The Newsletter of the International Association of Sedimentologists

Issue 12, 2021

Dear IAS Members,
Welcome to the final issue of the IAS Newsletter for 2021.

Thank you to everybody who attended the online IAS General Assembly on 10th December. All the resolutions put to the membership were passed unanimously.

The deadline for nominations for the **IAS Awards** has been extended – the closing date is now **31st December**. We are seeking nominations for the Early-Career Scientist Award, Sun Shu Prize, Sorby Medal and Johannes Walther Award. This is a great opportunity to give one of your colleagues the international recognition they deserve. The procedure is simple, and full instructions are provided for each of the awards on the website as well as lists of past recipients. Please do put forward candidates for consideration the process is surprisingly quick and easy and can really make a difference for the awardee.

Everybody whose **membership** is due for **renewal** should have received an email invitation to renew online. Please do **remember** to do this so that you can continue to enjoy all of the benefits of IAS membership including access to our high-impact journals, conferences and grants through 2022. The renewal process is quick and easy, and the rates compare very favourably with other societies.

We remind you that applications are open for the **IAS Postgraduate, Postdoctoral and Institutional Grants** as well as for the Judith McKenzie Field Work Award. The closing date for this round of applications is the 31st March 2022. This newsletter contains reports from some of the successful 2020 grant awardees.

We also alert **postgraduate student members** to the **2022 IAS Summer School**, which will be an unrivalled opportunity to study modern carbonate sediments and their lithified analogues on Eleuthera Island in the Bahamas. The application deadline is 15th January.

On behalf of the Society, I wish you and your families a healthy, safe and enjoyable New Year

Stephen Lokier, *General Secretary*

The 21st International Sedimentological Congress, Beijing 2022

The **21st International Sedimentological Congress** will be held in Beijing between the 22nd and 26th August 2022 – get the dates into your diary. Registration details and information on the format of the meeting (hybrid or online) will be available early in the new year. [Visit the website for full details.]

Don't miss out on all that the IAS has to offer - RENEW TODAY!

The IAS is **the** home of Sedimentology.

We are very proud of our ability to keep our membership fees so much lower than most other professional societies.

You can find a complete list of the benefits of membership of the IAS website.

You may also consider becoming a full member for 5 years at a cost of only €100 – effectively getting one year's membership for free. We also offer 'lifelong' membership for just €400.

STUDENT	FULL
STARTING FROM 10€	STARTING FROM 25€ /year
INCLUDED	**INCLUDED**
Annual membership fee	Annual membership fee
Online Sedimentology Online Basin Research Online Special Publications (5+ years)	Online Sedimentology Online Basin Research Online Special Publications (5+ years)
Travel Grants Postgraduate Grants J. McKenzie Field Work Award Conference Sponsorship Request	Post-doctoral Grants Institutional Grants Conference Sponsorship Request
Printed Sedimentology at favourable rates Reduction for IAS Conferences Printed thematic books discounts	Printed Sedimentology at reduced fee Reduction for IAS Conferences Printed thematic books discounts
Special Lecture Tour hosting	Special Lecture Tour hosting
Newsletter Contributed Content Members Directory	Newsletter Contributed Content Members Directory
OPTIONAL	**OPTIONAL**
	Multiple years membership at reduced fee Lifelong membership at reduced fee
Printed Sedimentology **+20€** Online Petroleum Geology **+45€** Online + Printed Petroleum Geology **+50€** Friendship Scheme Sponsor **+15€**	Printed Sedimentology **+20€**/year Online Petroleum Geology **+45€**/year Online + Printed Petroleum Geology **+50€**/year Friendship Scheme Sponsor **+15€**/year

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FINAL call for nominations for the:

IAS Sorby Medal
IAS Johannes Walther Award
IAS Early-Career Scientist Award
IAS Sun Shu Prizes

The **Sorby Medal** is the highest award of the International Association of Sedimentologists. It is awarded to scientists of eminent distinction in sedimentology. The Sorby Medal is awarded once every 4 years, at the occasion of the International Sedimentological Congress (ISC).

The **Johannes Walther Award** is awarded to scientists at any stage in their career who are considered to have made a significant impact in the field of sedimentology. The award is given once every 2 years.

Emmanuelle Vennin, recipient of the 2020 Johannes Walther Award

The **IAS Early-Career Scientist Award** is awarded to recognise contributions and potential of outstanding early-career scientists working in any area of sedimentology. The award is also given once every 2 years.

Or Bialik, winner of the 2020 Early Career Scientist Award

The **IAS Sun Shu Prizes** are awarded to recognise outstanding work in the field of sedimentology. The prizes are awarded every two years to a Chinese scientist (SUN SHU Prize China) and an international scientist (SUN SHU Prize International).

Full details of all prizes, together with the nomination guidelines can be found **here**.

The final application deadline for all awards is now 31st December 2021 24h00 Brussels Time (CEST, UTC+2).

Huaichun Wu, Winner of the Sun Shu Prize China, 2020

Alex Brasier, Winner of the Sun Shu Prize International, 2020

Call for Judith McKenzie Field Work Award applications (Spring 2022 Session)

The **Judith McKenzie Field Work Award** aims to promote sedimentological field observations for the newest generation of Earth Scientists – MSc Students.

Up to 5 awards of €300 each, will be awarded twice per year to IAS student members. Since the award is only available for MSc students, proof of student status will be required. The awardee shall also receive a one-year IAS student membership, upon submission of their MSc thesis.

Applicants should apply for the Judith McKenzie Field Work Award via the **IAS website here**. The application requires submission of a grant proposal (written by the student) with budget and CV (template provided on the submission webpage), and a signed letter of recommendation from the student's supervisor. Application deadline for the Spring 2022 Session is **31st March 24h00 Brussels Time (CET, UTC+1).**

Call for IAS Post-Doctoral Research Grant applications (Spring 2022 Session)

IAS Post-Doctoral Research Grants are intended as a seed to assist Early-Career post-doctoral researchers in either establishing a proof of concept, in order to support applications to national research funding bodies, or to fund areas of a project that were not included in the original project scope.

Up to 4 grants, each to a maximum of €2,500, are awarded twice per year to Early Career IAS members.

The application requires submission of a research proposal with budget and CV (template provided on the submission webpage, and a letter of support from the researcher's supervisor, line manager or Head of School. More details about the application procedure can be found on your membership profile.

Applications must be submitted via the IAS website. Application deadline for the Spring 2022 Session is **31st March 24h00 Brussels Time (CET, UTC+1).**

Eligibility:
- Applicants must be full members of the IAS and have secured their Ph.D. within the previous 7 years.
- Applicants can only benefit from a Post-Doctoral grant on one occasion.

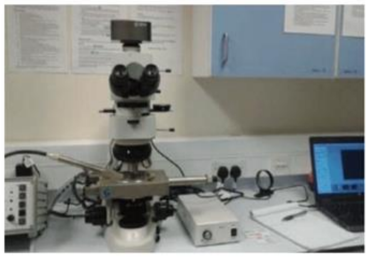
Call for Institutional Grant applications (Spring 2022 Session)

Twice a year, IAS awards an Institutional Grant of maximum 10,000 Euro, which is intended to support capacity building initiatives in less developed countries (LDCs). Grants will allow earth science departments in LDCs to acquire durable sedimentological equipment for teaching and research, or tools that can be used by all geology students. The grant application should thus clearly demonstrate how the grant will increase the recipient's capacity to teach sedimentology at undergraduate level in a sustainable way.

Applications must be submitted via the IAS website. Application deadline for the Spring 2022 Session is **31st March 24h00 Brussels Time (CET, UTC+1).**

More information about the Institutional Grant Scheme and guidelines on how to apply can be found on your membership profile.

Call for Post-Graduate Research Grant applications (Spring 2022 Session)

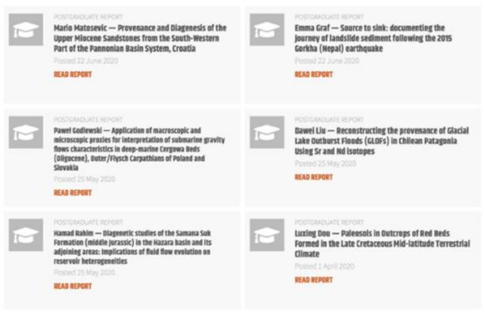


Up to 10 research grants, each to a maximum of €1,000, are awarded twice a year to **IAS Post-Graduate Student Members**. This grant scheme is designed to support PhD students in their studies and research. Post-Graduate Research Grants can be used to (co-)finance fieldwork, acquisition and analysis of data, visits to other institutes to use specialized facilities, etc.

Applications must be submitted via the IAS website. Application deadline for the Spring 2022 Session is **31st March 24h00 Brussels Time (CET, UTC+1).**
More information about the Post-Graduate Grant Scheme and guidelines on how to apply can be found on your membership profile.

IAS Grant Reports

You can read recent and past Grant Reports from IAS members who have benefited from Post-Doctoral or Post-Graduate grants here.



IAS Regional Correspondents

IAS Regional Correspondents are your local hotline to the IAS. These are IAS Members who have volunteered to act as a representative between sedimentologists in their region and the Society. The positions will be renewed in 2022 and we will be seeking proposals for new or continuing Regional Correspondents in the new year – watch this space for further details!

In the meantime you can see who your Regional Correspondent is using the interactive map. If you know of any sedimentology events going on in your region, then please get in touch with them and let them know. Similarly, if your region currently lacks a Regional Correspondent and you would like to propose an IAS Member (Full or Student), or yourself, for this position then please send an email to the General Secretary.

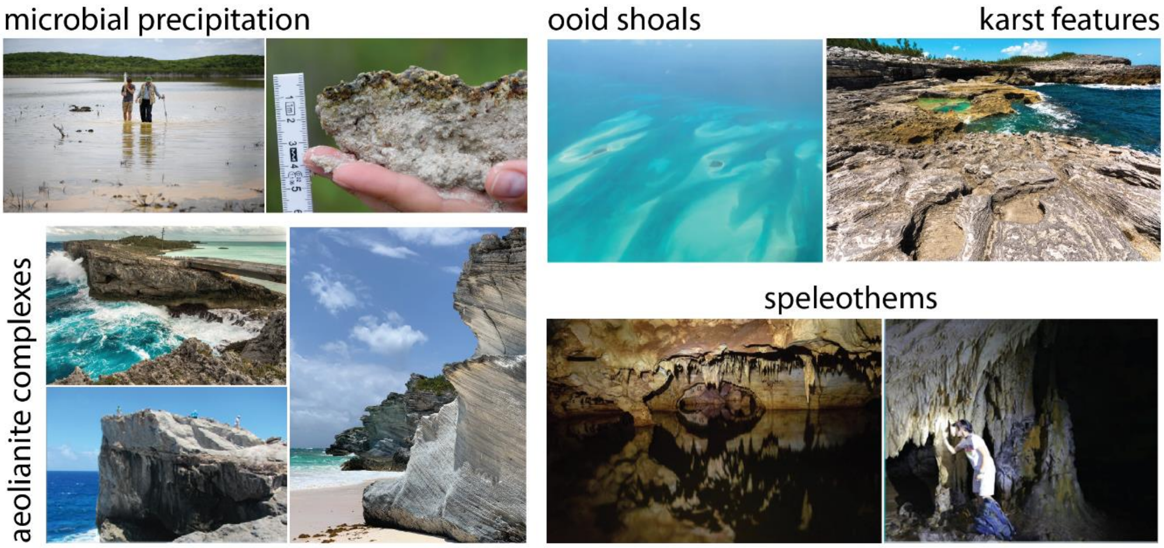
IAS Summer School - 2022

ATTENTION PHD STUDENTS !!

