



深时数字地球国际大科学计划

2024 DDE 古二氧化碳重建国际科学家工作坊项目 **2024 DDE International Workshop (Hangzhou) for** **Paleo-CO₂ Reconstruction**

Workshop Program

September 10–17, 2024, Hangzhou, China

2024 DDE 古二氧化碳重建国际科学家工作坊项目

2024 DDE International Workshop (Hangzhou) for Paleo-CO₂ Reconstruction

September 10–17, 2024, Hangzhou, China

1. Welcome

Welcomed to join the “DDE International Workshop for Paleo-CO₂ Reconstruction” to be held in Hangzhou, China’s southeastern Capital City of the Zhejiang Province from September 10–17, 2024.

International and Chinese participants from a variety of institutions are invited to join this workshop, including the PIs of CO₂PIP Project, the Leaders and Members of Paleo-CO₂ Task Group, as well as other international active scholars for Paleo-CO₂ reconstruction in USA, Sweden, Norway, Germany, Argentina, France, India, and China.

2. Introduction

Reconstructing paleo-atmospheric CO₂ concentrations across the Phanerozoic is crucial for understanding Earth’s climate evolution both in deep-time and in the future. The Paleo-CO₂ task group under the framework of Deep-time Digital Earth (DDE) Big Science Program is in tight collaboration with the NSF-funded “Phanerozoic CO₂ Proxy Integration Project (CO₂PIP)”. The topic of this workshop is “*Paleo-CO₂ Reconstruction of the Mesozoic*”.

The purpose of workshop is to expand further discussion and collaboration with integration for the DDE Paleo-CO₂ Task Group and the US project CO₂PIP. CO₂PIP can benefit from DDE on more geological aspects, such as sedimentology, palaeogeography, palaeoclimate, geochemistry, and tectonics, as well as geotechnical supporting, including use of open geoscience data, computational resources, and diverse geoscience analysis models. And the DDE can benefit from CO₂PIP for open dataset, the modernization of CO₂ proxies and variation of CO₂ in deep time.

3. Workshop aims and objective

The major topics of the workshop include: 1) discussions for the methodology,

templates, modernizing of paleo-CO₂ reconstructions used for the deep time; 2) integration of DDE platform, data science and model with CO₂PIP database of measured parameters and proxy CO₂ estimates; 3) further discussion on progresses of the concept proof paper on the paleo-CO₂ reconstruction of Triassic and Jurassic; and 4) discussion on the reconstruction of the Cretaceous paleo-CO₂.

4. Date and venue

Date: September 10–17, 2024

Venue: No.1 Building, The Zhejiang Lab Campus, Yuhang District, Hangzhou City, Zhejiang Province, China

All participants will stay at the Hotel of Academic Exchange Center in the Campus of Zhejiang Lab, about 10–15 minutes walking distance to the workshop venue.

5. Workshop organizers

Sponsors:

Deep-time Digital Earth IUGS Big Science Program

DDE Palaeo-CO₂ Task Group; CO₂PIP

Organizer:

Deep-time Digital Earth Research Center of Excellence, Zhejiang

Co-organizers:

Nanjing Institute of Geology & Palaeontology, Chinese Academy of Sciences; China University of Geosciences (Beijing); Zhejiang University; Zhejiang Lab.

6. Workshop schedules

Sept.10: Arrival and registration, ice breaker

Sept.11: Opening session, keynote lectures, and group discussion

Sept.12: Group discussions on standardization of paleo-CO₂ reconstruction, and on specific periods of the Mesozoic;

Sept.13: General discussion on challenges of paleo-CO₂ reconstruction of the Triassic and Jurassic;

Sept.14: Morning Field excursion and visit trip to Permian–Triassic GSSP in Changxing;

