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CHINESE ACADEMY OF SCIENCES

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LEAD ARTICLE

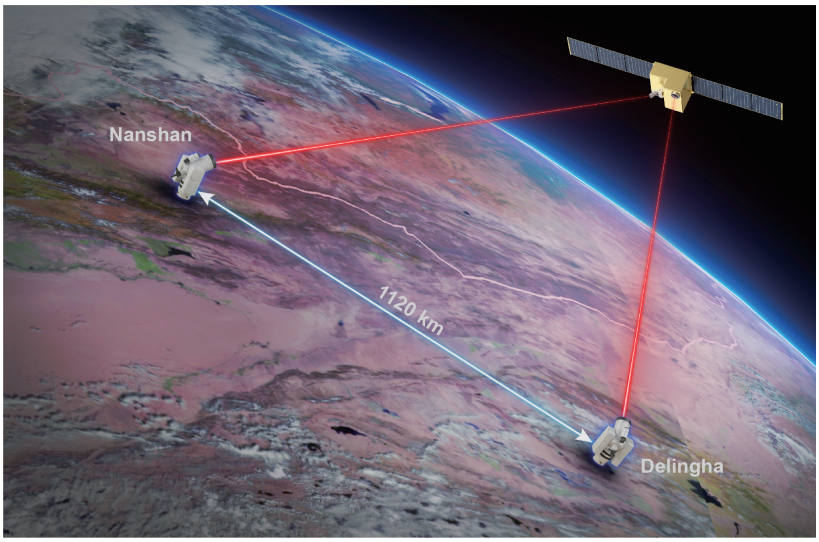

Illustration of the Micius satellite and the two ground stations [IMAGE: USTC]

Quantum physics: long-range satellite-based secure communications

The exchange of a 'secret key' for encrypting and decrypting messages over a distance of 1,120 kilometers was reported in *Nature* this week. This achievement was made using entanglement-based quantum key distribution, a theoretically secure communication technique. Previous attempts to directly distribute quantum keys between two ground users under real-world conditions have reached distances of only around 100 kilometers.

Quantum communication uses photons to securely distribute a 'secret key' to allow the exchange of encrypted messages. Previous work has demonstrated quantum key distribution along as much as 404 kilometers of coiled optical fiber in a laboratory, or from a satellite to a ground station up to 1,200 kilometers away. However, real-world application between two users has been limited to around 100 kilometers. This is due to photon losses, which increase rapidly with distance. Trusted relays or 'repeaters' offer a way to extend the distance and avoid photon loss, but the relay stations introduce security risks.

Pan Jianwei and colleagues circumvented the need for repeaters by using a satellite and entangled photons to establish a secure link between two ground stations on Earth. Entangled photons are linked in such a way that, even when separated by long distances, outcomes of measurements of their quantum properties are perfectly correlated.

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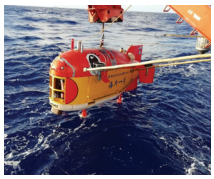
HOT ISSUE

10,907 meters under the sea! China's unmanned submersible sets new record



China's unmanned submersible Haidou-1 has beaten the country's deep-sea diving record by submerging 10,907 meters under the surface of the Pacific Ocean, deep into the Mariana Trench. >> PAGE 2

RESEARCH PROGRESS

New smart luminescent materials of Au(I) double salts

The research team of Professor Chen Yong from the Technical Institute of Physics and Chemistry (TIPC) of the Chinese Academy of Sciences reported their new work on smart luminescent materials in *Angew. Chem. Int. Ed.* >> PAGE 5

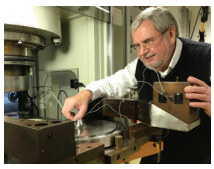
INTERNATIONAL COOPERATION

Satellite technology gives developing nations food security boost

China aims to help bridge this technology gap by offering developing countries access to its earth observation satellite system for crop monitoring, CropWatch, in partnership with the CSTD, under the secretariat of UNCTAD. >> PAGE 7

SCIENCE STORY

Working at CAS is an interesting and rewarding experience



I was quite excited when I obtained the opportunity of carrying out research in a country that is eager to be open for new goals and is open to incorporate and generate new ways of thinking in so many scientific fields. >> PAGE 10