Are you interested in learning
more about **carbonate sedimentology**?

Do you want to visit an island that takes you from water,
to sediment formation, to lithified rock?

Then check out the **IAS international summer school** in
Eleuthera, Bahamas from **May 7-14, 2022**



APPLICATIONS DUE: JANUARY 15, 2022

To apply, sign into your student member profile on the IAS website, then visit
https://www.sedimentologists.org/me/summer-school
(only visible for student members)
email *pswart@rsmas.miami.edu or chelsea.pederson@rub.de* with any questions
*All participants must be vaccinated with one of the WHO approved vaccines:
https://covid19.trackvaccines.org/agency/who/
*Due to trip cancellations in 2020 and 2021, previous applicants are
encouraged to reapply

What you'll need to apply:

1) motivation letter
2) letter of support from your PhD supervisor
3) proof of PhD studentship
4) updated CV

For more information see **here**

The Journals of the IAS

For a quick overview of the latest issues of **Sedimentology, Basin Research** and **The Depositional Record**, follow these links:

- **Sedimentology**: directly at Wiley or via the IAS website
- **Basin Research**: directly at Wiley or via the IAS website
- **The Depositional Record**: directly at Wiley or via the IAS website

All of the journals of the IAS are active on Twitter. Stay up to date on the latest news and papers in @sedimentology by following the IAS journals: @JSedimentology, @DepositRecord, @BasinResearch.

The Depositional Record – Open Access – Still no APC!

The Depositional Record will receive its Impact Factor in Summer 2022. The IAS continues to pay the APC for all papers accepted in The Depositional Record but this will not last forever. Get those submissions in soon!

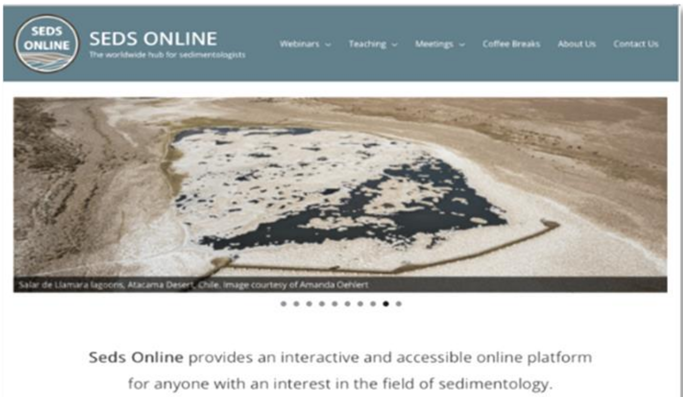
The Depositional Record is a fully open access journal publishing high quality articles from across the field of Sedimentology. The journal covers all timescales, from Ancient to Modern, and welcomes articles that emphasise the application of sedimentary processes to the study of paleoclimate, changes in the chemical environment, ocean acidification, extra-terrestrial sedimentology, and the application of genetic methods to understanding sedimentological processes.

Open Access

Submit your paper today!

Online resources sponsored by the IAS….

Seds Online is an exciting free, online initiative that provides an interactive, adaptable and accessible online platform for anyone with an interest in the field of sedimentology. Seds Online welcomes members at any career stage, from both industry and academia! It hosts free weekly webinars on the latest sedimentology research (many of which are archived and available for viewing in a growing video library), opportunities for research students to present their work in a friendly and enthusiastic forum, conferences such as the regular virtual "coffee breaks" where sedimentologists can informally chat and interact, teaching resources and virtual conferences such as the Carbonate Forum.



https://sedsonline.com: Twitter @Seds_Online

Carbonateworld is an online atlas containing more than 800 images covering an extensive spectrum of carbonate textures, grain types, diagenetic features, depositional environments and case studies. The images are organised in categories and subcategories (e.g., carbonate rock classification, skeletal grains, ooids, corals, burial diagenesis etc.) and are frequently updated with new material.

https://carbonateworld.com/

The **Antarctic Glaciers website** is a fabulous resource for anyone interested in global glacial processes, landforms and sedimentology – despite the name, this site goes way beyond Antarctica! **www.AntarcticGlaciers.org**

Follow the IAS on Social Media

Follow the IAS on **Facebook**, **Twitter**, **WeChat** and **LinkedIn** to keep up to date with all of the latest news, announcements and happenings.

@sedimentology and IAS沉积学之家

Tidalites 2022

The IAS is proud to be supporting the 10th Internationa Congress of Tidal Sedimentology in Matera (Italy), 3 – 5 May 2022, through sponsoring student travel grants. Please see the conference website for the registration circular, call for abstracts and full conference information. Guidelines for IAS travel grant applications can be found here. The procedure requires submitting a short letter of motivation and proof of enrolment as a PhD student, together with some specific details about location and travel distance, affiliation, etc. The closing date to apply for travel grants for this conference is 1st March 2022.

IAS Postdoctoral Research Grant 2020 Report

Carbonate precipitation in presence of microbial mats in a siliciclastic environment.

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Introduction and study area

Mineral precipitation in microbial ecosystems has been studied in detail in modern and past carbonate environments, where rapid mineralization favours preservation of microbialites (Reid et al., 2000, Dupraz et al., 2004). In contrast, in modern siliciclastic environments, microbial mats are generally unlithified and form planar soft organic layers that colonize depositional areas that are subject to erosive episodes by high-energy currents and to sediment deposition (Noffke, 2003). Nevertheless, the present study documents evidence of calcium carbonate precipitation in a siliciclastic coastal environment that enables the lithification of ripple marks and microbial mats. Sedimentary structures such as ripple marks, formed by severe hydrodynamic events, are biostabilized by microbial activity and the presence of exopolymeric substances (EPS; Cuadrado, 2020), which may produce sinoidal structures. In addition, the presence of a carbonate lamination over these sand sedimentary structures possibly would enhance the lithification of the colonized ripple structure. The analysis of this carbonate precipitation is the focus of these results, which coupled with the sinoidal structure, may provide potential for preservation in the fossil record. Paso Seco coastal area is an excellent case study to present the formation of carbonate lamination in microbial mats, which is a consequence of a combination of biogeochemical and physicochemical factors (Perillo et al., 2019, Maisano et al., 2020). The Paso Seco coastal environment (40°38’40´´S; 62°12´22´´W; Fig. 1) is in the northern coast of Patagonia (Argentina), which is characterized by a mesotidal regime with mean and maximum tidal ranges of 1.62 m and 2.5 m, respectively. The climate of the region is semiarid, as stated by the recent climatic classification of the Argentinian Pampas proposed by Aliaga et al. (2017), characterized by a potential evapotranspiration greater than precipitation, which generates enough aridity to limit vegetation development. The elongated study area (3.5 km in length and 0.4 km in width) corresponds to an ancient tidal channel closed more than 100 years ago by the generation of a sand spit (1.8 km wide) due to longshore sediment transport. Thus, the study area is a coastal environment behind the sand spit, a semi-closed basin categorized as a supratidal zone because it is flooded by seawater under specific oceanographic conditions when storm surges provoke seawater overpass the sand spit (Stempels Bautista, 2019). The flooding might occur up to 43 times per year, but the area remains unaffected by daily flood tides (Perillo et al., 2019; Maisano et al., 2019). The area is characterized by ≈ 1 cm-thick epibenthic mats that colonize the sediments (Cuadrado et al., 2015). The main constructor member of this microbial consortium is the filamentous cyanobacteria in the order *Oscillatoria sp*. where the *Coleofasciculus (Microcoleus) chthonoplastes* is the most abundant cosmopolitan cyanobacteria species in the area (Cuadrado and Pan, 2018). Other important microorganisms of the microbial association are pennate diatoms that are the first colonizers (Pan et al., 2017). Once the microbial mat is formed, the consortium of microorganisms, EPS and sediment produces a poorly permeable sediment surface, which causes slow water infiltration from the surface and allows gradual evaporation of seawater and evaporite precipitation (Perillo et al., 2019). Thus, Paso Seco can be considered a saline basin conditioned by the hydrological conditions and biological processes (Perillo et al., 2019).

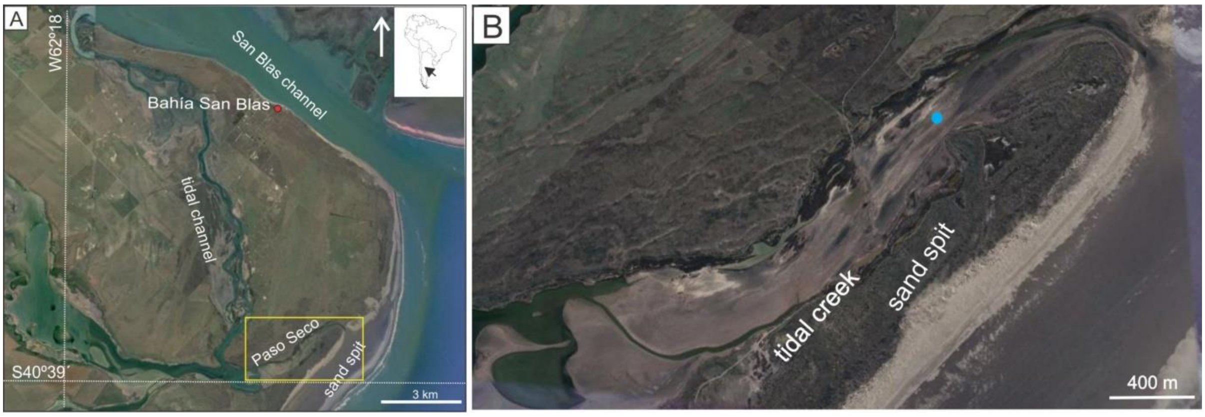

Figure 1. a) Location of the Paso Seco flat behind a sand spit (yellow square). b) Close-up view of the study area (yellow square in A). The blue mark indicates the location of the water level station.

Methods and results

To know the frequency of seawater entering the study zone, water-level fluctuations were measured in the tidal flat using a HOBO water level logger (Onset-model U20; 2.5 cm diameter, 15 cm length). It was deployed into a vertically buried, perforated PVC pipe, 40 cm in depth from the sedimentary surface. The sensor recorded water level and temperature every 10 min. The water level data were corrected by atmospheric pressure by means of another logger placed in an upper level close to the tidal flat. The present study shows the water level and temperature recorded over a 10-month period in 2018. Ripple field formation over the tidal flat was documented after the occurrence of a severe storm and was monitored throughout three field trips over a period of nearly six months since its creation, until December 2018. Firstly, ripples were examined two days after their creation, then in a following field trip carried out 20 days after a moderate storm that caused deposition of a thin sand layer over the previous ripples, and finally, six months afterwards. During the third field trip (December 2018) a sedimentary block (12 x 12 x 5 cm) which included the monitored ripples was taken for petrographic analysis. In addition, sedimentary cores were obtained using PVC tubes (3 cm diameter and 7 cm length) to examine the sedimentary texture and microstructures. They were opened in the laboratory, and subsequently analysed under a SMZ Nikon 1500 stereoscopic zoom binocular microscope. Thin sections (thicker than the 30-μm traditional thickness of petrographic thin sections to avoid losing fragments of sample) obtained from the sedimentary block were prepared for petrographic analysis. Thin sections were analysed by a Nikon Eclipse POL 50i transmitted-light microscope, coupled with a camera using lenses with lower and intermediate magnification (purchased with the IAS grant). The analysis was carried out under plane-polarized light and cross-polarized light to identify mineral species.

