Report on the IGCP 630 Conference and Field Workshop, October 8-14, 2017, in Armenia

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Introduction

The IGC Program 630, starting in 2014 under the leadership of Prof. Zhong-Qiang Chen, aims to investigate the recovery of ecosystems following the end-Permian mass extinction through analyses of the rock and fossil records via studies of biostratigraphy, paleontology, paleoecology, sedimentology, geochemistry and biogeochemistry. This conference and field workshop was organized by Lilit Sahakyan, Aymon Baud, and Zhong-Qiang Chen. As a first IGCP 630 workshop was held in June 2017 at Sendai (Japan) by Prof. Kaiho, this workshop, originally planned in May, was postponed to October 8-14. Aymon Baud, with Lilit Sahakyan and the help of Evelyn Friesenbichler and Sylvain Richoz, prepared the field workshop guide-book, available at:

https://www.researchgate.net/publication/320426260_The_Permian-Triassic_transition_in_Southern_Armenia

This guide-book (Sahakyan et al., 2017) takes into account the important contributions of Rostovtsev and Azaryan (1973), Kotlyar et al. (1983), Aslanian (1984), Baud et al. (1989), Leven (1989), Zakharov et al. (2005) and Frisenbichler et al. (2017).

On October 9th, at the Round hall of the of Presidium of the National Academy of Sciences of the Republic of Armenia (Fig. 1), a welcome speech was given by the Director of IGS, Dr. Sc. Kh. Meliksetian, followed by a presentation and a review of the geology and tectonics of the territory of Armenia based on new data, by Lilit Sahakyan, Deputy Director of IGS.

Aymon Baud presented an introduction to the fieldtrip. The main topics to be discussed were the Upper Permian shallow water succession followed by deeper water limestone with red ammonoid *Paratirolites* beds, the Permian-Triassic transition with the boundary shale, and the Lower Triassic stratigraphic succession with its sponge-microbial build-ups at the three main visited localities: Ogbin, Chanakchi and Vedi (Fig 2).

Four sessions and fourteen talks characterized the first day of the conference (session contents and abstracts are available at:

https://www.researchgate.net/publication/320467445_IGCP630_CONFERENCE_PROGRAM_Armenia

At the end of the four sessions, Zhong-Qiang Chen gave information on the IGCP 630 closure meeting 2018, to be held next May in Wuhan (China).

A group photo was taken on the steps of the Academy building entrance (Fig. 3).

On October 10th, at the same place, the second day of the conference started with four talks followed by a poster session and a visit to the Geological Museum followed by a visit to the Matenadaran Museum - Institute of Ancient Manuscripts that holds one of the world's richest depository of medieval manuscripts and books. This spans a broad range of subjects, including history, philosophy, medicine, literature, art history and cosmology in Armenian and many other languages.

In the afternoon, we took the opportunity to go to the KhorVirap monastery that is located in the Ararat plain in Armenia, near the closed border with Turkey. It is a shrine and a pilgrimage site important to Armenian Christianity (Fig. 4).

October 11th, the first day field workshop was dedicated to the most eastern of the three sections, Ogbin one, which is situated along the Tchahuk river (Fig. 5).

One of us (A. Baud) gave information on the seven stops of the day and Araik Grigoryan provided personal information on the Upper Permian and Lower Triassic conodont succession. The Wuchiapingian part of the Khachik Formation was examined which contains fossiliferous shallow water limestone, followed by the deeper water Akhura Formation (upper Wuchiapingian - Changhsingian, Fig. 6).

We spent time to look at the uppermost Permian *Paratirolites* beds which are very similar to the Ali Bashi (NW Iran) *Paratirolites* limestone, cropping out 70 km to the south.

According to Ghaderi et al. (2014), at Ali Bashi this 5 m thick topmost unit is highly fossiliferous with 8 ammonoid zones and 6 conodont zones of latest Changhsingian age.

Our last stop of the day involved examination of the Permian - Triassic transition with badly outcropping boundary shale, followed by small sized sponge-micrbial build-ups (Fig. 7).

Zhong-Qiang Chen and his four Ph.D. students, started a detailed sampling of the Induan platy limestone of the Karabaglyar Formation (the hill on Fig. 7.

October 12th, the second day field workshop was dedicated to the Chanakhchi section (Transcaucasia, S. Armenia), which is situated about 60km SE of Yerevan. It was described in the last century as the Sovetachen section (Fig. 8).

Situated in the upper part of the Chanakhchi hill (Fig. 9), the biochronology of this Permian-Triassic section has been worked out recently by Zakharov et al. (2005 with ref. to Grigoryan, 1990).

