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Report on SASEG's 83rd Annual Convention, 25-27 June 2016, at Heidelberg (Germany) Heinz M. Bürgisser¹

Participants (77): Participants (77): Bachmann, Martin; Baumgartner, Walter; Brink, Heinz-J.; Brumbaugh, William & Michele; Bruss, Dietfried [E] & Zeides, Beate; Bürgisser, Heinz & Trudy; Eckhardt, Peter; Felder, Theodor; Fiebig, Bernd & Irina; Fleckenstein, Martin & Margit; Fraenkl, Res & Katrin; Fricker, Peter & Marie Luise; Gilsbach, Lucas [StN]; Glaus, Martin; Gordijn, Tiemen [StN]; Gorin, Georges; Graf, René & Helena; Grasmück, Kurt & Madlen; Gregorczyk, Lukasz; Guglielmetti, Luca; Gunzenhauser, Bernhard & Censier, Kathrin; Hartmann, Daniel & Hartmann-Timmer, Anita; Hauck, Michael; Heinz, Roger; Hemsted, Tim; Herget, Wolfgang & Elke; Jentsch, Martin [N] & Hildegard; Kellerhals, Peter; Keusch, Rebecca [StN]; Knup, Peter; Leu, Werner; Matter, Albert & Dora; Meyer, Friedrich; Meylan, Benjamin; Mohler, Hanspeter & Dorothea; Moscariello, Andrea; Müller-Merz, Edith & Hansjakob Müller; Oehms, Eckhard; Pümpin, Volkmar & Anne; Reichetseder, Peter & Iris; Reinhard, Benedict & Eva; Reinhold, Carsten [E, Sp] & Christiane; Sass, Ingo [Sp]; Scherer, Frank; Schmid, Stefan & Jacobs, Inge; Schmidt, Thomas; Schmitt, Nicole [StN]; Schwarz, Michael [E]; Schwendener, Brigitte; Seemann, Ulrich; Stäuble, Martin; Stumm, Fred & Margrit; Suana, Michael [E, Sp]; Teyssen, Thomas; Wyss, Roland.

[E] Excursion leaders 26-27 June; [N] Non-member (Guest); [Sp] Speakers 25 June; [StN] New student member

Saturday 25 June: Administrative and Scientific Sessions (Hotel NH), Partners' Programme (Heidelberg Old Town), Cocktails and Dinner (Hotel NH)

I General Assembly / Generalversammlung

(Draft of minutes, to be adopted on 19 June 2017 by the General Assembly at Monte Verità, Ascona)

At 1:45 p.m. Bernhard Gunzenhauser, acting as president ad interim, welcomes the members at a meeting room of Hotel NH. He proposes to conduct the meeting in English rather than German as previously; there are no objections. B. Gunzenhauser is visibly shaken when announcing the unexpected demise of President Peter Burri, just two weeks prior to the Convention.

Regarding the meeting's agenda, B. Gunzenhauser adds item 8a: Election of a president.

B. Gunzenhauser informs that apologies were received from management committee members Daniel Bollinger and Peter Heitzmann, as well as from E. and V. Cartier. He thanks Rhein Petroleum GmbH for providing lectures and the excursion leaders during this convention.

1 Adoption of the Minutes of the General Assembly of 20 June 2015, in Baden

The draft minutes, published in Swiss Bulletin for Applied Geology (20/2, 2016, 97-102) are adopted without discussion.

At the 2015 General Assembly Walter Baumgartner expressed his wish to contribute to the association actively, e.g. by participating in working groups. Then a promise was made to bring this up at this G.A. B. Gunzenhauser welcomes help from all members and thanks W. Baumgartner.

¹ Vorstandsmitglied SASEG

2 President's Report, June 2015 – June 2016

Distinctions. First B. Gunzenhauser honours two members for long membership. Martin Glaus has been member for 50 years, Heinz J. Oertli even for 65 years. Martin Glaus is present and receives the certificate personally (Fig. 2/2); H.J. Oertli will receive his by mail, with a personal cover letter.