A sedimentary block containing the sand ripples deposited over a 1 mm-thick microbial mat (Fig. 2a) was petrographically analysed. The microbial mat (c frame in Fig. 2b) is composed of brownish organic matter laminae of ≈ 20 μm thickness (yellow arrows in Fig. 2c), interbedded with clay to fine-grained silt and micritic calcite laminae between 40 and 80 μm in thickness (orange arrows in Fig. 2c). The micritic layers sometimes are composed of peloids less than 100 μm in size (blue arrows in Fig.2c- d), which may coalesce forming laterally continuous layers (pink arrows in Fig. 2c-d).

The sand ripple deposited over the microbial mat is 6 mm in height and its trough is covered by a layer made up of fine silt and clay (limited by red dashed line in Fig. 2b). This fine-grained layer presents variable thickness, being thicker (≈ 1 mm) in the trough, and thinner (few tens of micrometres) towards the crest of the ripple. This layer presents a brownish interference colour under cross-polarized light (red dashed line in Fig. 2b, e-g) which is covered by a thin biofilm along the upper red dashed line (Fig. 2b, e-g). Upwards, another tiny train of sand ripples (up to ≈ 1 mm in height) covers the previous fine sediment layer and the thin biofilm (green arrows in Fig. 2b- e, f). This second train of ripples had not been recognized during the field trips due to its small size, and its identification was only possible under the microscope. Covering the previous laminae, a laterally continuous dense micritic calcite layer, 100-to-200 µm in thickness, is developed (m in Fig. 2e- f). The high-order interference colours of calcite under cross-polarized light allow to easily discern this lamina (Fig. 2h- i). The micritic layer is covered by an organic matter lamina forming a biofilm on the sediment surface (b in Fig. 2e- i).

Discussion

The analysis of the sedimentary block obtained from the flat after the formation and colonization of the ripples (Fig. 2a), coupled with the analysis of the water level record, allows the recognition of the successive hydrodynamic events that took place in Paso Seco along 2018 and the identification of all the processes involved in ripple preservation. The strong storm of June 2018 created the ripple resting on the microbial mat (yellow arrow, Fig. 2a-b). After that strong event and during the subsequent relative quiet conditions, when there was no sediment reworking, a clay and silt sediment layer of varying thickness was deposited (red dashed line in Fig. 2b, e). Moreover, during this period, a reorganization of the microbial mat fabrics occurred, and binding and trapping processes took place. These processes would lead to the formation of a thin biofilm covering the sediment surface forming a sinoidal structure (see Noffke, 2010) (located along the upper red dashed line in Fig. 2b, e-g). The subsequent moderate storm in July produced another ripple over that biofilm (green arrow in Fig. 2b), and finally the ripple was capped again by a thin biofilm formed during following subaerial exposure and several inundation events. Although the genesis of the ripples was triggered by mechanical processes (thus abiogenic), that is, transport of non-cohesive detrital sediments (Kennedy, 1969), the presence of the filamentous microorganisms in the microbial mats over which the sand was deposited, produced a fast stabilization (Cuadrado, 2020). The sedimentary processes identified in Paso Seco, in close relationship to the different hydrodynamic events that took place along 2018, allow us to interpret the main factors that contributed to the preservation of the studied ripples. First, the biostabilization of the ripples caused by the development of a thin biofilm over their surface could help to prevent these structures from erosion. The present study shows that carbonate precipitation within the microbial mats that colonize the ripples is crucial for the early lithification of these structures, which might significantly increase their preservation potential in the geological record.

Future directions

The first results obtained in this project about the calcite precipitation covering the microbial mat and ripple marks was documented in detail in a publication which was accepted in L*atin American Journal of Sedimentology and Basin Analysis (LAJSBA) as part of a special issue titled:* Exploring the geochemistry and biogeochemistry of modern and ancient sedimentary systems. Future results about the genesis of the carbonate peloids in modern siliciclastic microbial mats will be organized in a manuscript that will be submitted to The Depositional Record in 2022.

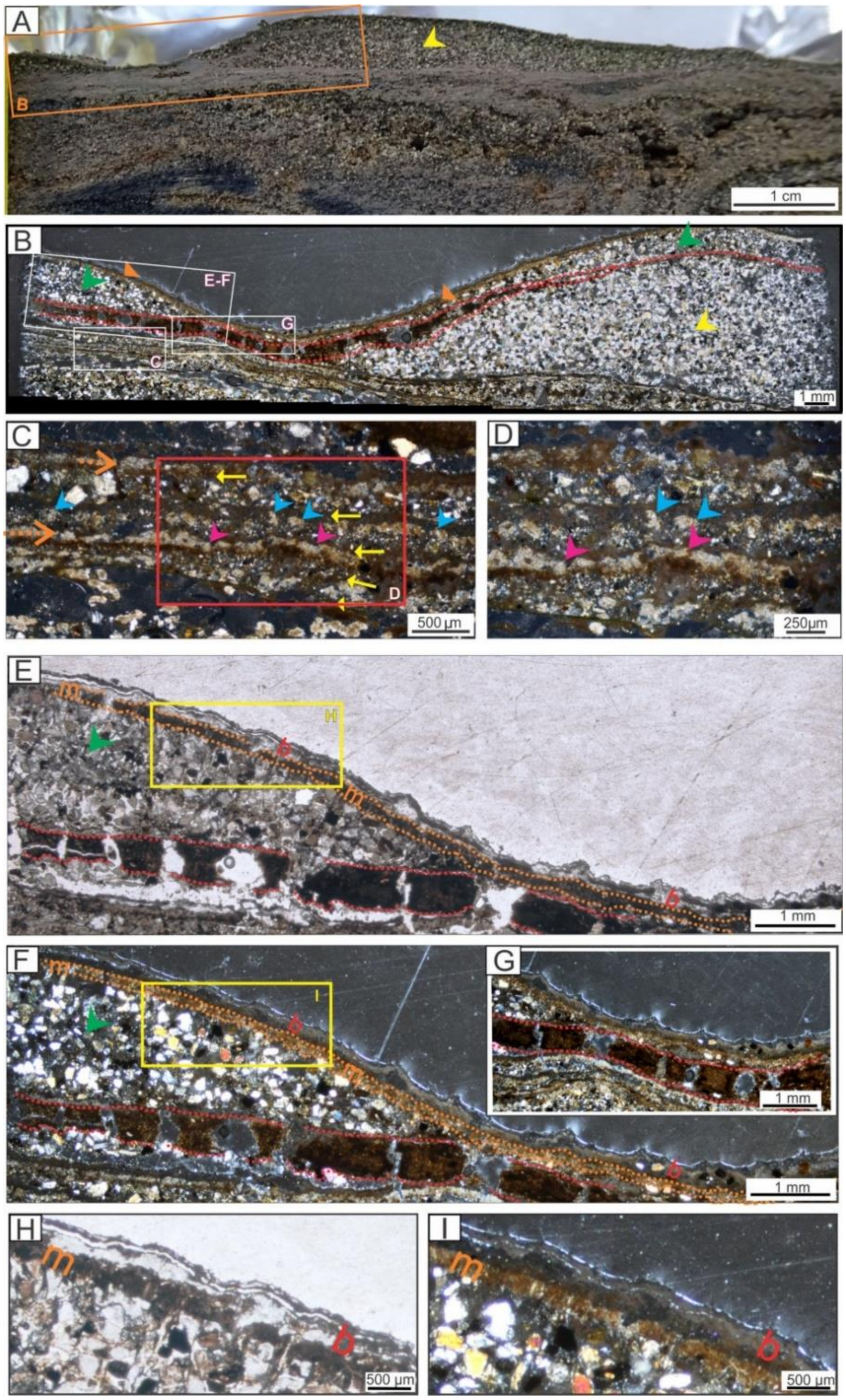

Figure 2: a) Vertical sedimentary profile of the block containing the ripple formed in June 2018 (yellow arrow). The location of the analysed thin section is indicated by the orange square. b) Thin-section cross-polarised light photomicrograph of the orange square in (a). Yellow arrow indicates the body of the ripple formed in June 2018; red dashed line indicates a layer made up fine silt and clay; green arrow indicates another ripple formed because of a moderate storm; orange arrow indicates a micritic layer covered by an organic matter lamina forming a biofilm. c) Cross-polarised light photomicrograph of a close-up of the microbial mat below the ripple (square c in b). Yellow arrows indicate brownish organic matter laminae; orange arrows indicate micritic calcite laminae; blue arrows indicate peloids; pink arrows indicate coalescent peloids. d) Cross-polarised light photomicrograph of a close-up of the microbial mat of (c). Blue arrows indicate peloids; pink arrows indicate coalescent peloids. e) Plane-polarised light photomicrograph of a close-up of the uppermost sand ripple (square e-f in b). Green arrow indicates the body of the ripple; b indicates an organic matter lamina forming a biofilm at the surface; orange dashed lines (m) indicate a laterally continuous dense micritic layer. Red dashed line indicates a lamina composed of fine silt and clay. f) Cross-polarised light photomicrograph of (e). g) Thin-section cross-polarised light photomicrograph of the square g in (b). Red dashed line indicates a lamina made up fine silt and clay. h) Plane-polarised light photomicrograph of a close-up of yellow square in (e). b indicates the biofilm covering the micritic layer (m). i) Cross-polarised light photomicrograph of (h).

References

Aliaga, V.S., Ferrelli, F., Piccolo, M.C., 2017. Regionalization of climate over the Argentine Pampas. International journal of climatology 37: 1237-1247.

Cuadrado, D.G., 2020. Geobiological model of ripple genesis and preservation in a heterolithic sedimentary sequence for a supratidal area. Sedimentology, 67(5): 2747-2763.

Cuadrado, D.G., Pan, J., 2018. Field observations on the evolution of reticulate patterns in microbial mats in a modern siliciclastic coastal environment. Journal of Sedimentary Research, 88 (1): 24-37.

Cuadrado, D.G., Pan, J., Gómez, E.A., Maisano, L., 2015. Deformed microbial mat structures in a semiarid temperate coastal setting. Sedimentary Geology 325: 106-118.

Dupraz, C., Visscher, P.T., Baumgertner, L.K., Reid, R.P., 2004. Microbe-mineral interaction: Early carbonate precipitation in a hypersaline lake (Eleuthera Islands, Bahamas). Sedimentology, 51: 745-765.