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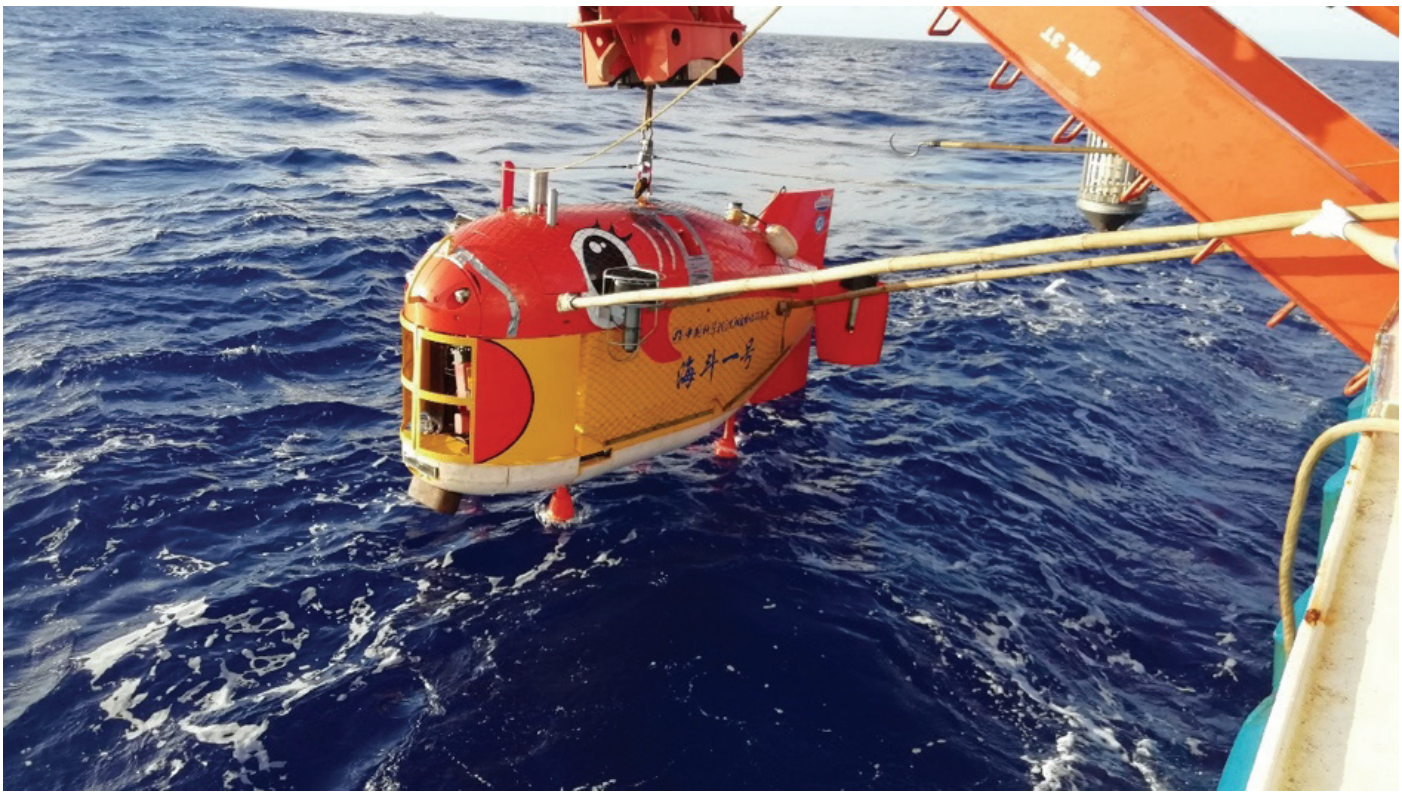


The deployment process of Haidou-1 [IMAGE: SHENYANG INSTITUTE OF AUTOMATION, CHINESE ACADEMY OF SCIENCES]

10,907 meters under the sea! China's unmanned submersible sets new record

China's unmanned submersible Haidou-1 has beaten the country's deep-sea diving record by submerging 10,907 meters under the surface of the Pacific Ocean, deep into the Mariana Trench.

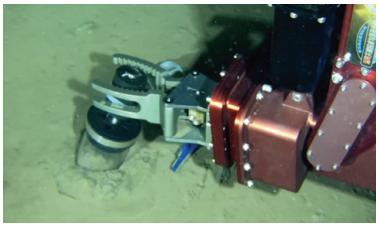
Members of the expedition team from the Shenyang Institute of Automation with the Chinese Academy of Sciences said that during the trip, the vehicle completed four dives of more than 10,000 meters into the 'Challenger Deep' part of the Mariana Trench.

The team left for the expedition on April 23 and returned to the Northeast China province of Liaoning on June 8.

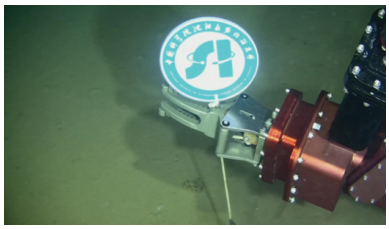
During the deep-sea diving operation, researchers tested high-precision depth detection, machine-hand operation, acoustic detection and positioning, and high-definition video transmission.

The submersible collected samples from the deep and captured high-definition images of the geological environment.

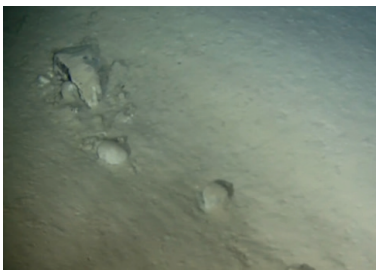
Source: Xinhua



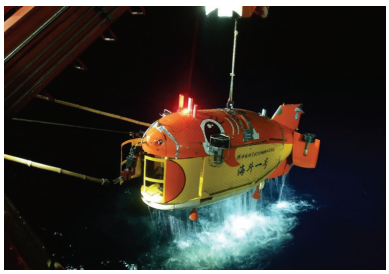
Manipulator takes submarine sediment samples. [IMAGE: SHENYANG INSTITUTE OF AUTOMATION, CHINESE ACADEMY OF SCIENCES]



Manipulator places "Shenyang Automation Institute" logo at the deepest point of the dive. [IMAGE: SHENYANG INSTITUTE OF AUTOMATION, CHINESE ACADEMY OF SCIENCES]



Photograph of 10,000-meter seabed rock taken by Haidou-1 [IMAGE: SHENYANG INSTITUTE OF AUTOMATION, CHINESE ACADEMY OF SCIENCES]



The recycling process of Haidou-1 [IMAGE: SHENYANG INSTITUTE OF AUTOMATION, CHINESE ACADEMY OF SCIENCES]

Ancient DNA unveils important missing piece of human history

Newly released genomes from Neolithic East Asia have unveiled a missing piece of human prehistory, according to a study conducted by Professor Fu Qiaomei's team from the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) of the Chinese Academy of Sciences.