Deaths. In the last 12 months notifications of passing away were received of the following five members:

- Jacques Gabus (member since 1958)
- Hans Laubscher (member since 1949 to approx. 1971 and again since 1988)
- Werner Heckendorn (member since 1976, treasurer 2005-2015)
- Werner Bolliger (member since 1997, secretary 2000-2011)
- Peter Burri (member since 1976, president 2005-June 10, 2016)

New members. In the last 12 months as many as 29 persons applied for membership and were accepted by the management committee. B. Gunzenhauser reads out the names of those present; these rise shortly from their seats and are applauded. Four are student members, sponsored by SASEG to participate at the convention; participants are thanked for specific financial support of this student sponsorship scheme.

B. Gunzenhauser is happy to announce that net membership grew by another 8 members in the last 12 months and stands now at 340:

| | |
|--|-------|
| Membership as of June 24, 2015 | 332 |
| Joining (personal members, of which 6 student members) | + 29 |
| Leaving | - 15 |
| Expulsions | - 1 |
| Deaths | - 5 |
| Membership as of June 25, 2016 | + 340 |

3 Treasurer's Report

René Graf introduces the report by deploreding his predecessor Werner Heckendorn's demise before the handover had been completed. Prior to explaining the balance sheet (distributed to all participants; Table 1) he emphasizes that he uses a different and simpler (non-transitory) accounting, which he finds more suitable for a volunteer organization.

In 2015 the total expenditure was Fr. 4,000 lower than in 2014, yet a substantial loss of Fr. 6,621.70 was recorded:

| | |
|------------------------|---------------|
| Total income 2015 | Fr. 39,712.60 |
| Total expenditure 2015 | Fr. 46,334.30 |
| Loss 2015 | Fr. 6,621.70 |

The largest contributors to this loss are unpaid 2015 membership dues of 53 members (Fr. 3,740 – never before did so many members not pay by the end of the year) and the Annual Convention Baden (Fr. 3,400; note that the student sponsoring expenditure, Fr. 1,592, is included whereas previously it was not). Also the Bulletin costs billed to SASEG were Fr. 2,100 higher in 2015 compared to 2014.

| | |
|---|----------------|
| Assets as per January 1, 2015 | Fr. 102,167.67 |
| Ditto, as reported in Bulletin 20/2, p.98 | |
| (different accounting used) | Fr. 95,215.74 |
| Assets as per December 31, 2015 | Fr. 94,891.22 |
| Reduction of assets in 2015 | Fr. 7,276.45 |

R. Graf states that SASEG is not a bank, therefore has too much money and should invest, slowly and wisely (i.e., in line with the aims of the association), to decrease its assets to a sensible level (R. Graf indicates Fr. 20,000). To this endeavour the management committee has formed a working group, which will report to the 2017 General Assembly. He concludes that SASEG is «a very healthy association».



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

| | | 31. Dec. 2015 | 31. Dec. 2014 |
|--------------------|--|----------------------|----------------------|
| Assets | | | |
| | Cash | 218.35 | 324.95 |
| | Post Giro Account | 9'655.32 | 10'025.10 |
| | ZKB Account | 85'017.55 | 91'817.62 |
| | Total Assets | 94'891.22 | 102'167.67 |
| Income: | | | |
| | Annual Fees | 18'044.25 | 22'272.75 |
| | Annual Convention | 18'521.27 | 19'080.00 |
| | Sponsoring Contributions | 3'059.88 | 1'313.00 |
| | Cash income | 87.20 | |
| | Interest (0.9 incl. In sponsoring) | | 620.50 |
| | Total Income: | 39'712.60 | 43'286.25 |
| Expenditure | | | |
| | Annual Convention | 21'921.95 | 19'080.00 |
| | Student Sponsoring (2015 incl. In Annual Convention) | 0.00 | 5'416.25 |
| | Bulletin | 17'733.50 | 15'620.15 |
| | Taxes | 384.10 | 399.90 |
| | Expenses Lecturers | 0.00 | 875.55 |
| | Website SASEG | 4'826.00 | 4'921.20 |
| | Postage, Office materials etc. | 426.55 | 3'865.86 |
| | Board expenses | 1'042.20 | |
| | Total Expenditure | 46'334.30 | 50'178.91 |
| Gain/Loss | | -6'621.70 | |
| Student Sponsoring | | | |
| | Income | 3'059.88 | |
| | Expenditure | 1'592.00 | |
| | Balance | 1'467.88 | |
| JB15 | Unpaid Membership Fees 2015: 53 | 3'740.00 | |