Kennedy, J.F., 1969. The formation of sediment ripples, dunes, and antidunes. Annual review of fluid mechanics, 1 (1): 147-168.

Maisano, L., Cuadrado, D.G., Gómez, E.A., 2019. Processes of MISS-formation in a modern siliciclastic tidal flat, Patagonia (Argentina). Sedimentary Geology 381: 1-12.

Maisano, L., Quijada, I.E., Cuadrado, D.G., Perillo, V.L., Pan, J., Martinez, A.M., 2020. Carbonate laminae recorded in a siliciclastic tidal flat colonized by microbial mats. Sedimentary Geology 405: 105702.

Noffke, N., 2003. Epibenthic cyanobacterial communities interacting with sedimentary processes in siliciclastic depositional systems (present and past). In Fossil and recent biofilms (pp. 265-280). Springer, Dordrecht.

Noffke, N., 2010. Geobiology: Microbial mats in sandy deposits from the Archean Era to today. Springer Science and Business Media.

Pan, J., Cuadrado, D.G., Bournod, C.N., 2017. Diatom-driven recolonization of microbial mat-dominated siliciclastic tidal flat sediments. FEMS Microbiology Ecology, 93 (10).

Perillo, V.L., Maisano, L., Martinez, A.M., Quijada, I.E., and Cuadrado, D.G., 2019. Microbial mat contribution to the formation of an evaporitic environment in a temperate-latitude ecosystem. Journal of Hydrology 575: 105-114.

Reid, R.P., Visscher, P.T., Decho, A.W., Stolz, J.F., Bebout, B.M., Dupraz, C., Steppe, T.F., 2000. The role of microbes in accretion, lamination and early lithification of modern marine stromatolites. Nature 406: 989-992.

Stempels Bautista, C., 2019. *Ondas de tormenta en la zona costera de Paso Seco. Buenos Aires, Argentina*. (Dissertation, Tesis), Universidad Nacional del Sur, 66 pp.

IAS Postgraduate Research Grant 2020 Report

Organic Rich Strata: Characterization, Origin, and Implications to Petroleum Exploration in Kazakhstan.

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Supervisors: Professors Randy Hazlett and Milovan Fustic, Nazarbayev University, Kazakhstan

Oil and gas potential of Kazakhstan is concentrated in 18 sedimentary basins. Source rocks of most of these basins remain under-studied due to the lack of well data (i.e. the North Caspian basin) or low economic value of the reserves (i.e. Zaysan basin). Previous investigations have identified several candidate source rock deposits in the North Caspian (Huvaz et al., 2007; Ulmishek 2001) and the Chu-Sarysu Basins (Zhao et al., 2017). The presence of source rock intervals in the basins of Kazakhstan has also been documented in geological maps (Fedorenko, O. and Militenko, K., 2002) and observed during prospecting for coal (Kotlukov et al. 1968). To fill the knowledge gaps, several sampling campaigns were accomplished in summer, 2021, targeting locations and stratigraphic units where organic-rich deposits crop out and serve as excellent analogues to the subsurface stratigraphy of the basins located in the western (Mangyshlak basin) and eastern parts of Kazakhstan (Zaysan basin). The main purpose was to i) determine and thoroughly characterize the organic-rich intervals to better predict and extrapolate their characteristics on a basin scale, ii) quantify the spatial distribution and petroleum generation potential of possible source rock intervals, and iii) estimate rock mechanical properties, i.e. Young's modulus and Poisson's ratio, to identify zones with a high propensity for fracturing and give a qualitative assessment of producing capacity.

The Zaysan Basin, located in eastern Kazakhstan contains a 1.5 km thick succession of Permian deposits. The accommodation space was formed by the Kazakhstan and Siberia plates' convergence, which caused subduction, strike-slip faulting, compressional faulting, mantle intrusions, and volcanism. Outcrops of the Late Paleozoic – Late Cenozoic (up to Early Neogene) strata of the Zaysan basin are well-exposed on its uplifted southern flank, over the Late Cenozoic Kenderlyk basin (Delvaux et al., 2013; Fazylov and Musina, 2017) (Figs. 1 and 2). While existing literature lacks interpretations of depositional systems, lithological descriptions of outcrops and cores suggest that all units are predominantly comprised of clastic continental deposits, including numerous coal and organic-rich strata and sporadic volcanoclastic interbeds. The paleogeographic reconstruction suggests that the basin was filled by locally sourced sediments, while the accommodation space was maintained by tectonic subsidence. Laterally extensive coals suggest the historic presence of shallow continental fresh water environments such as delta and fluvial plains. Pyrolysis results of 50 core samples collected from depths of 2424–2457m (well S-305, Upper Permian Maychat Formation) and 49 samples collected from outcrops (Upper Permian Maychat Formation, 4 samples; Lower Permian Tarancha Formation, 32 samples; Lower Permian Karaungur Formation, 3 samples; and Lower Permian Kenderlyk Formation, 10 samples) (Figs. 1 and 2), characterized by high hydrogen (>500) and very low oxygen (3–34) index (except the weathered outcrop samples) are interpreted as Type I-II kerogen, characteristic for lacustrine deposits. Numerous interbeds of sandstone, shale, coal, and organic-rich strata can be explained by frequent, tectonically driven base-level changes. An average TOC of 5.8% (Maychat Formation, core samples) indicates high paleobioproductivity, probably enhanced by warm climate, inferred alkaline waters associated with terranes of basic rocks, and algal blooms caused by nutrient rich volcanic ashfalls.

The high preservation potential is attributed to anoxic conditions typical for a stratified water columns in lakes and/or oxygen depletion caused by algal blooms. Although the overlying Triassic, Jurassic and Cenozoic strata contain hydrocarbon shows and host several oil and gas fields (believed to be sourced by Permian black shales), the Zaisan basin petroleum potential is considered to be low. The reasons may include: i) forced thermal maturation by syn- and post-depositional intrusions; ii) petroleum leakage along numerous faults; and iii) copious amounts of oil retained within the source rocks. Retained oil is of primary interest in this research. The studied interval (2424–2457m) in well S-305 has a calculated ultimate expulsion potential of 20.26 MMboe/km2 and ranks among the best known source rocks. However, T max values of 423 to 432 °C indicates thermally immature source rocks. Nevertheless, seismic data suggests that the same unit dips southeastwards and 16 km away reaches a depth of 4200m, indicating that the unit has passed through the oil and gas windows. The ongoing investigation aims to identify and map multiple black shale units and oil- and gas windows to delineate the areas with potential unconventional petroleum resources. Sedimentological, geochemical, and geomechanical studies will allow for assessing the feasibility of their development.

The Mangyshlak Basin is located in western Kazakhstan and comprises Triassic, Jurassic, Cretaceous, and Cenozoic sedimentary successions. These units are superbly exposed in the Aktau and Mangistau mountain ranges north of the basin. This study utilizes black shale outcrop exposures to better understand the origin of organic-rich strata and their role in the petroleum and basin evolution. The studied localities include i) Tauchik (Triassic); ii) Karadimien (Triassic and Jurassic); iii) Jarsu (Triassic and Jurassic); iv) Shershilly (Triassic, Jurassic, and Cretaceous); v) Shair (Jurassic); vi) Sherkala 1 and 2 (Jurassic); vii) Tyubedzhik (Cretaceous); viii) Aksurtau/Koksyrtau (Cretaceous); ix) Jarmish (Cretaceous); and x) Zhaprakty (Cretaceous). Minimal weathering, easy access, and the ability to correlate the units laterally for tens of kilometers on satellite images and land sites are heaven-like for those studying black shales. Preliminary interpretations suggest various autochthonous and allochthonous controls on paleobioproductivity and organic matter preservation. Moreover, the integration of sedimentological observations from outcrops, pyrolysis, and Xray fluorescence of over 80 black shale samples has provided valuable insights into the paleodepositional environments, paleoecology, and organic richness: i) The Triassic black shales represent mostly deep marine (turbidite) deposits with transported organic matter of mixed origin and siltstone and sandstone interbeds up to hundreds of meters thick. The observed bituminous sandstone intervals arguably suggest very short oil migration distances. The active syn-depositional volcanism may have provided temporary nutrient fluxes via mineral-rich volcanic ashfalls. ii) The Lower Jurassic black shales are up to 60 m thick and were deposited in lacustrine environment (organofacies Type C). These deposits suggest stratified water column and high algal bioproductivity. The accommodation space was likely formed by graben-like depressions created by strike-slip faults, while the deposition probably coincided with the Toarcian anoxic event (AOE). iii) The Middle and Upper Jurassic strata are usually represented by 1–5 m thick swamp deposits of coastal and/or deltaic origin (organofacies D–F). iv) The Cretaceous Aptian deposits are approximately 50 m thick and represent stacked shelf and/or prodelta successions (organofacies B). The timing of their deposition coincides with AOE 1a (Selli event). v) The Cretaceous Albian deposits comprise a 4-5 m thick black shale unit (organofacies B) formed in a shallow shelf environment. vi) The Cretaceous Cenomanian and Turonian black shales are 8 and 10 m thick, respectively, separated by approximately 20 m thick sandstone, shale, and phosphatic interbeds. Their deposition coincides with AOE 2 (Bonarelli event). The ongoing integration of these preliminary results with literature findings and publically available subsurface data allows us to refine previously made interpretations and generate more reliable depositional models.

Figures:

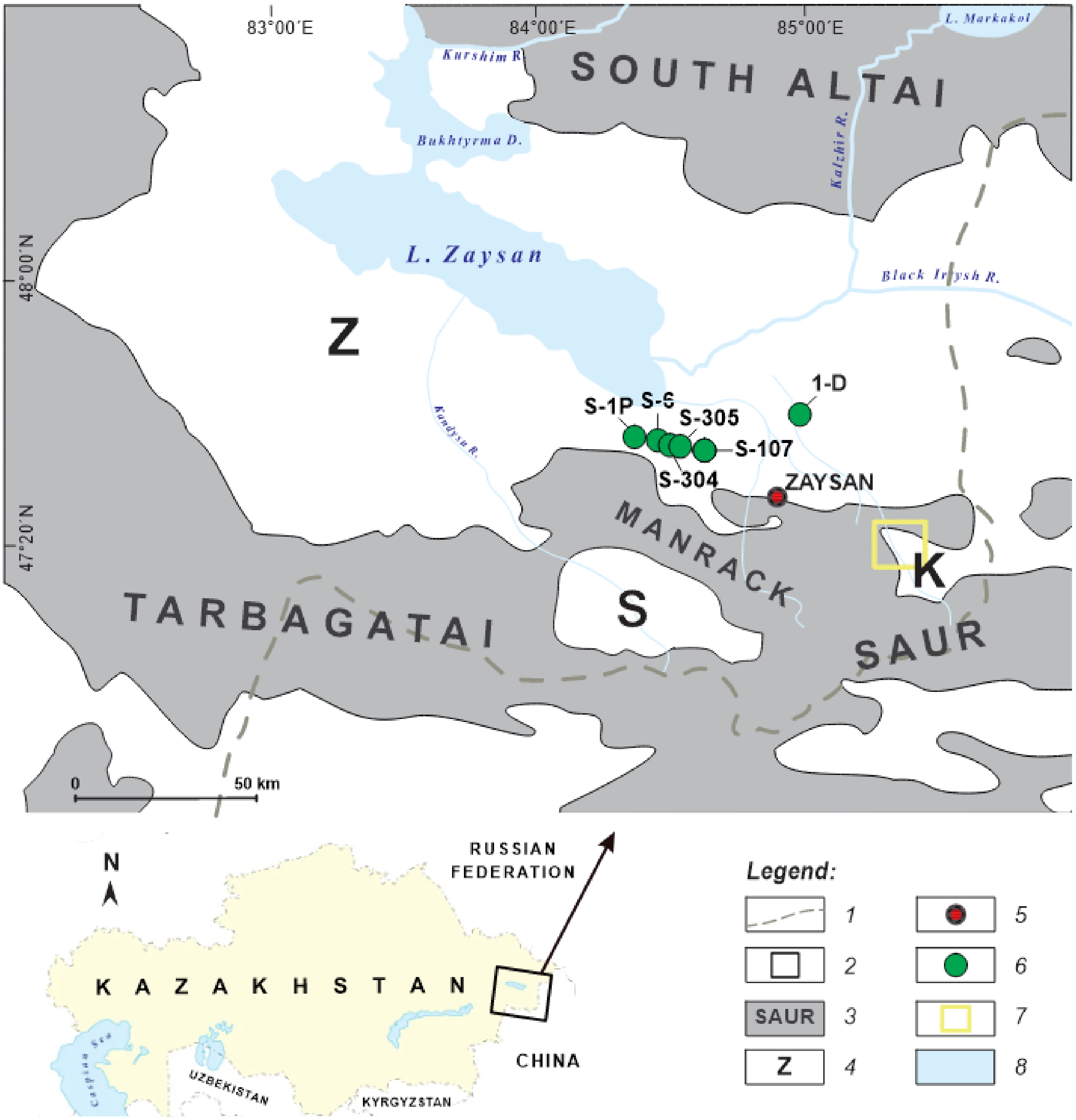

Figure 1. Geological sketch map of the Zaysan basin showing location of wells and the outcrop sampling site. 1, international border; 2, study area; 3, mountains; 4, basins: Z, Zaysan, S, Shylykty, K, Kendyrlyk; 5, city; 6, wells; 7, outcrop sampling site; 8, water bodies.

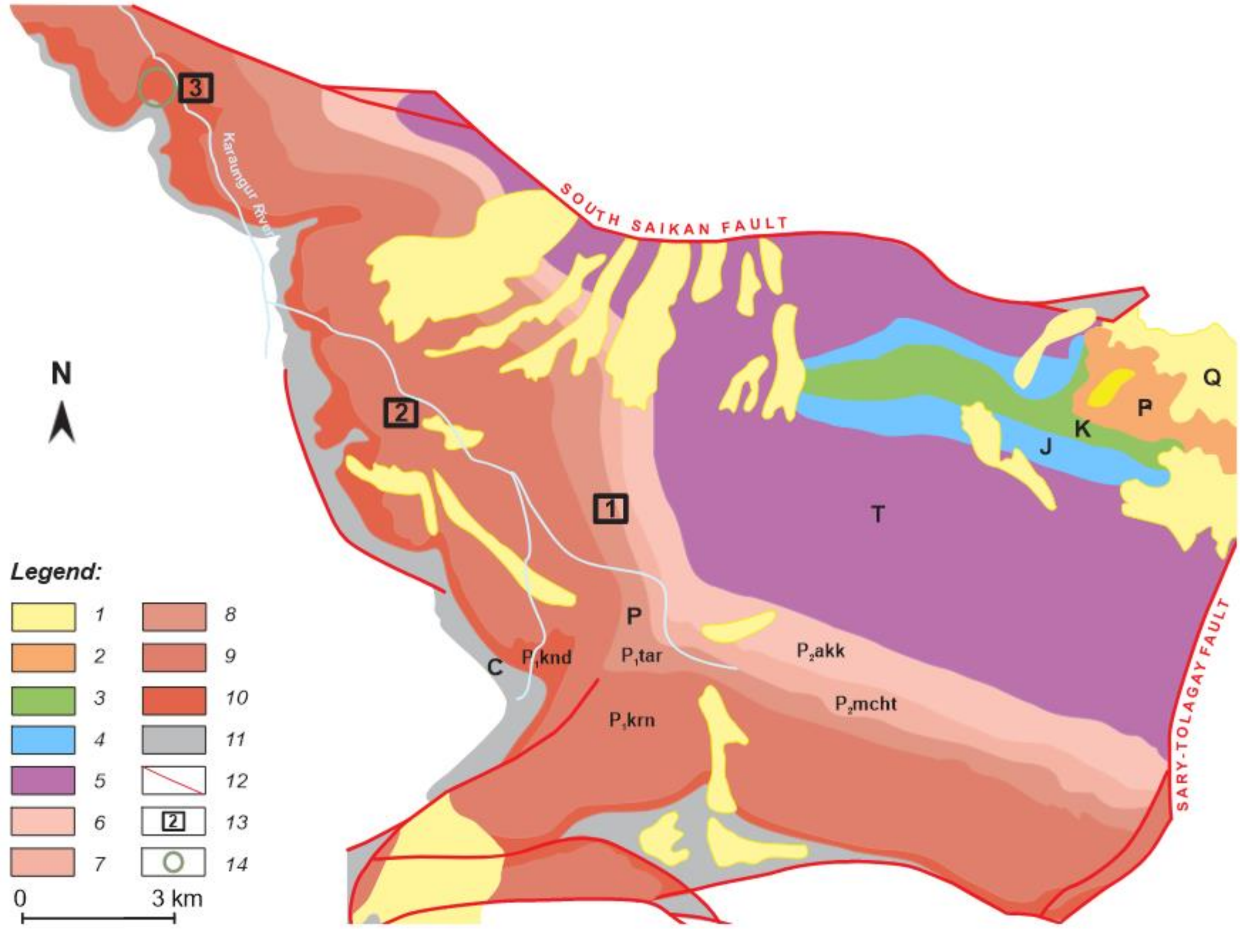

Figure 2. Geological sketch map of the Kenderlyk basin (modified after Fazylov and Musina (2017)), showing locations of the sampling sites. 1, Quaternary; 2, Paleogene; 3, Cretaceous; 4, Jurassic; 5, Triassic; 6, Upper Permian Akkolka formation; 7, Upper Permian Maychat formation; 8, Lower Permian Tarancha formation; 9, Lower Permian Karaungur formation; 10, Lower Permian Kenderlyk formation; 11, Carboniferous; 12, faults; 13, sampling sites: 1, Tarancha Formation; 2, Karaungur formation; 3, Kenderlyk formation; 14, Pre-Soviet time mining site.

Bibliography:

Delvaux, D., Cloetingh, S., Beekman, F., Sokoutis, D., Burov, E., Buslov, M., and Abdrakhmatov, K., 2013, Basin evolution in a folding lithosphere: Altai–Sayan and Tien Shan belts in Central Asia: Tectonophysics, v. 602, p. 194-222.

Fazylov, E., and Musina, E., 2017, The magmatic-sedimentary facies of Kenderlik middle-late carboniferous sediments and their role in the formation of oil shale facilities: News of the National Academy of Sciences of the Republic of Kazakhstan, v. 4, p. 56-64.

Fedorenko, O. and Militenko, K. (coordinators), 2002.Atlas of the lithology-paleogeographical, structural, palinspastical and geo-environmental maps of Central Eurasia.Yuggeo, Almaty

Huvaz, O., Sarikaya, H., and Işık, T. (2007). Petroleum systems and hydrocarbon potential analysis of the northwestern Uralsk basin, NW Kazakhstan, by utilizing 3D basin modeling methods.Marine and petroleum geology, 24(4), 247-275.

Kotlukov, V. A., Baukov, S. S., and Mustiagi, E. A. (1968). Geology of coal deposits and oil shales of the USSR: Oil shales of USSR. Moscow: Nedra.

Ulmishek, G. F. (2001). Petroleum geology and resources of the North Caspian Basin, Kazakhstan and Russia: US Department of the Interior, US Geological Survey

Zhao, Z., Pang, X., Li, Q., Hu, T., Wang, K., Li, W., Shao, X. (2017). Depositional environment and geochemical characteristics of the Lower Carboniferous source rocks in the Marsel area, Chu-Sarysu Basin, Southern Kazakhstan. Marine and Petroleum Geology, 81, 134-148.

IAS Postgraduate Research Grant 2020 Report

Carbonate microfacies, Mesozoic and Cenozoic benthic and planktonic foraminifera biostratigraphy, and stable isotope-stratigraphy from a sedimentary cover of a fossil magmatic arc during the latest Cretaceous and early Paleogene: Deciphering the evolution of the Eastern Sakarya Zone (ESZ) orogenic belt, Ardanuç/Artvin, Turkey

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1. Introduction

The Eastern Sakarya Zone (ESZ) was an active volcanic arc with bimodal volcanism from the Cenomanian to the Maastrichtian or Paleocene and sometimes intrusive rocks (granites and gabbros, etc.) probably until the Maastrichtian-Danian age and the final continent-continent collision in the Paleocene (Okay ve Şahintürk, 1997; Kandemir et al., 2019; Dokuz et al., 2019; Aydin et al., 2020). The Maastrichtian-Danian deposits begin in the lower sections with basal conglomerates, that spread of E-W along the Eastern Black Sea region (Aksay and Turhan, 1998; Kurt, 1998; Konak et al., 2001; Köroğlu and Kandemir, 2019; Consorti and Köroğlu, 2019; Consorti et al., 2020). A thick basal conglomerate, the Campanian-Paleocene facies, is characterized by hemipelagic and shallow-water limestones of a large-scale epeiric platform. The uplift of the ESZ during the Cretaceous-Paleogene is, due to the closure of the northern branch of the Neotethys Ocean. Relative sea-level peaked in the late Campanian and sea-level fall in the Maastrichtian-Paleocene, followed by a Campanian-Thanetian neritic-hemipelagic infilling (Sofracıoğlu and Kandemir, 2013; Sari et al., 2014; İnan ve İnan 2014; Hippolyte et al., 2015; Köroğlu and Kandemir, 2019; Özcan et al., 2019; Consorti and Köroğlu, 2019). The Cretaceous succession is truncated along an unconformity at the base of the Paleocene (pelagic; Korkmaz, 1993; Özkar and Kırcı, 1997, neritic; Köroğlu and Kandemir, 2019; Consorti and Köroğlu, 2019; Consorti et al., 2020). The unconformity recognized at the base of the succession (MDE: Maastrichtian-Danian Events) in the Cretaceous–Paleogene boundary interval is evidence of significant tectonic activity of the ESZ. Their formation is probably related to plate tectonic processes and sea-level changes (Haq, 2014; Ray et al., 2019) in response to the opening and closure of ocean basins surrounding the ESZ (Okay et al. 1994; Okay and Şahintürk, 1997; Hippolyte et al., 2015; Köroğlu and Kandemir, 2019; Consorti and Köroğlu, 2019; Kandemir et al., 2019; Consorti et al., 2020).