The study, published in *Science* on May 14, reveals that population movement played a profound role in the early genetic history of East Asians.

The researchers used advanced ancient DNA capture techniques to examine 25 individuals dating back 9,500-4,200 years and one individual dating back 300 years from northern and southern East Asia.

The newly sequenced DNA casts a spotlight on an important period in East Asia's early history: the transition from hunting and gathering to agricultural economies.

One hypothesis for population movement in East Asia is that during the Neolithic, a "second layer" of agriculturalists replaced a "first layer" of hunter-gatherers in East and Southeast Asia.

While the genetics of ancient humans in Southeast Asia, Siberia, and the Japanese archipelago have been well-studied, little was known until now about the genetics of ancient humans in northern and southern China.

Professor Fu and her team found that these Neolithic humans share the closest genetic relationship to present-day East Asians who belong to this "second layer." This suggests that by 9,500 years ago, the primary ancestries composing the genetic makeup of East Asians today could already be found in mainland East Asia.

Piece of petrous bone from a ~9,500-year-old individual from Bianbian Cave, Shandong, China. This individual was part of a northern ancestry group found along the Yellow River and up into the eastern steppes of Siberia. [IMAGE: GAO WEI]

While more divergent ancestries can be found in Southeast Asia and the Japanese archipelago, in the Chinese mainland Neolithic populations already displayed genetic features belonging to present-day East Asians.

Notably, this includes the Early Neolithic southern East Asians dating back 8,000 years from this study that should have been "first layer" early Asians, according to the earlier hypothesis. In fact, Professor Fu and her team showed that they shared a closer relationship to present-day "second layer" East Asians. Thus, the results of the current study fail to support a "two layer" dispersal model in this area of Neolithic East Asia.

The scientists also found that Early Neolithic East Asians were more genetically differentiated from each other than present-day East Asians are.

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>> PAGE 3

Skull of Qihe 2, a ~8,400-year-old individual from Qihe Cave, Fujian, China [IMAGE: FAN XUECHUN]

In early Neolithic East Asia from 9,500 BP, a northern ancestry existed along the Yellow River and up into the eastern steppes of Siberia, distinct from a southern ancestry that existed along the coast of the southern Chinese mainland and islands in the Taiwan Strait from 8,400 BP.

Population movement may have already started impacting East Asians by the Late Neolithic. For example, the Late Neolithic southern East Asians may have shared a connection to coastal northern East Asians and the former's ancestry may have extended northwards as well.

Today, most East Asian populations are not clearly separated into two distinct groups. Present-day mainland East Asians from both the north and south share a closer genetic relationship to northern Neolithic East Asians along the Yellow River than to southern Neolithic East Asians on the southern coast of China.

Further analyses show that they are almost all a mixture of northern and southern ancestry from Neolithic East Asia, with northern ancestry playing a larger role. Population movement, particularly from the north along the Yellow River southward was a prominent part of East Asian prehistory after the Neolithic.

Interestingly, present-day Han Chinese in all provinces, north and south, show a similar amount of northern and southern influences.

Southern ancestry, while less represented in mainland East Asia today, had extensive influence on other regions. Present-day Austronesian speakers, who share a close genetic relationship to present-day mainland East Asians but live across a wide swath of islands in Southeast Asia and the Southwest Pacific, show a remarkably close genetic relationship to Neolithic populations from the southern coast of China.

Archaeological materials dating back to the Middle Neolithic have long hinted at the connection between Austronesian islanders and populations in mainland East Asia. Now, the genetic relationships uncovered by Professor Fu and her team show unambiguous evidence that Austronesian speakers today originated from a proto-Austronesian population that derived from southern China at least 8,400 year ago.

The history revealed by these 26 ancient humans highlights the profound impact that population movement and mixture had on human history, but they also reveal continuity that extends back 9,500 years. Unlike in Europe, influences from Central Asia had no role in the formation of East Asian ancestry, with mixing largely occurring regionally between northern and southern populations in East Asia.

The whole slate of ancestries present across East Asia during the Neolithic is still unknown, as genome-wide data have not been retrieved from many inland regions of mainland East Asia.

But coastal connections between ancient populations in Siberia, Japan, China, and Southeast Asia suggest that as more ancient DNA is retrieved and studied a complex history of population contact and admixture in East Asian human prehistory will be revealed.

Source: Chinese Academy of Sciences

>> PAGE 1

Two telescopes, designed to receive such quantum signals, were built 1,120 kilometers apart in Delingha and Nanshan in China. Entangled photons produced by the Micius satellite are transmitted to the ground as the satellite passes over the stations. Although satellite-based entanglement distribution has been reported before, the authors have now increased transmission efficiency and reduced error rates enough to use entanglement to transmit quantum keys. They show that the system produces a secure channel that is resistant to attack.

The results represent a path towards entanglement-based global quantum networks, the authors conclude.