Before looking at the Giant Sponge-Microbial Build-ups (GSMB) presented during the conference by Baud et al., (2017), we spent time to look at the Upper Permian Khachick and Akhura formations. Araik Grigoryan described the stratigraphy and conodont content of the Permian - Triassic boundary shales (Fig. 10).

The basal Triassic giant sponge-microbial buildups (GSMB) took all our attention with their two phases of growth. The first one is shown in Fig. 11.

Fig. 1. The Round-hall of the conference.

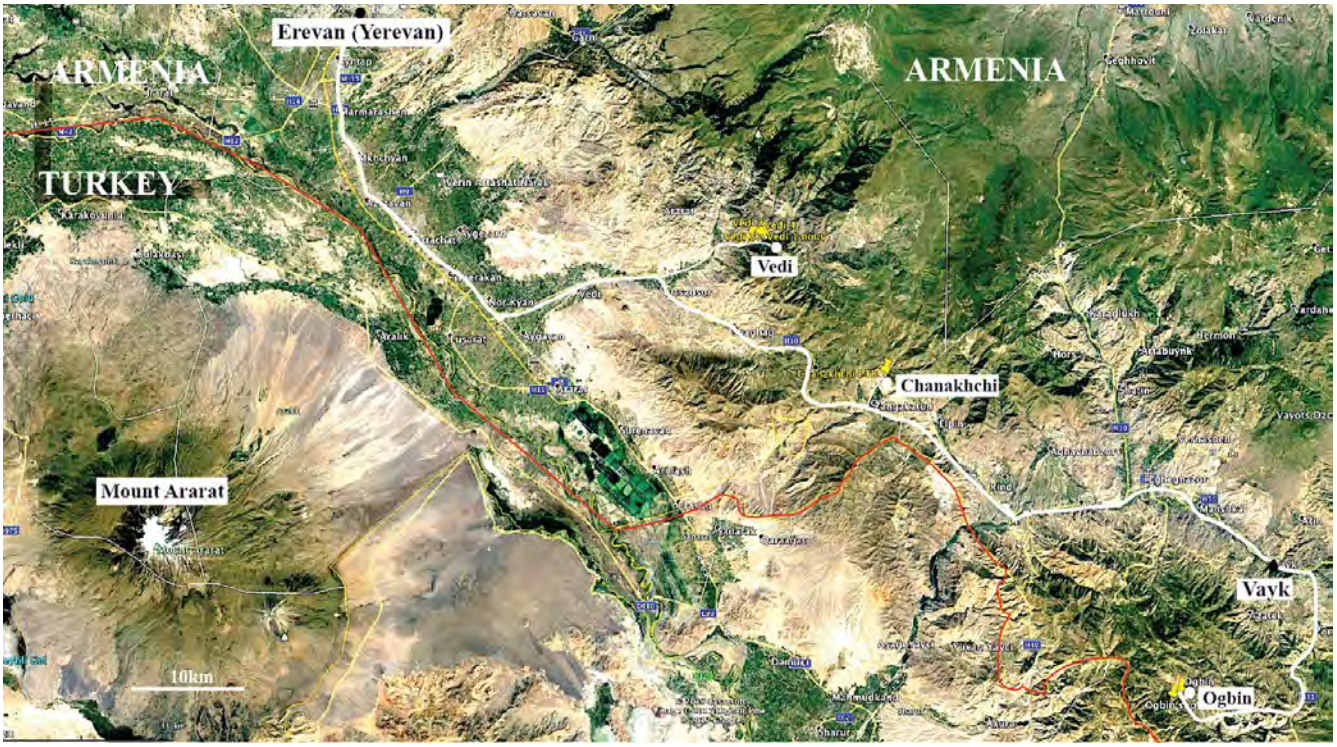

Fig. 2. Field workshop Itinerary (road in white, border in red).

Fig. 3. Participants at the conference, in the front, left to right: Dr. H.M. Adamyan, Prof. G. Bachmann, Prof. Z-Q. Chen, Dr. L. Sahakyan, Dr. A. Baud, Prof. S-Z. Shen, Prof. A. Biakov, Prof. L-S. Zhao.

Fig. 4. The Khor Virap Monastery at the foot of the Ararat Mountain, 5165m high.