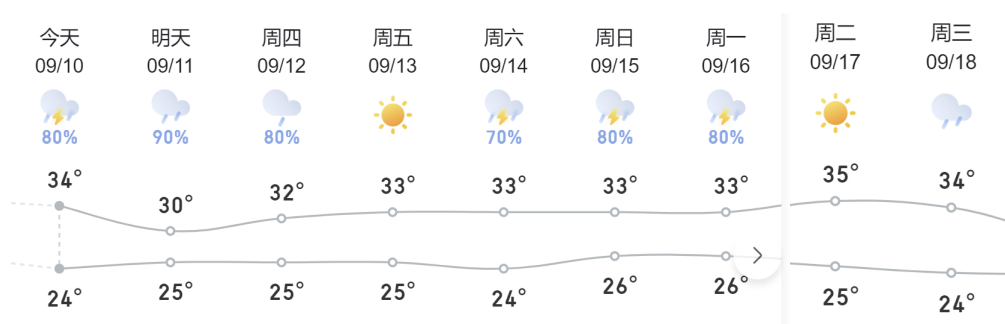
Sep.15–16: Discussion on paleo-CO₂ reconstruction of the Cretaceous;

Sept.17: Summary of workshop and departure.

7. Meal arrangements

Meal arrangements during workshop									
Date	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue
	9-Sep	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	15-Sep	16-Sep	17-Sep
Breakfast (07:30-09:00)	Hotel Buffet								
Refreshments (10:30-11:00)	—	—	Refreshments			—	Refreshments		
Lunch (12:00-13:30)	Buffet, 1F of 9# Restaurant					Field Restaurant	Buffet, 2F of 9# Restaurant		
Refreshments (15:30-16:00)	—	—	Refreshments			—	Refreshments with Chinese Mooncakes		—
Dinner (17:30-18:30)	Buffet, 1F of 9# Restaurant	Ice Breaker (at Hotel)	Buffet, 1F of 9# Restaurant		Nodus Western Restaurant, Zhongqiaocun Baiyang Ling No.1, Hangzhou	Buffet, 1F of 9# Restaurant	Buffet, 2F of 9# Restaurant		—

8. Whether in Hangzhou during the workshop



9. Workshop secretariat contact

Yongdong Wang: Nanjing Institute of Geology & Palaeontology, CAS (NIGPAS).
E-mail: ydwang@nigpas.ac.cn; Tel: 13952097125

Yuan Gao: China University of Geosciences (Beijing)(CUGB). E-mail:
yuangao@cugb.edu.cn; Tel: 13466721378

Ming Lei: Deep-time Digital Earth Research Center of Excellence, Zhejiang
(RCE (Hangzhou)). E-mail: hangzhou@ddeworld.org; Tel: 15658063152

10. Volunteer team

NIGPAS: Dr. Qing Li, Dr. Li Zhang, Mengge Li, Yue Yang; Dr. Pengchen An
(CDUT); Dr. Yuanyuan Xu (AUT)

CUGB: Zhengxuan Wu, Liu Yang, Yitian Yin, Hongyi Zhao

REC (Hangzhou): Xingkun Li, Zihan Hu, Chuchu Shao

2024 DDE International Workshop (Hangzhou) for Paleo-CO₂ Reconstruction

Workshop agenda

September 10–17, 2024, Hangzhou, China

Sept.10, Tuesday

Arrival and registration; ice breaker

Registration: in the Lobby of Academic Exchange Center Hotel, Zhejiang Lab, No.1 Kechuang Avenue, Yuhang District, Hangzhou

Workshop venue: Meeting Room 220, Building#1, Zhejiang Lab Campus, No.1 Kechuang Avenue, Yuhang District, Hangzhou

18:00–20:00 Ice breaker: Dining Hall at the First Floor of the Hotel

Sept.11, Wednesday

Opening session, invited talks and general discussion

Opening session: 9:00–9:20

Chair: Yuan Gao

- 1) Welcome address by Yongdong Wang
- 2) Opening address by Isabel Montanez
- 3) Address by Haipeng Li from DDE team
- 4) General introduction of the workshop program

Morning Session: 9:20–12:00 Invited talks (I)

Chair: Yongdong Wang

- 1) **9:20–9:50 Isabel Montanez**

CO₂PIP Consortium for Advancing paleo-CO₂ Reconstruction & Building the Next-Generation Phanerozoic Record — Progress & Future Plans

- 2) **9:50–10:20 Dana Royer**

Fossil stomata as a paleo-CO₂ proxy

---10:20–10:50 Tea break---

3) 10:50–11:20 Daniel Breecker

What do paleosols tell us about paleo-atmospheric CO₂?