Source: Chinese Academy of Sciences

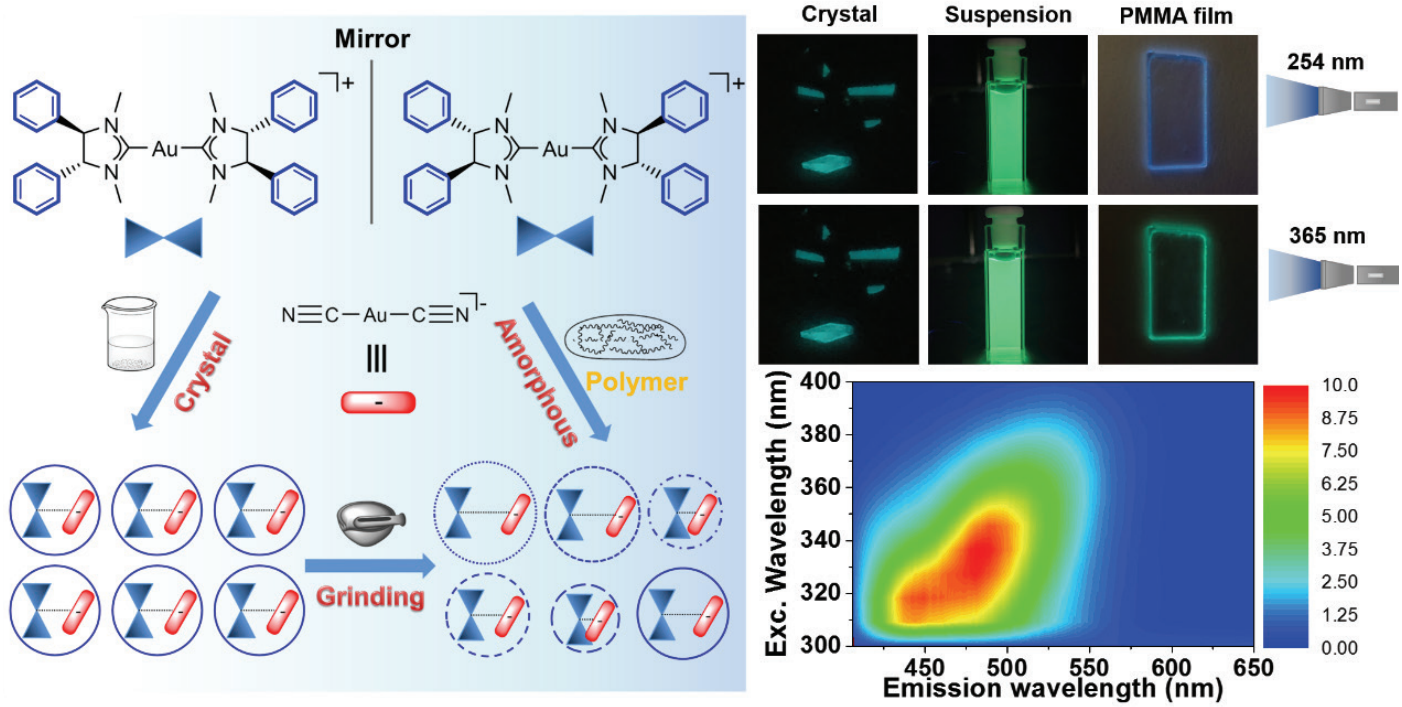

Figure: Structure of Au(I) double salt (left) and luminescence under different wavelengths (right) [IMAGE: CHEN YONG]

New smart luminescent materials of Au(I) double salts

Smart materials, especially among dynamic physical stimuli responsive materials, are being widely used. Wavelength-dependent (Ex-De) photoluminescent materials are of great interest to scientists because of their facile, non-invasive emission color tuning made possible by switching excitation wavelengths.

Recently, the research team of Professor Chen Yong from the Technical Institute of Physics and Chemistry (TIPC) of the Chinese Academy of Sciences reported their new work on smart luminescent materials in *Angew. Chem. Int. Ed.* In their work, they achieved excitation wavelength-tunable circularly polarized luminescence (Ex-De CPL) by controlling metallophilic interactions in chiral gold(I) double salts (RC-A and SC-A).

Different from the previous reported gold(I)-carbene double salt with infinite Au(I)···Au(I) chains *(Angew. Chem. Int. Ed. 2018, 57, 6279-6283; Chem. Commun. 2018, 54, 12844-12847; Angew. Chem. Int. Ed. 2020, 59, 2080-2984)*, the new dimeric double salt shows discrete ion pairs with the cation and anion adopting an orthogonal configuration to each other.

The Ex-Ed CPL of RC-A and SC-A in a poly (methyl methacrylate) (PMMA) matrix are ascribed to originating from multiple emissive excited states as a result of the existence of varied Au(I)···Au(I) distances. The emission maxima can be dynamically tuned from 440 to 530 nm by changing the excitation wavelength from 300 to 400 nm.

The unique Ex-De CPL means this material has promising applications in 3D displays, quantum encryption, anti-counterfeiting and security-enhanced optical communications.

For more information, please contact:
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Source: Technical Institute of Physics and Chemistry, Chinese Academy of Sciences