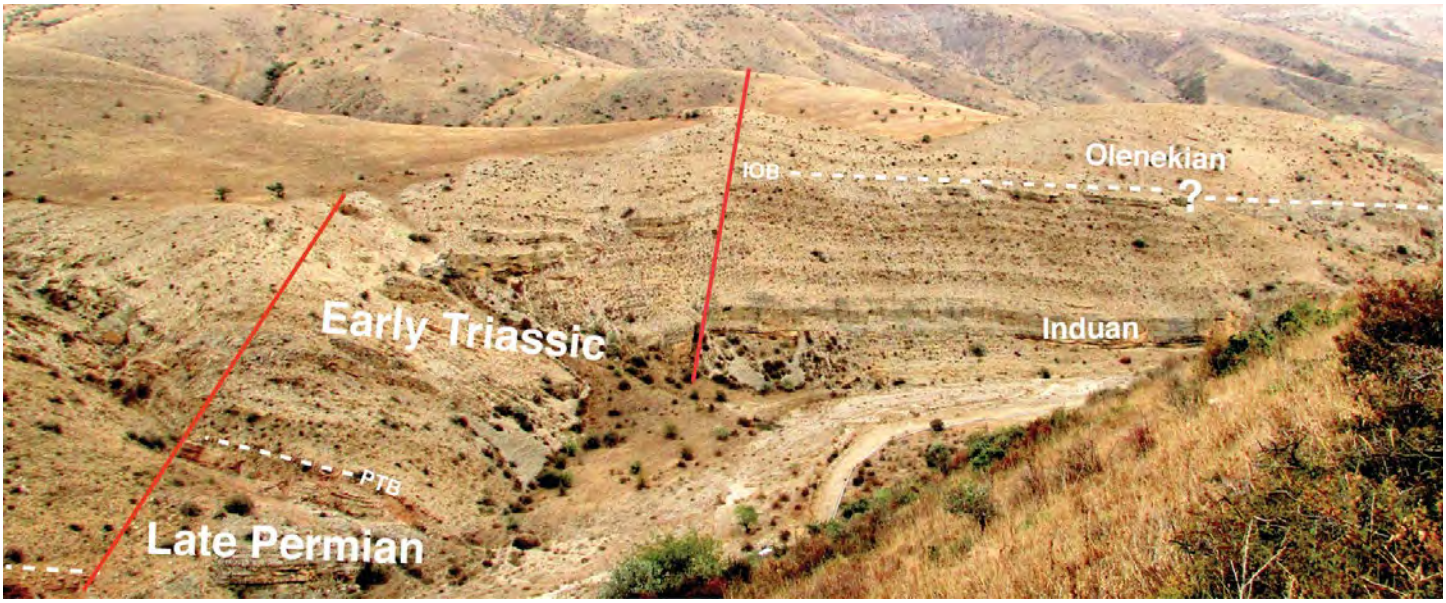

Fig. 5. The Ogbin section area looking to the NE, along the Tchahuk river.