2. Material and Methods

This study was conducted in three phases. The first phase involved the field geology of the region, the acquisition of geological maps, and the study of their lithostratigraphic relationships. In the second phase, 4 four measured stratigraphic sections (MSS) were taken from the region (AI, FK, GK, and TT), and 695 thin sections were prepared from 685 rock samples obtained from these sections. The third phase was concluded with both sedimentary petrography, and paleontological studies on thin sections with research microscopes. Geochemical studies are also ongoing. In the evaluation of the results, intensive use was made of the literature, which has developed and expanded with recent studies, Dunham (1962), Embry and Klovan (1971), Loeblich and Tappan (1988), Premoli-Silva and Verga (2004), Sari (2009), Flügel (2010), Hottinger (2014), Serra-Kiel et al. (2020), Özcan et al. (2021).

3. Stratigraphy of Eastern Sakarya Zone and Ziyarettepe Formation

The main lithological units consist of major magmatic and minor sedimentary rocks, otherwise small bodies of metamorphic rocks (Özsayar et al., 1982; Konak et al., 2001; Yılmaz et al., 2000; Dokuz et al., 2006; Kandemir et al., 2019; Aydin et al., 2020). This region is identical to the Georgian-

Armenian-Azerbaijan stratigraphic units and regional geodynamic history, with only the terminal Cretaceous-Paleogene showing minor differences **(Fig. 1a-b)**. The main research topic is often the regional stratigraphy and geological evolution of the Neotethys Ocean branch and Eastern Pontides of the southern and northern zones **(Fig. 1b)**. For this reason, the general review and robust consensus is the direct collision of the continent-continent after subduction to the north and close to the northern branch of the Neotethys Ocean, also the plate rotation of different aspects in two directions (Hisarlı, 2011; Adamia et al., 2011; Hippolyte et al., 2015; Rolland, 2019; Dokuz et al., 2019; Kandemir et al., 2019; Hassing et al., 2020; Aydin et al., 2020).

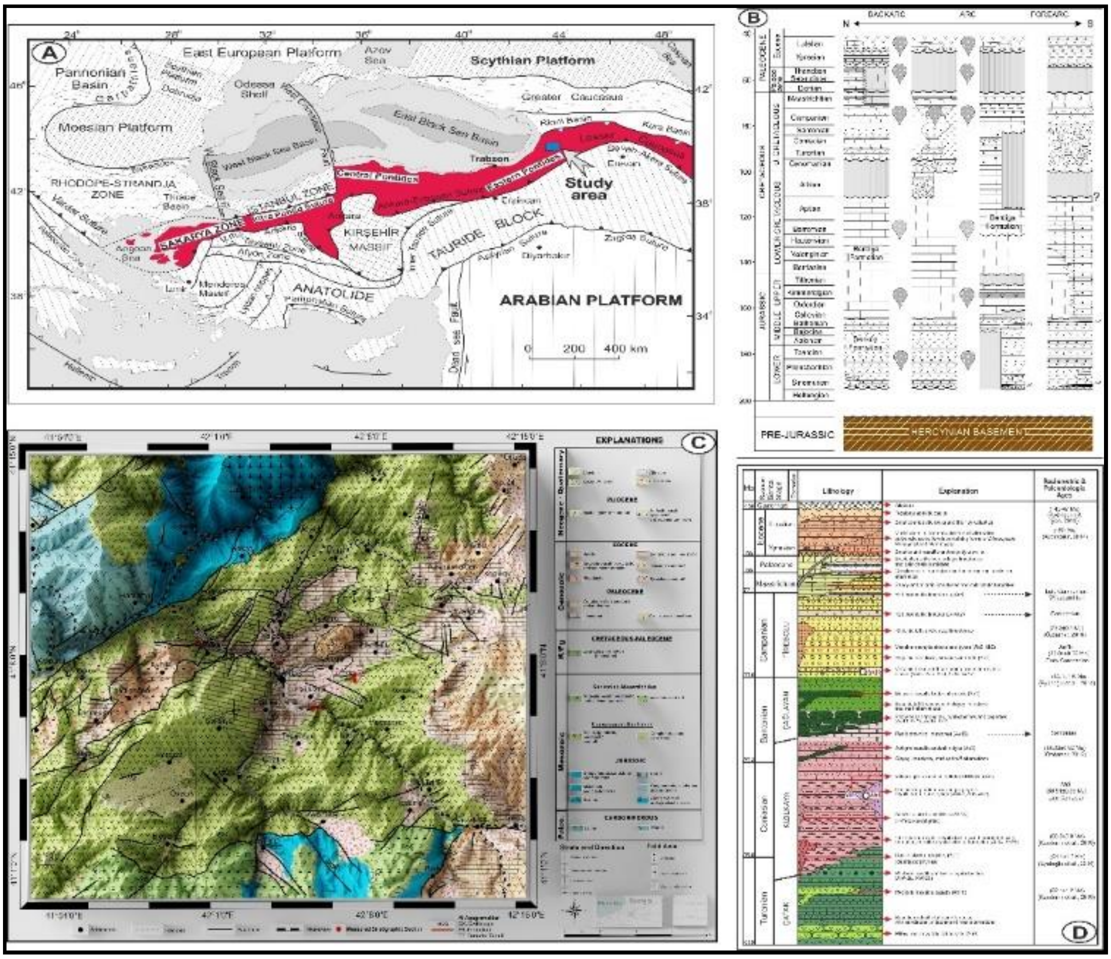

Figure 1. a) Tectonic zone map of Turkey and the adjacent region (modified from Okay and Tüysüz, 1999), b) Regional stratigraphy of the Eastern Sakarya Zone (modified from Karsli et al. 2021), c) Geological map of the Ardanuç region (Köroğlu, 2022; in progress), d) General stratigraphy of Artvin (modified from Aydin et al., 2020).

3.1. Lithostratigraphy

The geologic map **(Fig. 1c),** and general lithostratigraphy of the region are shown in **figure 1d,** and the stratigraphy of the study area is discussed in detail below. Volcanic, magmatic, and sedimentary masses of middle to Late Cretaceous age are concordantly located at the base of the Ziyarettepe Formation (Özsayar et al., 1982; Aksay and Turhan, 1998; Konak et al., 2001; Karsli et al., 2012; Kandemir et al., 2019; Aydin et al., 2020). It continues with the Ziyarettepe Formation (K/Pg) which overlies these masses with the basal conglomerate **(Fig. 2),** and the Kızılçık Formation (late Paleocene-early Eocene), which is also a sedimentary unit (Özsayar et al., 1982; Kurt, 1998; Aksay and Turhan, 1998; Konak et al., 2001; Hippolyte et al., 2015; Kandemir et al., 2019). The lithostratigraphy terminates with, the products of Eocene volcanism which can be observed throughout the region and later Neogene-Quaternary units (Özsayar et al., 1982; Kurt, 1998; Konak et al., 2001; Kandemir et al., 2019) **(Fig. 2).**

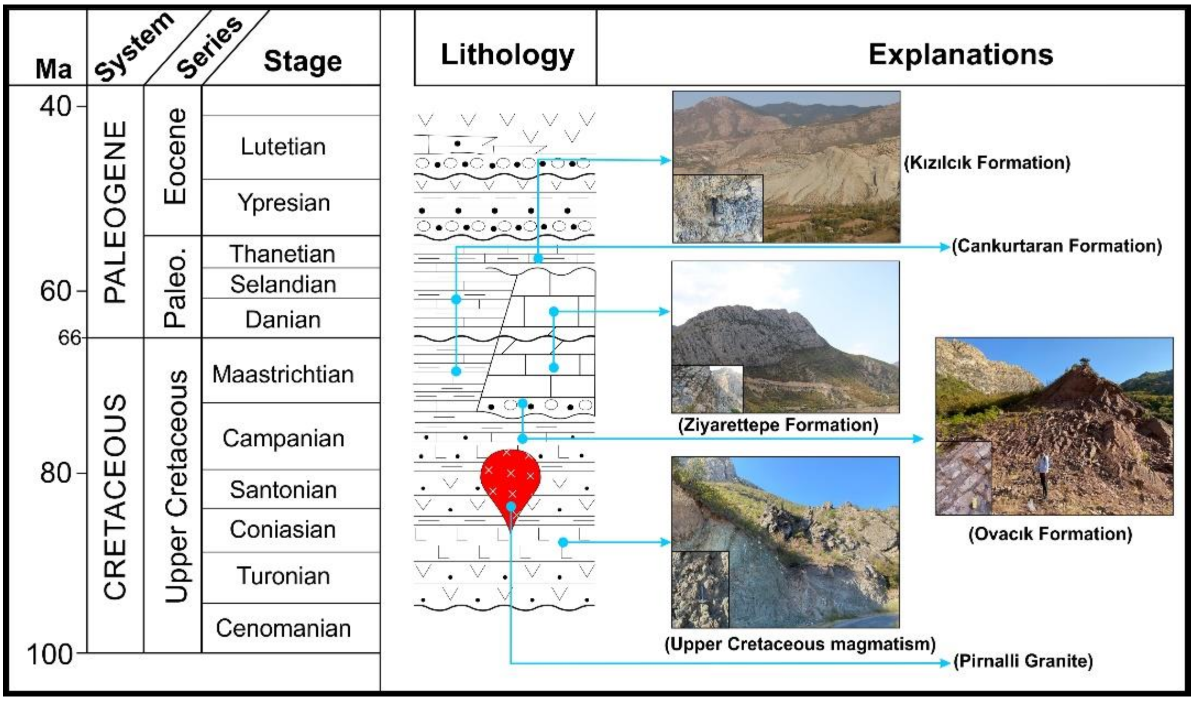

Figure 2. Lithostratigraphy of the Ardanuç region and the position of the Ziyarettepe Formation (Köroğlu, 2022; in progress).

3.2. Biostratigraphy and Sedimentology

The Upper Cretaceous-Paleogene benthic and planktonic Foraminifera, nannoplankton and macrofossils have been reported from the different lithological units of the ESZ (Özsayar et al., 1982; Korkmaz, 1993; Özkar and Kırcı, 1997; İnan et al., 1999; Özer et al., 2009; Sofracıoğlu and Kandemir, 2013; Sari et al., 2014, Hippolyte et al., 2015; Türk-Öz and Özyurt, 2018; Consorti and Köroğlu, 2019; Consorti et al., 2020 and others). The age of the Ziyarettepe Formation is based on the biostratigraphy of foraminifera both benthic and planktonic species. Here, the biostratigraphy is given based on the stratigraphic age of Cretaceous to Paleogene foraminifera species **(Fig. 3).** The Ziyarettepe Formation was deposited on the shelf environment with hemipelagic-neritic facies transitions, and effected by sea-level changes, therefore neritic and pelagic faunas are intensive.