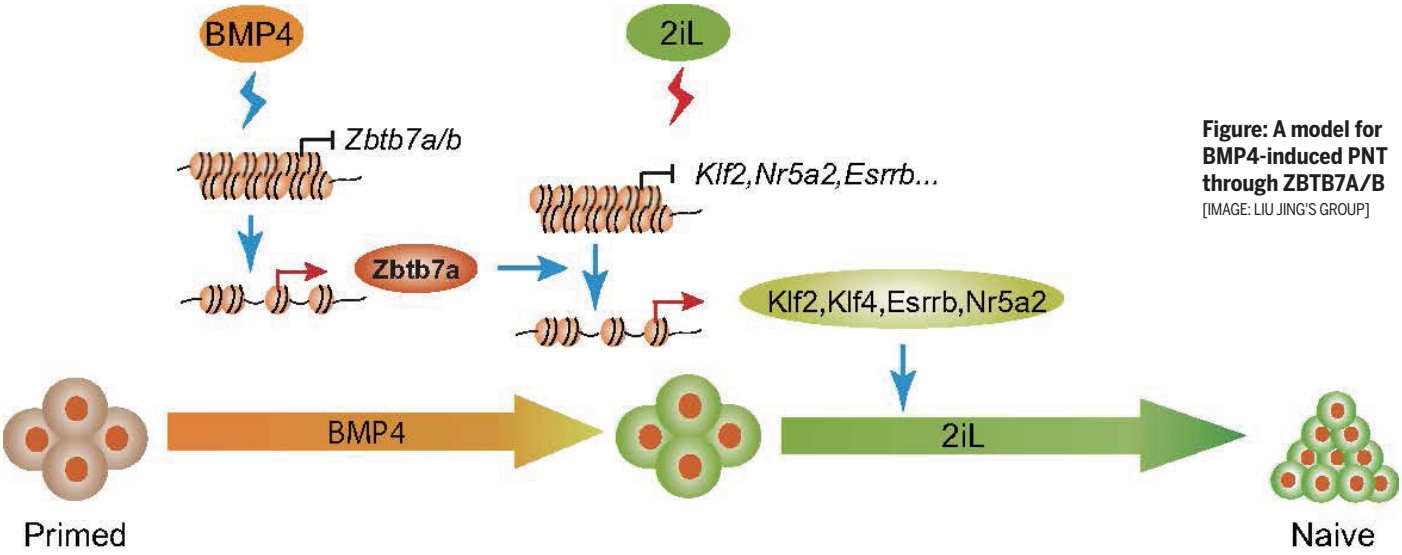

Figure: A model for BMP4-induced PNT through ZBTB7A/B
[IMAGE: LIU JING'S GROUP]

Novel system reveals the mechanisms of pluripotency transition

In a study published online in *Nature Cell Biology* on May 11, scientists from the Guangzhou Institute of Biomedicine and Health (GIBH) of the Chinese Academy of Sciences established a novel and efficient system for non-integrated mouse Primed pluripotency to Naive pluripotency Transition (PNT) and elaborated the new mechanisms underlying the PNT process.

Mouse embryonic stem cells exist in two unique pluripotent states, Naive state and Primed state. PNT represents reversal of the embryonic development stage from post-implantation to pre-implantation, which process needs to overcome some important epigenetic barriers. In the previous reports, PNT usually required the infection of transcription factors by viral vector, which is cumbersome in operation and low in efficiency, hampering its wide application in the field. In addition, the underlining mechanisms for PNT remain to be further clarified.

To address the above issues, the researchers established a PNT system. They first screened a series of growth factors and found that BMP4 was capable of inducing PNT in mice. By screening a compound library, they then identified two small molecule inhibitors, EPZ6438 and EPZ5676 that could improve PNT efficiency synergistically. Based on these, the researchers established a PNT induction system with more than 80 percent efficiency within eight days.

Importantly, the withdrawal of the BMP signal will totally abolish the PNT process; they thus termed this newly established PNT system as BiPNT (BMP induced PNT).

Besides, the researchers depicted the chromatin accessibility dynamics during BiPNT by using RNA-seq and ATAC-seq (chromatin transposase accessibility sequencing), and proved that BMP4, the most critical diver factor in BiPNT, inhibited the opening of chromatin loci of differentiation related genes and promoted the opening of chromatin loci of naive pluripotent related genes.

They for the first time identified transcription factors *Zbtb7a* and *Zbtb7b*, as novel targets of BMP4 that regulate PNT by affecting chromatin remodeling. ChIP-seq experiments further proved that *Zbtb7a* directly activates the expression of naive pluripotency genes such as *Esrrb, Klf2* and *Nr5a2* by binding to the upstream regulating elements in the chromatin, thus regulating the occurrence of PNT.

This study improved the PNT transition technique and revealed novel mechanisms for understanding the PNT process. The BiPNT system provides a wonderful paradigm for studying the mechanism of how extracellular signal mediated cell fate transition occurs. In addition, this study offered a valuable reference for the acquisition of naive human embryonic stem cells.

Cell reprogramming and cell fate transition are determined by sophisticated signals transduction and epigenetic regulation. The underlying mechanism and working models for these processes are core issues in the field of cell biology.

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Source: Guangzhou Institute of Biomedicine and Health (GIBH), Chinese Academy of Sciences

Satellite technology gives developing nations food security boost

Earth observation and crop monitoring on a massive scale are neither easy nor cheap exercises, but both are necessary for proper food security planning. Yet many developing countries simply don't have access to the required tools, either due to lack of technology or high costs.

China aims to help bridge this technology gap by offering developing countries access to its earth observation satellite system for crop monitoring, CropWatch, in partnership with the United Nations Commission on Science and Technology for Development (CSTD), under the secretariat of UNCTAD.

CropWatch is a system that uses satellite data to monitor crop conditions and integrates this with other climate-related data on drought, pests and disease for better farm management.

"In a time of crisis, satellite technology can support critical decision-making and help countries shore up their food security," said Ms. Shamika Sirimanne, CSTD secretariat head and UNCTAD technology and logistics director.

The severe locust swarms in East Africa and the Horn of Africa earlier this year, and disruptions to normal farming and the food supply chain caused by stalled trade due to the COVID-19 crisis, are two examples of where better access to technology could have helped.

Closing the gap

The Chinese government is seeking to close this gap through a new three-way partnership between the Chinese Academy of Sciences (CAS), the Alliance of International Science Organizations (ANSO) and CSTD.

CropWatch has been used by China since 1998 to assess national and global crop production, serving as an important tool in decision-making on the food market, plus annual planning of food import-exports and disaster relief.

The technology has been deployed in several developing countries and will now be extended to more under the partnership.

It will help them monitor their crops and the system can be customized by country and region to meet specific needs.