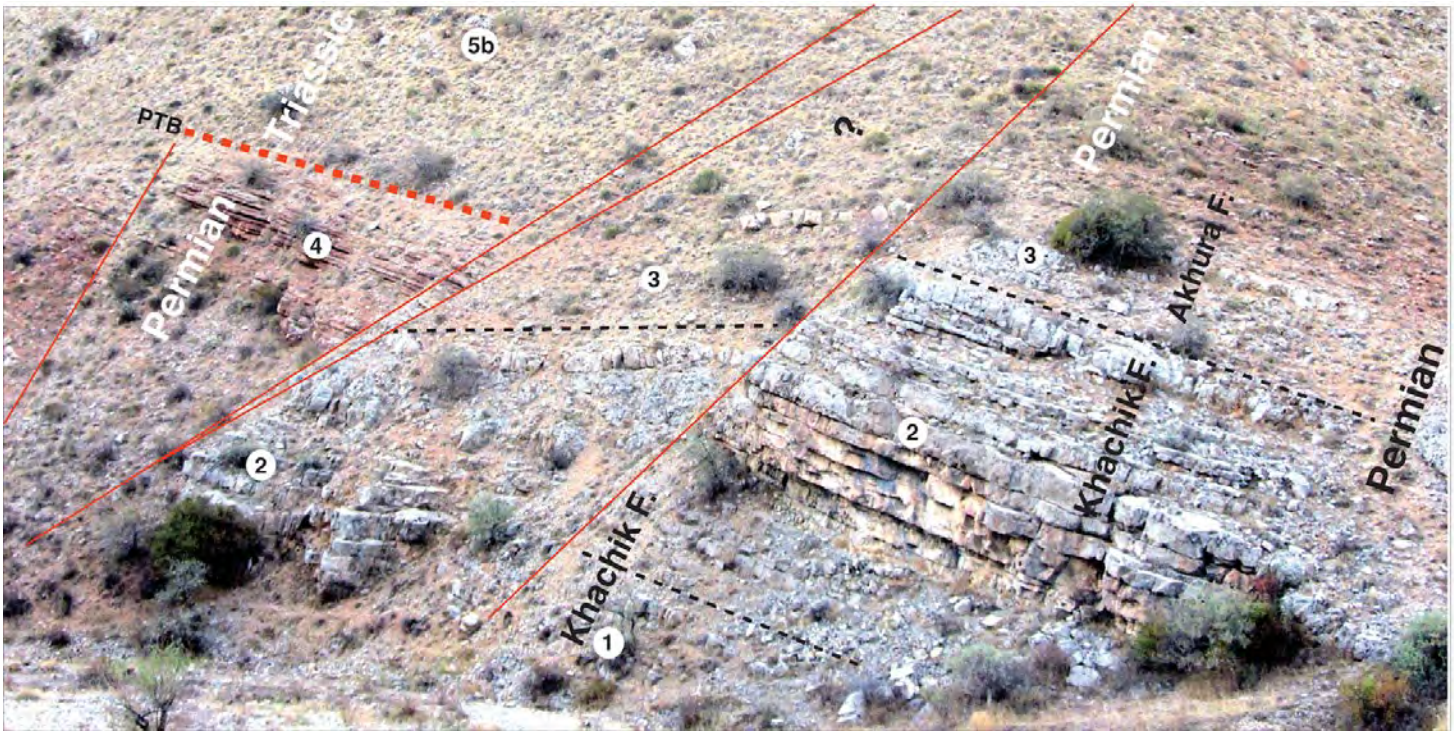

Fig. 6. Bottom right, outcrop of the Middle-Upper Permian Khachik Formation (Units 1-2); Unit 1, top of the Middle Permian (Capitanian) dark gray limestones. Unit 2, *Reichelina* - *Araxilevis* beds (lower Wuchiapingian), gray limestones followed by the upper Permian Akhura Formation (Units 3-4). Unit 3, *Araxoceras* and *Vedioceras* beds, gray yellowish marly limestones (upper Wuchiapingian). Unit 4, *Phisonites* to *Paratirolites* beds, red nodular marls and limestones (Changhsingian). Unit 5b, thin bedded limestones with SMB (Induan). Dashed black line: boundary between lithological units. Dashed red line: Permian-Triassic Boundary (PTB).