4. Preliminary Results and Features Implications

By comparing the seismic stratigraphic sections (seafloor) and the lithostratigraphic sections (land) of the Black Sea, new inferences have been made about the formation of the Black Sea basin (Muntenau et al., 2011; Espurt et al., 2014; Nikishin et al., 2015; Consorti and Köroğlu, 2019). In this scenario, the basin is thought to have developed as an epeiric sea (epicontinental sea), that began after arc volcanism that ended at the end of the Maastrichtian, at the latest during the Cretaceous-Paleogene. In my opinion, the NE Black Sea basin absolutely opened as an extensional basin in a back-arc environment due to its tectonic-sedimentary characteristics both on the land and on the back-arc setting. The age of the Ziyarettepe Formation was determined biostratigraphically based on benthic and planktonic foraminiferas. as Campanian-Thanetian. On the other hand, samples from the biostratigraphically determined neritic limestone with K/Pg boundary were selected for geochemical study. The analyses of Sr, O, C, and whole-rock geochemistry will be from these samples. Geochemical analyses (stable isotopes and whole-rock) will continue in the laboratory.

All results of this study will be summarised in a manuscript to be submitted to the journal Sedimentology (IAS) between 2022 to 2023.

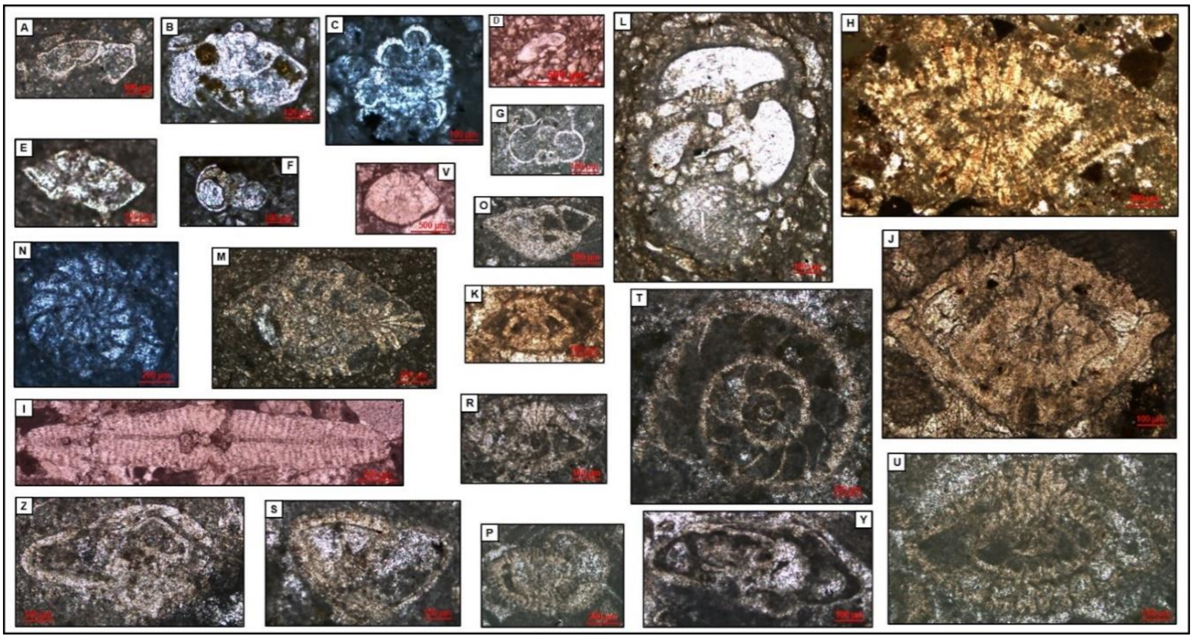

Figure 3. A-B) *Globotruncana* cf. *arca*, bioclastic wackestone with planktonic-benthic foraminifera (TT-66,71), C) *Racemiguembelina* sp. (TT-81), D) ?*Globotruncanella havanensis* (TT-95) , E) *Globotruncana* cf. *esnehensis* (TT-123), F) *Globotruncanita* cf. *conica* (TT-133), G) *Parasubbotina* sp., (TT173), H) *Pseudosiderolites vidali* (TT5), I) *Lepidorbitoides* sp., (TT9), J) *Sirtina orbitoidoformis* (TT38), K) *Pararotalia* sp. (TT51), L) ?*Tekkeina anatoliensis* (TT97), M) *Siderolites calcitrapoides*, bioclastic packstone (TT101), N) *Gavelinella* sp., bioclastic wackestone with planktonic-benthic foraminifera (TT128), O) *Rotorbinella* sp., P) *Miscellanites globularis*, R) *Miscellanites minutus* (TT173), S) *Eponides* sp. (TT174), T) *Cibicidoides* sp. (TT179), U) *Miscellanea* sp. (TT196), V) *Elazigina* sp., Y) *Stomatorbina binkhorsti* (TT201), Z) *Rotorbinella hermi* (TT203).

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REFERENCES

Adamia, S.A., Zakariadze, G.S., Chkhotua, T., Sadradze, N., Tsereteli, N., Chabukiani, A. and Gventsadze, A., 2011. Geology of the Caucasus: A review. Turkish Journal Earth Sciences 20, 489-544.

Aksay, A. ve Turhan, N., 1998. Şavşat-Ardanuç (Artvin) Dolayının (Ardahan-F48 Paftası) Jeolojisi. Maden Tetkik ve Arama Genel Müdürlüğü Rapor No: 10188; Ankara. (In Turkish)

Aydin, F., Oğuz-Saka, S., Şen, C., Dokuz, A., Aiglsperger, T., Uysal, İ., Kandemir, R., Karsli, O., Sari, B., Başer, R., 2020. Temporal, geochemical and geodynamic evolution of the Late Cretaceous subduction zone volcanism in the eastern Sakarya Zone, NE Turkey: Implications for mantle-crust interaction in an arc setting. Journal of Asian Earth Sciences 192, 104217.

Aydınçakır, E. and Şen, C., 2013. Petrogenesis of the post-collisional volcanic rocks from the Borçka (Artvin) area: Implications for the evolution of the Eocene magmatism in the Eastern Pontides (NE Turkey). Lithos 172–173, 98–117.

Aydınçakır, E., 2014. The petrogenesis of Early Eocene non-adakitic volcanism in NE Turkey: Constraints on the geodynamic implications. Lithos 208–209, 361–377.

Consorti, L. and Köroğlu, F., 2019. Maastrichtian-Paleocene larger Foraminifera biostratigraphy and facies of the Şahinkaya Member (NE Sakarya Zone, Turkey): insights for the Eastern Pontides arc sedimentary cover. Journal of Asian Earth Sciences 183, 103965.

Consorti, L., Schlagintweit, F., Köroğlu, F. and Rashidi, K., 2020. Stratigraphic record of *Eponides* Montfort, 1808 (benthic Foraminifera) from the Paleocene of the northern Neotethys margin. Micropaleontology 66 (5), 369-376.

Dokuz, A. and Tanyolu, E., 2006.Geochemical constraints on the provenance, mineral sorting and subaerial weathering of Lower Jurassic and Upper Cretaceous clastic rocks from the Eastern Pontides, Yusufeli (Artvin) NE Turkey. Turkish Journal of Earth Sciences 15, 181-209.

Dokuz, A., Aydin, F. and Karsli, O., 2019. Post-collisional transition from subduction- to intraplate-type magmatism in the eastern Sakarya Zone, Turkey: Indicators of the northern Neotethyan slab breakoff. GSA Bull. 131 (9/10), 1623-1642.

Dunham, R.J., 1962. Classification of Carbonate Rocks According to Depositional Textures. In W.E. Ham. (Ed), Classification of Carbonate Rocks, American Association of Petroleum Geologists Memory 1, 108-121.

Embry, A.F. and Klovan, J.E., 1971. A late Devonian reef tract on northeastern Banks Island Nordwest Territories. Bulletin of Canadian Petroleum Geology 19, 730-781.

Espurt, N., Hippolyte, J-C., Kaymakci, N., Sangu, E., 2014. Lithospheric structural control on inversion of the southern margin of the Black Sea Basin, Central Pontides, Turkey. *Lithosphere* 6 (1), 26–34.

Eyüboğlu, Y., Santosh, M., Yi, K., Tuysuz, N., Korkmaz, S., Akaryali, E., Dudas, F.O. and Bektaş, O., 2014. The Eastern Black Sea-type Volcanogenic Massive Sulfide Deposits: Geochemistry, zircon U-Pb geochronology and an overview of the geodynamics of ore genesis. Ore Geology Review 59, 29-54.

Flügel, E., 2010. Microfacies of Carbonate Rocks (Second Edition). Springer, 984, Berlin, Heidelberg, Germany.

Haq, B.U., 2014. Cretaceous eustasy revisited. Global and Planetary Change 113, 44-58.

Hippolyte, J.C., Müller, C., Sangu, E. and Kaymakci, N., 2015.Stratigraphic comparisons along the Pontides (Turkey) based on new nannoplankton age determinations in the Eastern Pontides: geodynamic implications. Geological Society of London, Special Publications, 428, 323-358.

Hisarli, Z.M., 2011. New paleomagnetic constraints on the late Cretaceous and early Cenozoic tectonic history of the Eastern Pontides. Journal of Geodynamics 52, 114-128.

Hottinger, L. 2014. Paleogene Larger Rotaliid Foraminifera from the Western and Central Neotethys. Springer International Publishing, 196, Heidelberg, Germany.

İnan, N., İnan, S. and Kurt, İ., 1999. Conformable benthic K/T transition in the Eastern Pontides: Şahinkaya member of the Tonya Formation (SW Turkey). Geological Bulletin of Turkey 42, 63–67. (In Turkish)

İnan, N. and İnan, S., 2014. Stratigraphic ranges of the benthic foraminifera and microfacies of the upper Maastrichtian-Paleocene shallow marine carbonate successions in the Eastern Pontides (Ne Turkey). Bulletin of Earth Sciences, 35, 79-86.

Kandemir, Ö., Akbayram, K., Çobankaya, M., Kanar, F., Pehlivan, S., Tok, T., Hakyemez, A., Ekmekçi, E., Danacı, F. and Temiz, U., 2019. From arc evolution to arc-continent collision: Late Cretaceous–middle Eocene geology of the Eastern Pontides, northeastern Turkey. GSA Bull. 131 (11-12), 1889-1906.

Karsli, O., Caran, S., Dokuz, A., Çoban, H., Chen, B. and Kandemir, R., 2012. A-type granitoids from the Eastern Pontides, NE Turkey: Records for generation of hybrid A-type rocks in a subduction-related environment. Tectonophysics 530–531, 208–224.

Karsli, O., İlhan, M., Kandemir, R., Dokuz, A., Aydin, F., Uysal, İ. and Duygu, L., 2021. Nature of the Early Cretaceous lamprophyre and high-Nb basaltic dykes, NE Turkey: Constraints on their linkage to subduction initiation of Neotethyan oceanic lithosphere. Lithos 380, 105884.

Konak, N., Hakyemez, Y., Bilgiç, T., Bilgin, R., Hepşen, N. ve Ercan, T., 2001. Kuzeydoğu Pontidler'in (Oltu-Olur-Şenkaya-Narman-Tortum-Uzundere-Yusufeli) Jeolojisi, MTA Genel Müdürlüğü, Rapor No: 10489; Ankara. (In Turkish)

Korkmaz, S., 1993. Tonya-Düzköy(GB-Trabzon) Stratigrafisi. Türkiye Jeoloji Bülteni 36, 151-158. (In Turkish)

Köroğlu, F. and Kandemir, R., 2019. The bio-lithoclastic carbonate facies analysis: Şahinkaya Member Maastrichtian (Late Cretaceous) skeletal carbonate deposit, Sakarya Zone, Ne Turkey. Carbonates and Evaporites. 34 (4), 1737–1755.