Tab. 1: Balance sheet SASEG on 31 December 2015; profit and loss account 2015

During the following discussion, V. Pümpin voices his concern about the unpaid 2015 membership dues, which is a matter not only for the committee, but for the entire association. Explanations could be hardship (a matter for the committee) and lazy members (threat of dismissal). A proposal by B. Brumbaugh to publish the names of members who have not paid was not accepted enthusiastically. The management committee plans to write a reminder to each member with outstanding dues, to which the General Assembly consented without a voted decision.

4 Auditors' Report

The report, signed by auditor Walter Frei on 14 June and by auditor Danielle Decrouez on 17 June, proposes to the General Assembly to discharge treasurer R. Graf. Discharge was given by applause.

5 Editor's Report

Roger Heinz is presented as the new Bulletin editor (and, *ex officio*, as a new SASEG management committee member). B. Gunzenhauser reads a letter from the absent editor Daniel Bollinger, in which he praises Peter Burri for having written many articles for the Bulletin. In his letter he thanks for the support experienced and the opportunity given to him to shape the Bulletin for 10 years.

6 Discharge of the members of the management committee

F. Stumm proposes discharge of the management committee. The members present give this discharge by a show of hands and pass therefore a vote of confidence in the committee.

7 Proposal for changing article 7 of by-laws

The management committee proposes to modify the somewhat loose wording of the current article (the German text is the relevant one)

«Art. 7: Der Austritt erfolgt durch schriftliche Erklärung an den Präsidenten/die Präsidentin. Ein Ausschluss von der Mitgliedschaft kann durch den Vorstand beschlossen werden bei Nichterfüllung der Beitragspflicht eines Mitgliedes.» as follows:

«Art. 7: Der Austritt erfolgt durch schriftliche Erklärung an den Präsidenten/die Präsidentin und ist auf Ende eines Kalenderjahres möglich. Ein Ausschluss von der Mitgliedschaft kann durch den Vorstand nach Nichtbezahlung von zwei Jahresbeiträgen beschlossen werden.»

In the discussion, clarifications were asked; it was also pointed out that the English and French translations do not fully correspond to the German wording. Accordingly, the above German text was modified: ... Ende des laufenden Kalenderjahres Subsequently, the new German Art. 7 was adopted.

Following the observations made by members at the General Assembly, the management committee modified the translations after the convention. Modified Art. 7 reads now as follows:

Art. 7: Der Austritt erfolgt durch schriftliche Erklärung an den Präsidenten/die Präsidentin und ist auf Ende des laufenden Kalenderjahres möglich. Ein Ausschluss von der Mitgliedschaft kann durch den Vorstand nach Nichtbezahlung von zwei Jahresbeiträgen beschlossen werden (adopted by the General Assembly, see above).

Art. 7: La démission doit faire l'objet d'une déclaration écrite au président/ à la présidente et n'est possible qu'à la fin de l'année

civile en cours. Le comité peut prononcer l'exclusion de tout membre n'ayant pas payé sa cotisation annuelle pendant deux années.