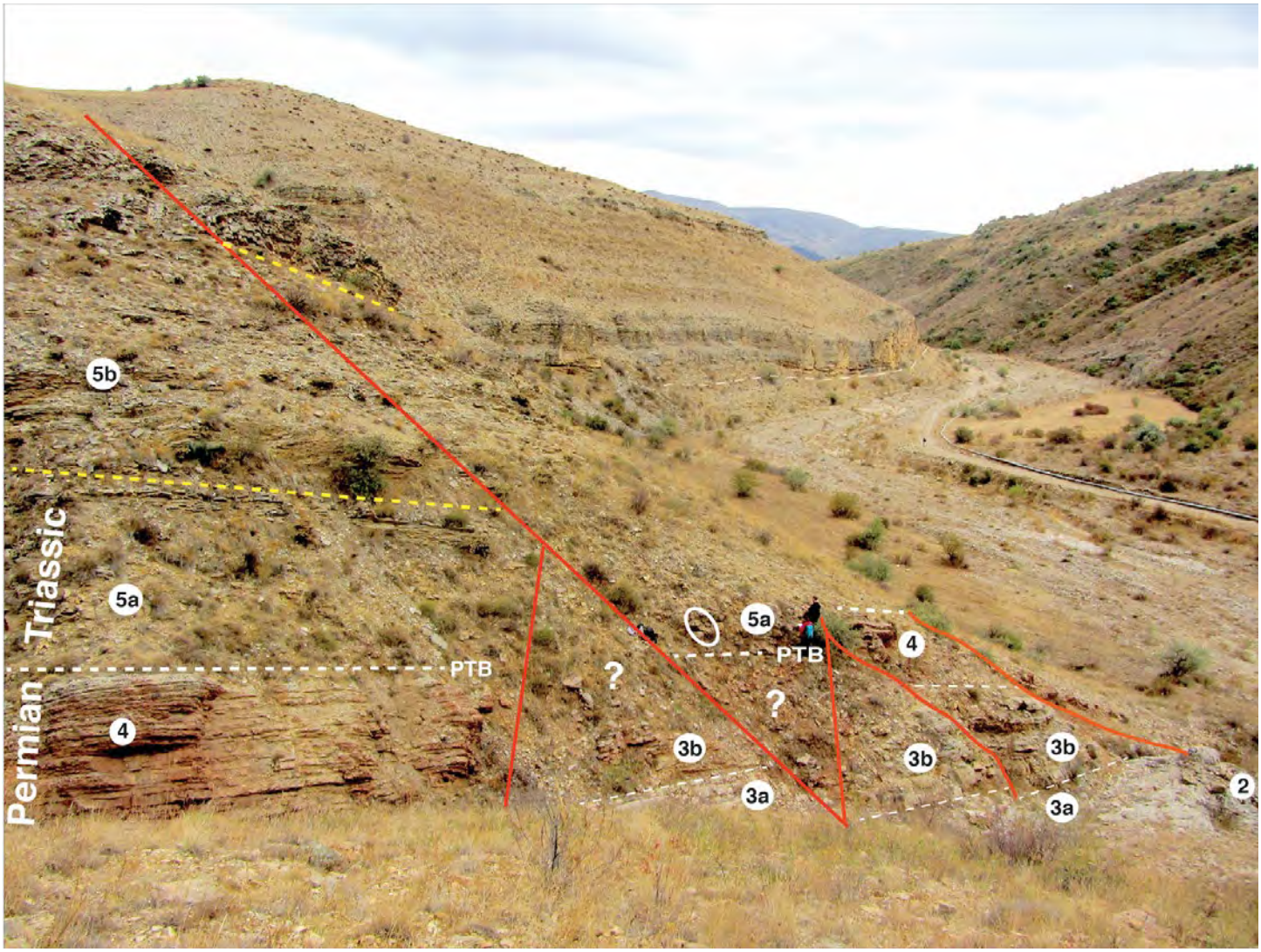

Fig. 7. View of the Permian-Triassic boundary and the red *Paratirolites* beds (4) bottom left (for unit 3 to 5, see caption in Fig. 6).

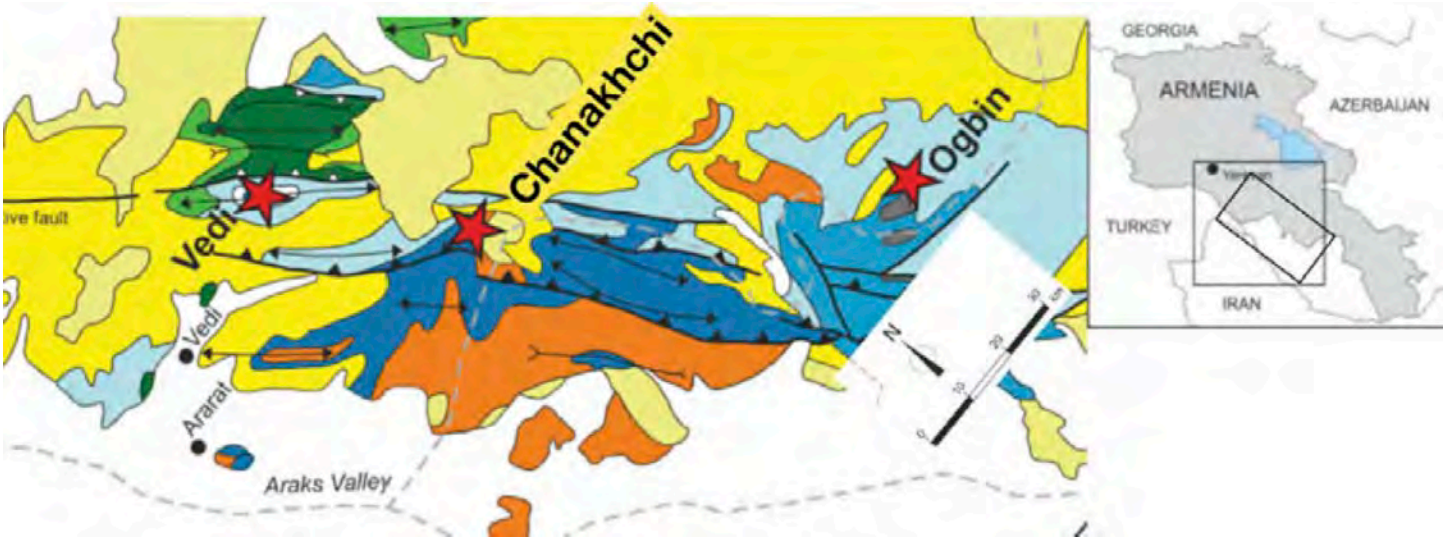

Fig. 8. Geological map of the area (Chanakhchi section: middle red star).