4) 11:20–11:30 DDE Team by Haipeng Li

Introduction on the DDE Big Science Program: progress and future plan

5) 11:30–11:50 DDE Team by Linshu Hu

DDE Platform (Deep-time.org): One-stop online research platform for geoscientists

6) 11:50–12:20 DDE Team by Jieping Ye

GeoGPT: AI for Geoscientists

Afternoon session: 14:00–18:00 Invited talks (II)

Chair: Isabel Montanez

7) 14:00–14:30 Katharine Huntington

CO₂ proxy modernization: Strategies and methods from the CO₂PIP Project

8) 14:30–15:00 Gabriel Bowen

Progress on proxy system models for paleo-CO₂

9) 15:00–15:30 Dustin Harper

Bayesian Paleo-Environment Reconstructor (BPER): An R package for reconstructing paleo-CO₂ and more

--15:30–16:00 Tea break---

10) 16:00–16:25 Ying Cui

CO₂ reconstruction based on C3 land plant fossils for the Paleozoic and Mesozoic

11) 16:25–16:50 Yongdong Wang

Cretaceous paleo-CO₂ reconstruction: progress and problem

12) 16:50–17:15 Yuan Gao

Continental Scientific Drilling of Songliao Basin and Cretaceous Terrestrial Paleoclimate in East Asia

13) 17:15–17:30 Laiming Zhang

An introduction to the "Deep Extreme" project

13) 17:10–18:00 General or group discussion / help with templates from Dana Royer and Daniel Breecker

Sept.12, Thursday

Discussion on integrating data, proxy templates, modernization and model between DDE and CO₂PIP database

Morning session: 9:00–12:00

Chair: Dana Royer

1) 9:00–9:20 Margret Steinthorsdottir

Exploring Climate Sensitivity with Living and Fossil Plants

2) 9:20–9:40 Wolfram Kürschner

The stomata proxy method – from the beginnings to new developments

3) 9:40–10:00 Richard Barclay

A Ginkgo-specific CO₂ barometer

4) 10:00–10:20 Tao Su and Jinjin Hu

Paleo-CO₂ reconstruction based on alpine oaks

---10:20–10:50 Tea break---

5) 10:50–11:10 DDE team by Minghua Zhang

Progress of DDE standardization work

6) 11:10–12:00 Free time for general or group discussion

Afternoon session: 14:00–18:00

Chair: Daniel Breecker

1) 14:00–14:25 Carina Colombi A critical review of the paleo- atmospheric CO₂ along the poorly characterized Upper Carnian interval-The effect on paleocommunities of the Ischigualasto Fm

2) 14:25–14:50 Prosenjit Ghosh

Wildfire and CO₂ draw during Plio-Pleistocene boundary

3) 14:50–15:15 Gaëtan Guignard Technical practise on the plant fossil cuticles using TEM

--15:15–15:45 Tea break---

4) 15:45–18:00 Free time for general or group discussion

Sept.13, Friday

General discussion on progresses of paleo-CO₂ reconstruction of the Triassic and Jurassic with updates, next steps, concerns and timelines

Morning session 09:00–12:00

Chair: Margret Steinthorsdottir

1) **9:00–9:20 Jessica Whiteside**

Atmospheric CO₂, hydrological, and floral insights into Earth's largest igneous province at the Triassic–Jurassic Transition

2) **9:20–9:40 (Zoom) Morgan Schaller** Direct constraints on the composition of the ancient atmosphere from fluid inclusions in surficial minerals at key intervals of Earth's history

3) **9:40–10:00 (Zoom) Xiaoqing Zhang, Jiawei Da**

---10:00–10:30 Tea break---

4) **10:30–12:00 General or group discussion**

Afternoon session: 14:00–18:00

Chair: Katharine Huntington

5) **14:00–14:20 Jingyu Wu**

Paleo-CO₂ reconstruction for the Mesozoic based on fossil stomata of ginkgopsida: accuracy and difference

6) **14:20–14:40 Li Zhang**

Early Jurassic Paleo-CO₂ in the Qaidam Basin based on fossil ginkgo stomata

7) **14:40–15:00 Yanyuan Xu**

Preliminary research of the Late Triassic paleo-CO₂ in northern Sichuan Basin, China based on ginkgo fossil cuticle data

8) **15:00–15:20 Tianjie Jin**

Preliminary paleo-CO₂ reconstruction of the Middle Jurassic in East China

--15:20–15:50 Tea break--

9) **15:50–16:10 DDE Team by Linshu Hu**

How DDE Platform integrate or support the CO₂PIP?