Combating food insecurity with data

The partnership was announced by Professor Bai Chunli, President of CAS and the ANSO, at the 23rd annual meeting of the CSTD, which this year took place virtually, for the first time.

During the CSTD meeting, various countries made commitments to advancing science and technology collaborations.

Mr. Bai said the coronavirus pandemic lays bare the data divide between developed and developing countries, and this impacts their ability to make good, strategic decisions about food supply.

"The COVID-19 pandemic has made us realize more than ever before, the importance of solidarity, international cooperation and the need for science and innovation in our fight against our common challenges," Mr. Bai said.

"In the current crisis, it is important for food-insecure countries to have first-hand information on the world's food production, both at national and global levels," he said.

The availability and transparency of this information is a challenge, Mr. Bai noted, because the countries don't own their own monitoring and analysis systems. "These countries must take the risk of making decisions based on information from a third party, which is either delayed or unverifiable," he said.

The best situation is one in which countries have a monitoring and analysis system of their own. CropWatch offers this opportunity by allowing countries to carry out independent monitoring and analysis of agro-information and crop production with the application of remote sensing data.

CropWatch to help with global goals

Under the new partnership, developing countries that need CropWatch can access the technology directly and use it for Earth observation and food security purposes.

Countries will be trained on the system, its underlying techniques, as well as options for customization and localization.

CropWatch is also expected to contribute towards the achievement of the sustainable development goals (SDGs) in developing countries.

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CAS, Mérieux Foundation strengthen cooperation to defeat COVID-19 pandemic

"Scientific international cooperation has never been more important than it is today", said Professor Zhang Yaping, Vice-President of the Chinese Academy of Sciences (CAS), at a video-conference between CAS and the Mérieux Foundation on May 7, 2020, which was specially called to discuss the scientific response to COVID-19.

The meeting was intended to share information about COVID-19 and explore potential scientific collaboration opportunities to defeat the virus.

CAS launched a special COVID-19 Emergency Prevention and Control Project at the outset of the epidemic. The combined efforts of 396 teams from CAS, involving over 2,600 researchers, have resulted in significant progress and science-based innovations for epidemic prevention and control work.

"CAS scientists isolated the SARS-CoV-2 virus early on in the epidemic and have developed about 18 kits for detecting SARS-CoV-2 in cooperation with diagnostic companies. CAS has instigated research on four different types of SARS-CoV-2 vaccines - mRNA, Adenovirus Vector, Recombinant DNA protein and Inactivated viral vaccines. Drugs screened by CAS such as Hydroxychloroquine, Tocilizumab and Tanreqing have been included in *China's National Diagnosis and Treatment Guidelines for COVID-19,*" said Professor Xu Tao, Director-General, CAS Bureau of Frontier Sciences and Education.

Professor Yuan Zhiming, Director-General of the Wuhan P4 Laboratory and also President of the CAS Wuhan Branch mentioned their laboratory "played an important role in the prevention and control of the COVID-19 pandemic, which was the result of the early deployment of China and France". He also emphasized some of the vicious accusations and rumors about the virus's origins were completely unfounded.

Mr. Alain Mérieux, President of Mérieux Foundation said that after four months of the COVID-19 pandemic that has profoundly affected the entire world, it is crucial today to reinforce medical and scientific collaborations between China and France and also with other countries because epidemics can only be fought through global and long-term approaches. He congratulated Chinese scientists on their achievements in vaccine and antiviral drugs development, which will greatly benefit the Chinese population and also the rest of the world.

Mérieux Foundation will continue to support partnerships like the regional infectious disease surveillance "Great Mekong project", that is particularly relevant after the COVID-19 crisis.

"I assisted the Wuhan P4 laboratory to carry out certification work, so that it could continuously meet the updated Chinese and international standards," said Mr. René Courcol, international technique expert for quality assurance in Wuhan P4 Laboratory since 2017. His work on quality control and biosafety in the laboratory is carried out under the framework of the China-France cooperation agreement on infectious diseases. He pointed out that the laboratory was approved by China National Accreditation Service for Conformity Assessment (CNAS).

Mr. Tang Hong, Director-General of the Institute Pasteur Shanghai (IPS) and Mr. Fernando Arenzana-Seisdedos, the Co-Director, briefed the productive progress of IPS in Sino-French cooperation projects and the research progress in diagnostic test, antibodies, and vaccines. Relying on the joint support of both sides, IPS has successfully recruited several important international scientists who have been very active in the recent research work.

Both sides expressed their hope and support to further strengthen Sino-French scientific exchanges and cooperation, including the joint platform and cooperation in Southeast Asia. "Many projects needed to be carried out to achieve a brilliant, positive and useful collaboration between China and France," said Mr. Alain Mérieux.

Source: Chinese Academy of Sciences

COVID-19: new common target for CAS and Institut Pasteur cooperation

At a video-conference on May 15, the Chinese Academy of Sciences (CAS) and the Institut Pasteur, which have been two key institutions of Sino-French Cooperation on Emerging Infectious Diseases since 2003, reached a consensus to make sustained common efforts to defeat the COVID-19 pandemic.

Both sides reiterated that mutual trust and continuous cooperation are key to Sino-French cooperation on infectious diseases, and will make sustained efforts to defeat COVID-19 and ensure the public health security of the two countries. "This is not just for our two countries, but also for the rest of the world, to fight against this global health crisis", said Professor Zhang Yaping, Vice-President of CAS.

Professor Zhang expressed his gratitude to the French side for their long-term support for the CAS Institut Pasteur of Shanghai (IPS), which has become an important platform not just for CAS scientists to fight against COVID-19, but also for the cooperation between the two scientific communities. The detection kit for COVID-19 developed by IPS was listed as one of the leading detecting devices by the Chinese government, he said.