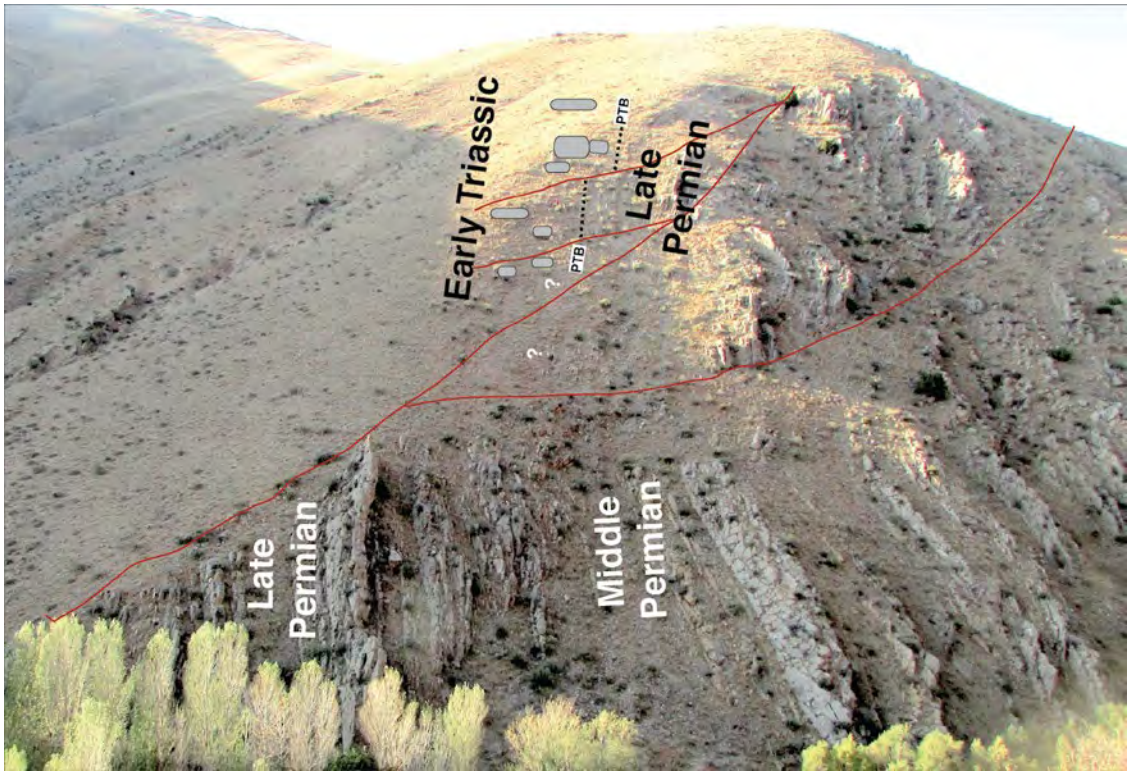

Fig. 9. View on the Chanakhchi hill from the opposite side. The vertical bedding of the Permian to Lower Triassic limestone is cut by large faults. The visited outcrops are in the upper part of the hill. Small gray surfaces: Sponge Microbial Build-ups (SMB). Dashed black line: PTB.