Art. 7: Resignation requires a written statement to the president and is possible by the end of the current calendar year. Dismissal of members can be decided upon by the management committee if the member has not paid his annual dues for two years.

8 Election of a new management committee member

Georges Gorin steps down; he has served on the management committee for seven years. The assembly thanks him by applauding. The committee proposes Andrea Moscariello, Full Professor of Reservoir Geology and Basin Analysis at the Department of Earth Sciences, University of Geneva, as a new committee member. His two-page CV was distributed to all participants at the beginning of the meeting. There are no questions, whereupon A. Moscariello is elected as SASEG management committee member with applause.

The sitting committee members will stand for re-election (if applicable) in June 2017 (term of two years).

8a Election of a new president

There is no proposal from members. Bernhard Gunzenhauser, until P. Burri's demise SASEG's Vice-President, volunteers to be president for a maximum of three years. V. Pümpin says that B. Gunzenhauser will be a worthy president and then leads the election. B. Gunzenhauser is elected with no votes against, which is followed by applause.

B. Gunzenhauser thanks the assembly and informs that Roland Wyss will be SASEG's new Vice-President.

9 Annual Convention 2017, 19-21 June, Monte Verità, Ascona

Committee member Stefan Schmid who initiated the proposal presents briefly the excursion programme.

10 Annual Convention 2018

Convention town will be Chur, with excursions in the northern part of the Canton of Grisons. Roland Wyss, who has mapped the Ilanz map sheet, will be the lead for the programme. The convention date has not yet been fixed, depending on the availability of suitable accommodation.

11 A.O.B.

Newly elected committee member Andrea Moscariello speaks on behalf of the AAPG leadership team. He has just returned from the AAPG Annual Convention & Exhibition in Calgary. He received many messages on Peter Burri, from all continents. It was proposed that the AAPG Distinguished Lecture Tour Europe be named after P. Burri. This lecture tour will be in the care of A. Moscariello.

B. Gunzenhauser reminds participants to fill in the distributed questionnaire on SASEG's Annual Conventions and to return it to him before leaving Heidelberg.

Finally, all members of the General Assembly rise and remain silent in honour of Peter Burri. Thereafter, at 2:35 p.m., the General Assembly is declared closed.

II Scientific Presentations

These followed the General Assembly straight away, with a 30-minutes break after the second presentation. All three talks, as well as the excursions on the following two

days, centred on the Upper Rhine Graben (URG) as an energy source. The summary of the first two talks is very short because these are presented elsewhere in this Bulletin as an integrated paper (pp. 35-65).

- Dr. Carsten Reinhold (Rhein Petroleum, Manager Subsurface Evaluation and Business Development): *The Upper Rhine Graben – Re-dawn of a mature petroleum province: part I – basin development and petroleum systems.* The presentation covered the evolution of the rift basin; neotectonics; and the elements of the petroleum systems: The two source rocks (Liassic & marine Posidonia Shale; Lower Oligocene) and their maturity development, reservoirs (pre-rift and within the Tertiary rift fill), trap styles and critical moments (early Miocene and Pliocene for the Liassic, Pliocene for the Oligocene source rock).
- Dr. Michael Suana (CEO Rhein Petroleum and SASEG management committee member): *The Upper Rhine Graben – Re-dawn of a mature petroleum province: part II – the past, present and future of oil exploration.* Petroleum exploration activities in the URG have been discontinuous over time for technological and commercial reasons. The ongoing, 4th exploration wave was triggered by the accidental discovery, during drilling of a geothermal well, of the Römerberg oil field in 2003 (Triassic reservoirs). Rhein Petroleum GmbH holds several licenses in the URG, was at the time of the Convention producing oil from Schwarzbach 1 (see Sunday's excursion report, below) and drilling exploration well Hofwiese 1. M. Suana emphasizes the importance of effective stakeholder engagement in this densely populated area; he knows every mayor in the concession areas personally and has allocated considerable manpower to deal with stakeholders.
- Prof. Dr. Ingo Sass (TU Darmstadt, Chair of