Kurt, İ. 1998. Doğu Pontid'lerde Kretase/Tersiyer geçişinin paleontolojik incelenmesi. Yüksek Lisans Tezi. Cumhuriyet Üniversitesi, Fen Bilimleri Enstitüsü, Sivas. (In Turkish)

Loeblich, Jr., A.R. and Tappan, H., 1988. Foraminiferal genera and their classification. Van Nostrand Reinhold Press, 203, New York, USA.

Munteanu, I., Matenco, L., Dinu, C. and Cloetingh, S.P.L., 2011. Kinematics of back-arc inversion of the Western Black Sea Basin. Tectonics 30, 1-21.

Nikishin, A.M., Okay, A., Tüysüz, O., Demirer, A., Wannier, M., Amelin, N. and Petrov, E., 2015. The Black Sea basins structure and history: new model based on new deep penetration regional seismic data. Part 2: tectonic history and paleogeography. Marine Petroleum Geology 59, 656-670.

Okay, A.I., Şengör, A.M.C. and Görür, N., 1994. Kinematic history of the opening of the Black Sea and its effect on the surrounding region. Geology 22, 267–270.

Okay, A.I. and Şahintürk, Ö., 1997. Geology of the Eastern Pontides, in A. Robinson, ed., Regional and petroleum geology of the Black Sea and surrounding regions. AAPG Memoir 68, 291-311.

Okay, A.I. and Tüysüz, O., 1999. Tethyan Sutures Northern Turkey. In “The Mediterranean Basins: Tertiary Extension Within the Alpine Orogen”. Geol. Soc. Spec. Publ. 156, 475-515.

Özcan, E., van Gorsel, J.T., Sari, B., Yücel, A.O., Erbay, S., Okay, A.I., 2019. Primitive Helicorbitoides (Foraminifera) and associated larger benthic foraminifera from the Campanian Tonya Formation, Trabzon, eastern Pontides, NE Turkey. Cretaceous Research 101, 30-42.

Özcan, E., Yücel, A.O., Catanzariti, R. et al., 2020. Multiple *Orbitoides* d’Orbigny lineages in the Maastrichtian? Data from the Central Sakarya Basin (Turkey) and Arabian Platform successions (Southeastern Turkey and Oman). Swiss Journal of Palaeontology 140, 8.

Özdamar, Ş., 2016. Geochemistry and geochronology of late Mesozoic volcanic rocks in the northern part of the Eastern Pontide Orogenic Belt (NE Turkey): Implications for the Closure of the Neotethys Ocean. Lithos 248–251, 240–256.

Özer, S., Meriç, E., Görmüş, M. and Kanbur, S., 2009. Biogeographic distribution of rudists and benthic foraminifera: an approach to Campanian-Maastrichtian palaeobiogeography of Turkey. Geobios 42, 623–638.

Özkar, İ. ve Kırcı, E., 1997. GB Trabzon Yöresinin Planktik Foraminifer Biyostratigrafisi. İstanbul Üniversitesi Mühendislik Fakültesi Yerbilimleri Dergisi 10, 79-93. (In Turkish)

Özsayar, T., Pelin, S., Gedikoğlu, A., Eren, A. and Çapkınoğlu, Ş., 1982. Ardanuç (Artvin) yöresinin jeolojisi (The geology of the Ardanuç (Artvin) region). Karadeniz Üniversitesi Yerbilimleri Dergisi Jeoloji 2, 21-38. (In Turkish)

Premoli-Silva, I. and Verga, D., 2004. Practical Manual of Cretaceous Planktonic Foraminifera. International School on Planktonic Foraminifera, 3. Course: Cretaceous. Verga and Rettori Eds. Universities of Perugia and Milan, Tipografia Pontefelcino, Perugia (Italy), 283.

Ray, D.C, van Buchem, F.S.P., Baines, G., Davies, A., Gréselle, B., Simmons, M.D. and Robson, C. 2019. The magnitude and cause of short-term eustatic Cretaceous sea-level change: A synthesis. Earth Sciences Review 197, 102901.

Rolland, Y., 2017. Caucasus collisional history: review of data from East Anatolia to West Iran. Gondwana Research 49, 130-146.

Sari, B., 2009. Planktonic foraminiferal biostratigraphy of the Coniacian - Maastrichtian sequences of the Bey Dağları Autochthon, western Taurides, Turkey: thin section zonation. Cretaceous Research 30 (5), 1103-1132.

Sari, B., Kandemir, R., Özer, S., Walaszczyk, I., Görmüş, M., Demircan, H., Yilmaz, C., 2014. Upper Campanian calciclastic turbidite sequences from the Hacımehmet area (eastern Pontides, NE Turkey): integrated biostratigraphy and microfacies analysis. Acta Geologica Polonica 64(4), 393-418.

Serra-Kiel, J., Vicedo, V., Baceta, J.I., Bernaola, G. and Robador, A., 2020.Paleocene Larger Foraminifera from the Pyrenean Basin with a recalibration of the Paleocene Shallow Benthic Zones. Geologica Acta 18.8, 1-69, I-III.

Sofracıoğlu, D. and Kandemir, R., 2013. The Upper Cretaceous calciclastic submarine fan deposits in the Eastern Pontides, NE Turkey: facies architecture and controlling factors. Turkish Journal of Earth Sciences 22, 588-610.

Türk-Öz, E. and Özyurt, M., 2018. Paleoenvironment reconstruction and planktonic foraminiferal assemblages of Campanian (Cretaceous) carbonate succession, Çayırbağ area (Trabzon, NE Turkey). Carbonates and Evaporites 33, 1-33.

Yılmaz, A., Adamia, S.A., Chabukiani, A., Chkhotua, T., Erdoğan, K., Tuzcu, S. and Karabıyıkoğlu, M.F., 2000. Structural correlation of the southern Transcaucasus (Georgia)–eastern Pontides (Turkey). In: E. Bozkurt, J.A. Winchester, J.D.A., Piper (eds.) Tectonics and magmatism in Turkey and the Surrounding Area. Geological Society of London, Special Publications 182, 171-182.

REPORT

Turkish Sedimentology Working Group (SCG) 2020 Workshop with International Participants
2-5 SEPTEMBER 2021, Ayvalık / BALIKESİR (NW-TURKEY)
"Lacustrine Depositional Systems" WORKSHOP

On September 2-5, 2021, Turkish Sedimentology Working Group-2020 Workshop was held in Cunda Application Hotel, Blue Hall (Ayvalık-Balıkesir, NW-Turkey). It has been organized on behalf of Balıkesir University, Geological Engineering Department and Turkish Sedimentology Working Group. The aim of this workshop was to bring together national and international researchers and students who study on sedimentology and focus on record of lacustrine depositional systems. The presented talks were organized into several thematic sets. These are;

- Lacustrine Basins and Fills
- Climate Studies in Lake sediments
- Sedimentary Processes and Facies
- Soft Sedimentary Deformation Structures
- Dating Techniques
- Carbonate Sequences
- Coal seams
- Borate deposits

Approximately 85 attended participants coming from all different regions of the Turkey and several universities for this organization. 34 academicians, 11 PhD students, 7 master students, 11 institution representatives (TPAO, ETİSODA, MTA), 2 representatives of chambers (JMO), 10 representatives of private company (TÜMAD Mining, Altıntaşlar Mining, TEKFEN Engineering, ADA Engineering), 4 bachelor students and 6 guest participants have attended in this workshop. 18 graduate students who contributed with oral and poster presentations have been supported by the IAS (International Association of Sedimentologists). Totally, 34 oral and 10 poster presentations included 2 of which are keynote talks (Fig.1a and b). Concha Arenas (University of Zaragoza, Spain) from Spain and Massimo Moretti (University of Bari, Italy) from Italy, who virtually participated in the workshop as invited speakers, gave remarkable lectures on lacustrine carbonate deposits (tufa and travertine) and soft sediment deformation structures, respectively.

During the coffee/tea breaks; participants look over the poster presentations while having delicious traditional taste (Fig.1)

Fig. 1. The participants attended with oral and poster presentations. They also continued to discuss at the coffee/tea break.

The first 2 days had been continued presentations and the Gala dinner has been organized by organizing committee of the workshop. The participants have gathered in fish restaurant in Cunda island and deeply enjoyed with delicious Aegean meals and magnificent environment of sea sides (Fig. 2).

Fig. 2. All participants had unforgettable moments and tasted traditional foods & drinks during the Workshop dinner

Last 2 days of the workshop continued with field excursions with participants. The 3rd day of the SÇG Workshop, participants have visited the Bigadiç Boron Mine which is Turkish state-owned mining and chemicals company focusing on boron products. The one of the biggest open pit mining in the Bigadiç area has been examined and magnificent soft deformation structures within lacustrine deposits have been identified by sedimentologists who specialized on this topic (Fig. 3).

Moreover, there are significantly observed large scale folding as main sedimentary structures (Fig.3a and b). This folding divided in two parts and the lower part dominantly formed as slump-slide structures that continued tens of meters (Fig. 3c). In related to folding syn-sedimentary reverse faults have been occurred in fine grained sediments such as clayey limestone, claystone and tuffs. Bigadiç volcano-sedimentary succession consists of different aged volcanic units and lacustrine sediments. These lacustrine deposits are basal limestone unit, lower tuff unit, lower borate unit, upper tuff unit and upper borate unit from bottom to top (Fig. 3c). All participants were fascinated due to the biggest Boron open pit area and remarkable soft-deformation structures (Fig. 3d).

Fig. 3. All participants have been witnessed of these remarkable structures in the Bigadiç Boron Mining area.

In the afternoon, field excursion continued to the Hisaralan village of Balıkesir province for visiting geothermal field area. In the Hisaralan geothermal field, there are many hot water springs with water temperature up to 99°C in places. Although the number of the springs is still unknown, approximately 70 hot water springs were discovered up till now. Travertine precipitations are common in this area. Pinnacles are observed spectacularly, and participants had a good opportunity to investigate these unique travertine forms (Fig 4).

Fig. 4. The field images of travertine towers (pinnacles) significantly observed in Hisaralan geothermal field area.

In the fourth day of workshop, field trip started to visit with historical and cultural places in Cunda island and Ayvalık town (Fig. 5).

Fig. 5. The participants visited spectacular historical and cultural sites in Ayvalık, Balıkesir

On the last day of this workshop, the members of the Turkish Sedimentology Working Group have decided to hold the next meeting between 1-4 September, 2022 in Trabzon (NE-Turkey). The theme of the meeting has been decided to be "*Sedimentology and Sedimentary Basins of Black Sea*". In addition, multidisciplinary contributions are also welcome. It will be a great pleasure to have all participants in the Turkish Sedimentology Working Group 2022 Workshop in Trabzon.

We all appreciate to organization committee and all participants. Thanks to IAS 18 sponsored students were able to attend this workshop and present their research successfully!! Thanks a lot IAS!!

Hope to see you in our next meetings…

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The secretary of the SCG
(Turkish Sedimentology Working Group)