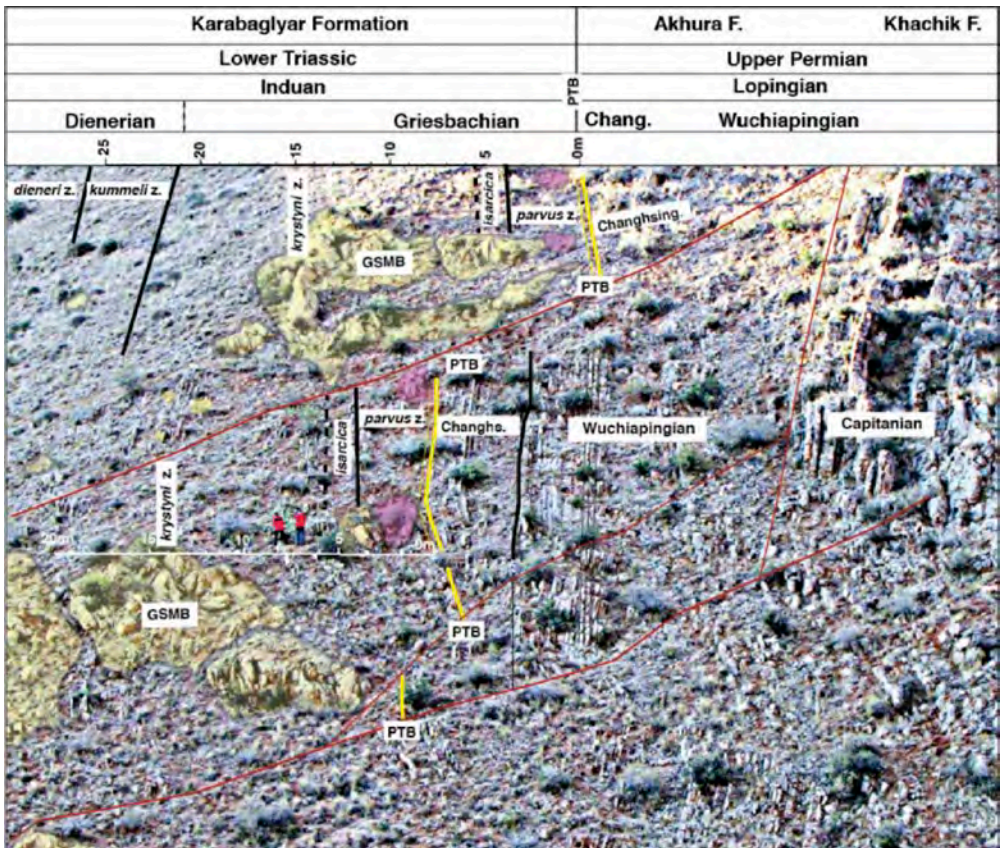

Fig. 10. Stratigraphic data across the Permian-Triassic Boundary (PTB: yellow line); red line: fault. Scale is given by two geologists with red jacket in the middle, just above horizontal white scale. Beds are vertical. The basal Triassic Giant Sponge-Microbial Build-ups (GSMB), highlighted in yellow and early phase of growth in pink).

Part of the group had a long discussion on the main giant sponge-microbial (GSMB) growth phase that is illustrated in Figs 12 and 13.

At the top of the Chanakhchi section, observed and discusses the Dienerian mini-sponge microbial build-up with our Chinese and Australian colleagues (Fig. 14). A group photo of participants was taken at the Chanakhchi section (Fig. 15)

Going back to our hotel in Vayk and Amrots, we got the opportunity to visit the 13th-century Noravank monastery near the top of the Norvank Valley. The church, completed in 1339, is said to be the masterpiece of the great medieval Armenian architect Momik (Fig. 16).

October 13th, the Vedi section, the subject of the last field day. After a night of heavy rain, we were lucky to get a sunny day and on the way to Vedi, and we had the opportunity to see the snow-covered Ararat Volcano through the clouds. Situated at the core of a large anticline, the Vedi sections expose well the Upper Permian carbonates followed by the thin bedded Lower Triassic platy limestones (Fig. 17).

At the Vedi 2 section, we started to look in detail the vertical bedded shallow-water Khachik Formation. As with the other South Armenian sections, a major facies change occurs at the top of the Khachik Formation (middle Wuchiapingian) due to drowning of the carbonate platform between the Upper Khachik Formation and the Lower Akhura Formation. We had a close look at the uppermost Permian *Paratirolites* limestone, exclusively of gray color here, and Araik Grigoryan gave explanation on the conodont biochronology from Wuchiapingian to Induan.

At this section, the Permian-Triassic is well exposed with vertical beds. We focussed on the onset of the basal Triassic SMB that directly overlies the Permian-Triassic Boundary shale (Fig. 18).

A few meters higher up in the section, the first ichnofacies appears on the bedding surfaces of platy limestones, along with a large collection of small SMB.

To look at a larger SMB, we moved to locality Vedi 4 where Lilit Sahakyan showed the participants a 12 m high Sponge Microbial Build-up (Fig. 20).

In the evening, the official dinner took place in the Yervan Pandok Restaurant (Fig. 21) and the participants, so pleased by the success of the workshop, addressed warm thanks to the organizers, and particularly to Lilit Sahakyan and her group of students (Taron Grigoryan, Hayk Hovakimyan and Kristina Sahakyan) who helped greatly in the field work organization and lunch preparation.

On October 14th, most of the participants started their journey home and Lilit Sahakyan provided the necessary special permission for sample exportat as required by some of the participants. Lilit Sahakyan also helped Zhong-Qiang Chen and his Ph. D. students to pack the large number of collected samples.

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Fig. 11. The Permian-Triassic transition, from right to left: top of the *Paratirolites* beds, in red the boundary shale (with 1 m scale along) and above the domal structure of the early phase of growth of 2 m-thick Sponge-Microbial Build-ups, with coalescent stromatolite or acicular stromatolite.

Fig. 12. A. Baud is giving explanations on the main giant sponge-microbial build-up discovered three years before.

Fig. 13. The main giant Sponge-Microbial Build-up behind part of a happy group after discussion.