Geothermal Science and Technology): *URG Geothermal Energy, exploration, production and outlook.* The speaker started his overview by showing geothermal well Trebur GT1, drilling at the time of the Convention. He then focussed on the differences between geothermal and petroleum ventures in the URG, especially in terms of financing and perception of risk; often a geothermal venture is stopped after the first failure due to lack of further funds. At the end Prof. Sass presented the ongoing project «3D modelling of the deep geothermal potential of [the state of] Hesse». The GOCAD-based model is complex; for data input a rigorous quality assessment was applied and many data rejected. 400 realizations were run for one cross-section. A huge potential for energy production was modelled (see this Bulletin, pp. 57-65). A Q & A session with several critical observations by petroleum geologists concluded the talk.

- Dr. Bernhard Gunzenhauser (SASEG President): Latest news on the convention excursions.

The meeting closed at 6:10 p.m.

III Partners' Programme: Guided tour of Heidelberg Old Town

Whilst members convened for the General Assembly, thirteen partners of members, equipped with public transport tickets provided by SASEG, embarked on a tram ride from the convention hotel to Universitätsplatz, where they met a guide provided by the tourist office. They first explored the old town on foot and then took the funicular railway to reach Heidelberg Castle. The guide led them to various attractions within the spread out, partly ruined building complex (Fig. 2/3). A highlight was the Heidelberg Tun, the world's largest wine barrel. It was built in 1751, stands seven meters high, used

to hold up to 220,000 litres of wine (a mixture of many sorts of wine which the farmers had to give as a tribute to the landlord), and has a dance floor built on top of it!

IV Evening

At 7 p.m. the cocktail reception started at NH Hotel, and soon animated talks filled the room. Newly elected president Bernhard Gunzenhauser welcomed all and recalled Peter Burri's huge merits for the association (Figs 2/4-2/6). The subsequent association dinner was the Convention's main social event. In the spirit of Peter Burri there were many cheerful moments amongst Convention participants during the dinner (Fig. 2/7).

Excursions

The theme of both Sunday's and Monday's excursions was the petroleum systems of the northern part of the Upper Rhine Graben. Staff of Rhein Petroleum GmbH, led by CEO Dr. Michael Suana, prepared and guided these excursions. Each participant received a 39-page field guide «Hydrocarbon Source Rocks and Reservoirs in the Northern Upper Rhine Graben», authored by Dr. Michael Schwarz, Dr. Carsten Reinhold and Dr. Dietfried Bruss. In the following write-up, technical data are from this field guide and also from notes made by the author during explanations in the field.

Sunday 26 June: Coach excursion: Tertiary source rocks and reservoirs in the Upper Rhine Graben area north of Heidelberg

At 8 a.m. 68 participants boarded two coaches for an 80-minute drive to the **Messel pit**, a UNESCO world heritage site because of its unique and uniquely well-preserved Middle Eocene fossils, of which *Eurohippus messe-*

lensis, a small proto-horse, is the most famous (Fig. 2/9). After nearly 90 years of oil shale exploitation (the first 80 years for oil, the last 10 years for electricity) the pit was to become a rubbish dump site. Hobby palaeontologists discovered the unique geological value of the oil shale deposit, whereupon the state of Hesse bought the site in 1991, in order to block the dumping and to allow for official palaeontological excavations by the Senckenberg Forschungsinstitut. Today Senckenberg employees and interns still hunt for fossils during 90 days per year, by cutting blocks of oil shale with a chain saw and splitting these along bedding planes by knives. Visitors are welcomed at a visitor centre that is also a museum, and are guided through the pit by volunteers.

