, R.L. (eds.). Landslides from Massive Rock Slope Failure; 347-375, Springer, Berlin.

Wach, H. 2018: Overview of the actual Global, European and Swiss Natural Gas Market. Swiss Bull. angew. Geol. 23/2, 125-127.