Professor Stewart Cole, President of the Institut Pasteur, congratulated CAS and IPS for the progress and scientific achievements that they have made on COVID-19. French scientists were as busy as their Chinese colleagues in developing vaccines and diagnostic tools, and in identifying antibodies and drugs, he said. He also introduced the recent major progress of the Institut Pasteur and the international contribution made by the Institut Pasteur International Network.

He thanked the IPS for its international contribution and was confident that with the support of CAS and the Shanghai Municipal Government, the Institute would achieve even greater development in the future.

Professor Tang Hong, Director General of IPS, highlighted the productive cooperation with the Institut Pasteur over three months of fighting against COVID-19, as well as the efforts made towards helping Africa and Iran.

CAS launched a special COVID-19 Emergency Prevention and Control Project at the very beginning of the epidemic. The combined efforts of 396 teams from CAS, involving over 2,600 researchers, has resulted in significant progress and science-based innovations for prevention and control work in the COVID-19 epidemic. "CAS scientists isolated the SARS-CoV-2 virus early on in the epidemic and have developed about 18 detecting kits in cooperation with diagnostic companies," said Professor Zhang Yongqing, Deputy Director-General, CAS Bureau of Frontier Sciences and Education.

The high-level biosafety laboratory, jointly constructed by China and France after SARS, has played an important role in fighting COVID-19. "The development of vaccine has entered clinical trials, and it is expected to achieve good results", said Professor Yuan Zhiming, Director of the Wuhan P4 Laboratory of the CAS Wuhan Institute of Virology.

Professor Shi Zhengli, a coronavirus expert at Wuhan P4 Laboratory, showed her gratitude to the Institut Pasteur for hosting a student exchange and hoped for more cooperation in the near future.

The two institutions agreed to further strengthen IP-CAS scientific exchanges and cooperation through IPS development and projects like the G4 Program, Kunming joint center and their cooperation in Southeast Asia.

Source: Chinese Academy of Sciences

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"It is easy to see how the impact of an incident in one country can easily spill over into others – and food insecurity in particular threatens many nations and regions," Ms. Sirimanne said.

She warned that without global collaboration in science and technology, many existing divides would worsen, but shared data and technology could minimize the negative impacts of this.

"We welcome this partnership to ensure that developing nations have the right tools to determine their own destiny," she said.

This new partnership will add to a growing list of concrete cooperation initiatives in science and technology for development, delivered through the CSTD.

The list includes collaborations between UNCTAD and Brazil to deliver courses on STI for industrial policy, capacity-building on STI policies and incubator management provided by China, and trainings for young female scientists offered by the Okayama University of Japan.

Crop monitoring systems help developing nations [IMAGE: UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT]

Source: United Nations Conference on Trade and Development

Working at CAS is an interesting and rewarding experience

I was quite excited when I obtained the opportunity of carrying out research in a country that is eager to be open for new goals and is open to incorporate and generate new ways of thinking in so many scientific fields.

I met many colleagues who are very determined to achieve their scientific goals and who are working very hard to that end. Also, the availability and amount of the most modern, up-to-date research equipment is very impressive. However, my impression is that this equipment is not always accompanied by sufficiently trained technical personnel and scientists who can master such new techniques. Here, it is important to find the right balance. For my own needs I was always able to find the right partners to promote the joint research projects.

I enjoyed my stay in China very much. People are very friendly and helpful, even though there is a natural language barrier on many occasions. This does not exist within the research institution where colleagues could always be found to help out with language problems. Food was an interesting new experience even though I had already enjoyed "Chinese food" for a long time. Local cuisine brings different tastes than what one can experience from westernized food. Most impressive were visits to old Chinese heritage sites like temples and villages and the spectacular landscape that surrounds Guiyang.

Working with CAS was highly rewarding for me. It resulted in two publications with a further one under review. Also, there are two projects on the development of the early Earth in an advanced state that should also be published in international journals in the near future.