We split up into three groups to explore the former oil shale pit. The sides of the pit are much vegetated today; however, heaps of oil-shale waste from recent digs were along our walking route, creating much interest. We passed several container offices where our guides demonstrated photographs and models of fossils found and discussed possible reasons for the unique preservation of the fossils (including e.g., stomach contents and fur remains). We also visited the site of the scientific well drilled in 2001 in the centre of the pit to a depth of 433 m (Fig. 2/8). In the bottom section of this well, a diatreme breccia composed of host rock fragments (Rotliegend and basement) proved that Messel originated from a large phreatomagmatic eruption 47.8 Ma ago, after which a lake formed in the depression. In the anaerobic part of this lake nearly 150 m of laminated black oil shales formed. Our guides also explained the special present-day flora, thriving in a climate that is 5°C different from that of the surroundings (warmer when sunny, colder in winter). After 2½ very worthwhile hours at Messel the coaches dropped us for lunch at the banks of the Rhine River, at Gernsheim (Fig. 3/10).

From oil shale to oil: After the lengthy lunch break we visited Rhein Petroleum's first oil production site **Schwarzbach**. As required for such an industrial site, all participants put on the safety vests and personalized helmets received during registration at the Convention Desk. While Dr. Carsten Reinholt explained the structuration at objective level to one group (Fig. 3/11), Dr. Michael Suana presented the gleaming installations and the production process to the other group (Fig. 3/12).

Schwarzbach 1 was drilled as a deviated well in 2015 after on 3D seismic data a compressional pop-up structure was identified at Oligocene level as part of a larger tilted fault block that also contains an abandoned oil field. Schwarzbach is the northernmost oil discovery in the URG and produces from flu-

vial and coastal sandstones of the Oligocene Lower and Upper Pechelbronner Schichten. Top seal is a marine shale that is also the source rock for the oil. Oil expulsion started in a kitchen 10 km more basinwards around 8 Ma ago and is still ongoing.

Since March 2016 the sweet, light (39 API) oil, with a low oil-gas ratio and a pour point of 20°C, is produced by an electric submersible pump by means of a long-term production test through a remotely-controlled modular oil production facility (MPFO) developed by Rhein Petroleum and the oil & gas division of Siemens (Fig. 1). Associated gas and formation water are separated at the facility. The gas is used for the heating of the oil in the facility, whereas lorries transport the crude to a refinery and the formation water to a disposal site. There was a lot of

Rhein Petroleum Erdölförderanlage Schwarzbach 1



Erdölförderung - Aus der Tiefe bis zur Verladung:

- ① Förderpumpe
- ② Wärmetauscher (kühlt oder erwärmt Rohöl je nach Witterung)
- ③ Trennbehälter mit Lagerkammern für Öl, Lagerstättenwasser und Gas
- ④ Tankwagen-Abfüllstation für Öl und Lagerstättenwasser

Weitere Hilfsaggregate:

- ⑤ Förderpumpenantrieb
- ⑥ Hochtemperaturverbrennungsanlage für nicht nutzbares Gas
- ⑦ Heizzentrale (falls Rohöl zu kalt)
- ⑧ Ölkühler (falls Rohöl zu heiß)
- ⑨ Propangastank für Heizzentrale und Pilotflamme
- ⑩ Regenwasserabscheider (Coalescer)
- ⑪ Regenwassersammeltank

Fig. 1: Rhein Petroleum's Schwarzbach 1 oil production facility (Photograph: P. Reichetseder).

energy amongst participants discussing sub-surface and production details with Rhein Petroleum staff.

At 4:45 p.m. one coach returned from Schwarzbach directly to Heidelberg, while the other managed a narrow forest road towards the **Essigkamm viewpoint**, just to the west of the outer boundary fault of the Upper Rhine Graben. From there we had an excellent view of the peneplain surface of the graben. Dr. Michael Schwarz explained the trap configurations at the boundary fault with the help of W-E seismic lines (Fig. 3/13), which caused a lot of discussion despite the advanced time (this bus arrived at the hotel only at 7 p.m.).