Fig. 14. Dienerian small cylinder Sponge-Microbial Build-up (in front) with from left to right: Prof. Z-Q.Chen, Prof. S-Z. Shen, Dr. A. Baud, Dr. L. Sahakyan and Prof. G. Shi

Fig. 15. Participants to the 5th IGCP 630 International Conference and Field Workshop. Photo taken at Chanakhchi section.

Fig. 16. The medieval Noravank monastery (1339).

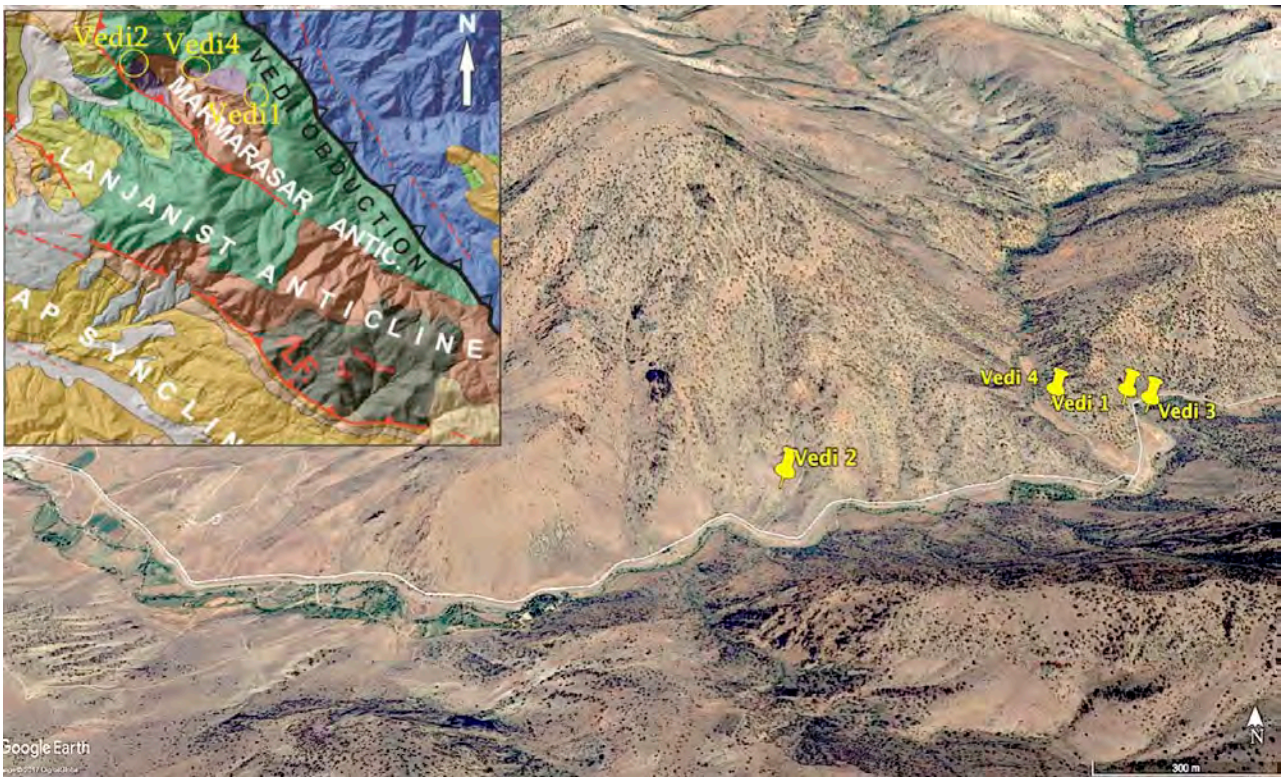

Fig. 17. Google Earth view on the Vedi river valley showing the position of the localities Vedi 1 to 4. Top left: Geological map of the Vedi area (Avagyan et al., 2015), with the Marmarasar (or Terterasar) anticline and the Vedi localities 1, 2and 4 (yellow circles).

Fig. 18. The Permian-Triassic transition with, from left to right, the basal Triassic SMB with fan structures, the boundary shale, the top of the *Paratirolites* bed. Scale (yellow), 20 cm.

Fig. 19. Left, detailed field view on part of the early growth of the basal Triassic SMB with its fan structures up to 20 cm high. Right, thin section scan view of the stromatolite microstructures. Scale bar: 1 cm.

Fig. 20. Dr. Lilit Sahakyan explaining the large Sponge Microbial Build-up at the Vedi 4 locality.

Fig. 21. Official dinner with Aymon's last song (Alouette).