10) **16:10–17:00 Free time for general or group discussion**

Sept.14, Saturday

Field excursion of PTB GSSP and integrating discussion

8:00–16:00 Field excursion and visit to Permian–Triassic GSSP in Changxing

- 1) 8:00 Departure from Hotel and bus ride to Changxing, about 1.5h
- 2) 9:40–12:30 Visit the Global Stratotype Section and Point (GSSP) for the P–T boundary (PTB) in Meishan Section, Changxing in Zhejiang Province, as well as the golden spike geopark and museum.

Field Guider: Prof. Quanfeng Zheng (Nanjing Institute of Geology and Palaeontology, CAS)

- 3) 12:30–14:00 Lunch at Changxing
- 4) 14:00–16:00 Bus ride and return to hotel



The PTB GSSP Golden Spike Geopark at Meishan Section in Changxing, Zhejiang Province

Sep.15, Sunday

**Discussion on existing paleo-CO₂ data, records, templates of proxy
and model of the Cretaceous**

Morning session: 9:00–12:00

Chair: Dustin Harper

1) 9:00–9:40 Isabel P. Montanez & Dana Royer

Plot of the published CO₂ records for the Cretaceous

The next steps of Cretaceous CO₂ records, modernization

2) 9:40–10:20 Xiaoqing Zhang & Jiawei Da (Zoom)

On templates of the Cretaceous stomata CO₂ records

---10:20–10:50 Tea break---

3) 10:50–12:00 General or group discussion on the modernization of Cretaceous CO₂ records

Afternoon session: 14:00–18:00

Chair: Yongdong Wang

4) 14:00–14:20 Yuan Gao and Zhengxuan Wu

Paleo-CO₂ reconstruction with the cores of Continental Scientific Drilling of Songliao Basin through the Cretaceous

5) 14:20–14:40 Laiming Zhang

Deccan eruptions and paleo-CO₂ evolution during the K-Pg boundary in East China

6) 14:40–15:00 Tianjie Jin

Preliminary paleo-CO₂ reconstruction of the Middle Jurassic in East China

--15:00–15:30-- Tea break--

7) 15:30–17:00 General or group discussion on paleo-CO₂ proxy and model of the Cretaceous

8) 17:00–18:00 Free time

Sept.16, Monday

Further discussion on the Cretaceous CO₂ reconstruction with next-generation of CO₂ curve

Morning 9:00–10:30

Chairs: Isabel Montanez, Yongdong Wang

- 1) Discussion of products: next generation CO₂ curve of Cretaceous and Mesozoic
- 2) Follow up discussion on modernization and modeling tools

Breakout Group Discussions 10:30–12:00

- 1) The paleosol carbonate proxy group: discussion of best practices manuscript
- 2) The plant-based (stomatal approaches, $\delta^{13}\text{C}$ of C₃ plants approach) proxy group: discussion of best practices manuscript

Afternoon 14:00–17:30

Chairs: Dan Breecker, Gabriel Bowen

- 1) Continued discussion of Cretaceous CO₂ records, including data, templates of proxy, modernization, of data, and models
- 2) Group discussion on integration of CO₂PIP and DDE platform, data set.

Sept.17, Tuesday

Summary of workshop (morning) and departure (after lunch)

Morning 9:00–11:30

Wrap up: define action items and participant roles in each item/product & timeline (map backwards)

Afternoon: 14:00 departure

2024 DDE International Workshop (Hangzhou) for Paleo-CO₂ Reconstruction

List of Workshop Participants

(in alphabetical order of names)