Monday 27 June: Coach excursion: Mesozoic source rocks and reservoirs in the Kraichgau area (SE of Heidelberg)

After a 40-minute drive the coach with 40 participants reached a nature area near Langenbrücken, where the **Posidonia Shale**, the main Mesozoic oil source rock (Liassic ε, Lower Toarcian), had been mined from 1878 to 1926. Due to the unstable nature of the former quarry face (signs warned geologists of the dangers; Fig. 3/14) we did not examine the bituminous, pyrite-rich calcareous marine mudstones from close-by, but gathered in front of the best outcrop (representing the uppermost 10 m of the Posidonia Shale) to listen to Dr. Dietfried Bruss (Fig. 3/15). He explained the regional distribution and quality of the source rock and also pointed out that the Posidonia Shale is the best target for producing shale oil by fracking in the URG according to a 2016 report, which led to several questions by participants.

Helmets and safety vest were compulsory at the next stop, the active **Abele quarry** at the outskirts of the village of Weiher (Fig. 3/16).

It provided insight into the architecture of the Schilfsandstein reservoir rock, which forms the uppermost Upper Triassic («Keuper») sequence; at the 2015 convention we observed the Schilfsandstein at the Gruhalde clay pit at Frick (Switzerland), 200 km further south (Bürgisser 2016, p. 103). The two main preserved rock faces, 50 m apart, expose about 6 m of section at the same stratigraphic position; however, the lithologies are conspicuously different: At the western rock face, cross-bedded sandstones dominate; near the top they are overlain by a thin-bedded claystone-sandstone sequence. At the eastern rock face, dark gray laminated shales with plant debris are overlain by shales and thin sandstone layers. Overall the sequence is of fluvial origin, associated with incised valley fills of a relative sea-level lowstand and subsequent rising base level, causing the aggradation of levee-crevasse deposits. The western rock face represents part of the main channel fill, the eastern rock face the transition into the claystones of the floodplain.

This heterogeneity, and discontinuity of reservoir facies, was experienced in the small Weiher oil field, where more than 50 wells produced oil from the Schilfsandstein. Despite coring the reservoir in every single well, it was not possible to correlate the lithofacies between the wells. Furthermore, the production behaviour was much influenced by faults and fracture corridors that cross the reservoir. At the western outcrop we observed the joint pattern in the competent sandstone and in less competent sequence at the top. All this was the reason for an animated discussion on producing such a «difficult» reservoir. A participant reported that at the Weiher oil field wells drilled directly into a main fracture zone produced oil at a rate up to 10 times higher but drew water soon; the highest overall production was achieved by wells that penetrated the Schilfsandstein at some distance from main fracture zones.

After an expediently served lunch at Restaurant «Scharfes Eck» in Mühlacker we drove to the last outcrop of the day, the impressively huge, active **Sämann quarry** between Illingen and Vaihingen. The quarried rock is the Trigonodus Dolomite at the top of the Middle Triassic carbonate sequence («Muschelkalk»), which constitutes a hydrocarbon reservoir in the subsurface. However, the sequence our group accessed was the lowest 15 m of the Lettenkeuper-Formation above the quarried carbonates, which forms the lowermost Upper Triassic («Keuper») sequence (Fig. 3/17).

This is a cyclic dolomite / fine-grained clastics sequence which comprises several layers of claystones with frequent molds of *Estheria* («clam-shrimp»), an extinct genus of crustaceans indicating fresh to brackish water. One intercalated sandstone body of several metres thickness (Hauptsandstein) represents a lowstand channel-fill deposit.

B. Gunzenhauser expressed his gratitude to the Sämann management who allowed us to visit the impressive quarry. He also thanked the four Rhein Petroleum excursion leaders for the time spent organizing and leading the excursions and preparing the field guide. From this stop the coach returned to Heidelberg, reaching the train station and convention hotel at 4 p.m. as scheduled.

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