	Name	Institution	Title
1	Carina E. Colombi	National University of San Juan, Argentina	Assistant Professor
2	Chengshan Wang	China University of Geosciences (Beijing), China	Professor; Academician of CAS
3	Dana L. Royer	Wesleyan University, USA	Professor
4	Daniel Breecker	University of Texas at Austin, USA	Professor
5	Dustin T. Harper	University of Utah, USA	Post Doc
6	Gabriel J. Bowen	University of Utah, USA	Professor
7	Gaëtan Guignard	Honorary from Université Claude-Bernard Lyon 1 France/Nanjing Institute of Geology & Palaeontology, CAS	Honorary Professor
8	Haipeng Li	Deep-time Digital Earth Research Center of Excellence (RCE, Hangzhou), Zhejiang, China	Associate Research Fellow
9	Hongyang Chen	Zhejiang Lab, Hangzhou, China	Research Fellow
10	Isabel P. Montañez	University of California Davis, USA	Professor; Member of NAS
11	Jessica H. Whiteside	San Diego State University, USA	Professor
12	Jiacheng Leng	Zhejiang Lab, Hangzhou, China	Senior Research Specialist
13	Jiawei Da (online)	University of Texas at Austin, USA	Post Doc
14	Jieping Ye	Zhejiang Lab, Hangzhou, China	Senior Researcher
15	Jingyu Wu	Lanzhou University, China	Professor
16	Jinjin Hu	Xishuangbanna Tropical Botanical Garden, CAS, China	Assistant Professor
17	Jon Richey (online)	University of California Davis, USA	Post Doc

18	Katharine W. Huntington	University of Washington, USA	Professor
19	Laiming Zhang	China University of Geosciences (Beijing), China	Professor
20	Li Zhang	Nanjing Institute of Geology & Palaeontology, CAS, China	Post Doc
21	Linshu Hu	DDE/Zhejiang University, China	Associate Research Fellow
22	Margret Steinhorsdottir	Swedish Museum of Natural History, Sweden	Professor
23	Mingqian Li	Zhejiang Lab, Hangzhou, China	Post Doc
24	Minghua Zhang	Zhejiang Lab, Hangzhou, China	Professor
25	Morgan Schaller (online)	Rutgers University, USA	Assistant Professor
26	Pengcheng An	Chengdu University of Technology, China	Researcher
27	Prosenjit Ghosh	Indian Institute of Science, India	Professor
28	Qing Li	Nanjing Institute of Geology & Palaeontology, CAS, China	Post Doc
29	Quanfeng Zheng	Nanjing Institute of Geology & Palaeontology, CAS, China	Professor
30	Richard S.Barclay	Smithsonian Institution, USA	Research Geologist
31	Tao Su	Chengdu University of Technology, China	Professor
32	Tianjie Jin	China University of Geosciences (Beijing), China	Post Doc
33	Wolfram M. Kürschner	University of Oslo, Norway	Professor
34	Xiao Deng	Zhejiang Lab, Hangzhou, China	Post Doc
35	Xiaomin Jiang	Zhejiang University, China	Senior Engineer
36	Xiaoqing Zhang (online)	Wesleyan University, USA	Post Doc
37	Yi Yu	Zhejiang Lab, Hangzhou, China	Post Doc
38	Ying Cui	Montclair State University, USA	Associate Professor
39	Yongdong Wang	Nanjing Institute of Geology & Palaeontology, CAS, China	Professor

40	Yuan Gao	China University of Geosciences (Beijing), China	Professor
41	Yuanyuan Wang	Deep-time Digital Earth Research Center of Excellence (RCE, Hangzhou), Zhejiang, China	Associate Research Fellow
42	Yuanyuan Xu	Anhui University of Science & Technology, China	Post Doc/Lecture
43	Zhenhong Du	Zhejiang University, China	Professor
	<p style="text-align: center;">List of volunteers (in alphabetical order)</p>		
1	Hongyi Zhao	China University of Geosciences (Beijing), China	PhD student
2	Li Zhang	Nanjing Institute of Geology & Palaeontology, CAS, China	Post Doc
3	Liu Yang	China University of Geosciences (Beijing), China	PhD student
4	Mengge Li	Nanjing Institute of Geology & Palaeontology, CAS, China	Research Assistant
5	Pengcheng An	Chengdu University of Technology, China	Researcher
6	Qing Li	Nanjing Institute of Geology & Palaeontology, CAS, China	Post Doc
7	Yitian Yin	China University of Geosciences (Beijing), China	PhD student
8	Yuanyuan Xu	Anhui University of Science & Technology, China	Post Doc/Lecture
9	Yue Yang	Nanjing Institute of Geology & Palaeontology, CAS, China	Research Assistant
10	Zhengxuan Wu	China University of Geosciences (Beijing), China	PhD student