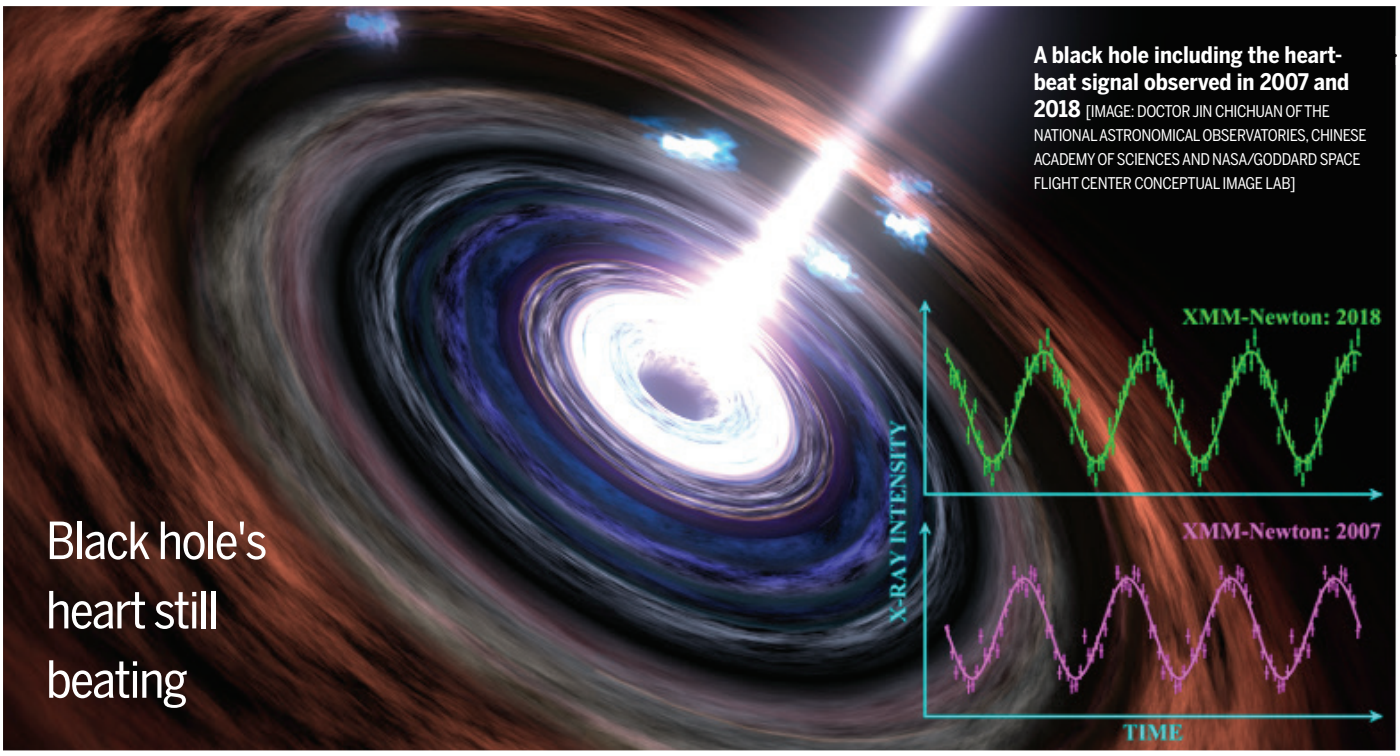
Gerhard Brey [IMAGE: INSTITUTE OF GEOCHEMISTRY, CHINESE ACADEMY OF SCIENCES]

CAS in Guiyang has many excellent scientists and possibilities to carry out leading research in a variety of fields in geoscience. However, my impression is that the scientists are somewhat plagued by a too high absolute pressure for publication and by a load of organizational work that leaves little room for the establishment of new methods in the new laboratories and with new sophisticated analytical equipment. Especially the latter work seems to be little rewarding for the individual scientist. The time-consuming work of establishing new methods is not recognized because during that time there will be no new publications. However, new methods bring progress and open new ways in science.

I hope that I can continue my collaboration with CAS in Guiyang. Through the scientific exchange with the colleagues here and especially with my host, Professor Doctor Qiao Shu, we found new interesting projects that could be tackled here successfully in collaboration.

Gerhard Brey

Source: Institute of Geochemistry, Chinese Academy of Sciences



A black hole including the heart-beat signal observed in 2007 and 2018 [IMAGE: DOCTOR JIN CHICHUAN OF THE NATIONAL ASTRONOMICAL OBSERVATORIES, CHINESE ACADEMY OF SCIENCES AND NASA/GODDARD SPACE FLIGHT CENTER CONCEPTUAL IMAGE LAB]

Black hole's heart still beating

X-ray satellite observations spotted the repeated beat after its signal had been blocked by our Sun for a number of years.

Astronomers say this is the most long-lived heartbeat ever seen in a black hole and tells us more about the size and structure close to its 'event horizon' – the space around a black hole from which nothing, including light, can escape.

The research, by the National Astronomical Observatories, Chinese Academy of Sciences, China, and Durham University, UK, appears in the journal *Monthly Notices of the Royal Astronomical Society.*

The black hole's heartbeat was first detected in 2007 at the centre of a galaxy called RE J1034+396 which is approximately 600 million light years from Earth.

The signal from this galactic giant repeated every hour and this behaviour was seen in several snapshots taken before satellite observations were blocked by our Sun in 2011.

In 2018 the European Space Agency's XMM-Newton X-ray satellite was able to finally re-observe the black hole and to scientists' amazement the same repeated heartbeat could still be seen.

Matter falling on to a supermassive black hole as it feeds from the accretion disc of material surrounding it releases an enormous amount of power from a comparatively tiny region of space, but this is rarely seen as a specific repeatable pattern like a heartbeat.

The time between beats can tell us about the size and structure of the matter close to the black hole's event horizon.

Professor Chris Done, from Durham University's Centre for Extragalactic Astronomy, collaborated on the findings with colleague Professor Martin Ward, Temple Chevallier Chair of Astronomy.

Professor Done said: "The main idea for how this heartbeat is formed is that the inner parts of the accretion disc are expanding and contracting.

"The only other system we know which seems to do the same thing is a 100,000 times smaller stellar-mass black hole in our Milky Way, fed by a binary companion star, with correspondingly smaller luminosities and timescales.

"This shows us that simple scalings with black hole mass work even for the rarest types of behaviour."

Lead author Doctor Jin Chichuan of the National Astronomical Observatories, Chinese Academy of Sciences, said: "This heartbeat is amazing!"

"It proves that such signals arising from a supermassive black hole can be very strong and persistent. It also provides the best opportunity for scientists to further investigate the nature and origin of this heartbeat signal."

The next step in the research is to perform a comprehensive analysis of this intriguing signal, and compare it with the behaviour of stellar-mass black holes in our Milky Way.

The research was funded by the National Natural Science Foundation of China, the Strategic Pioneer Program on Space Science of the Chinese Academy of Sciences, and the Science and Technology Facilities Council, UK.

Source: National Astronomical Observatories, Chinese Academy of Sciences

Researchers calculate age of the oldest-known forest in West Junggar region, China

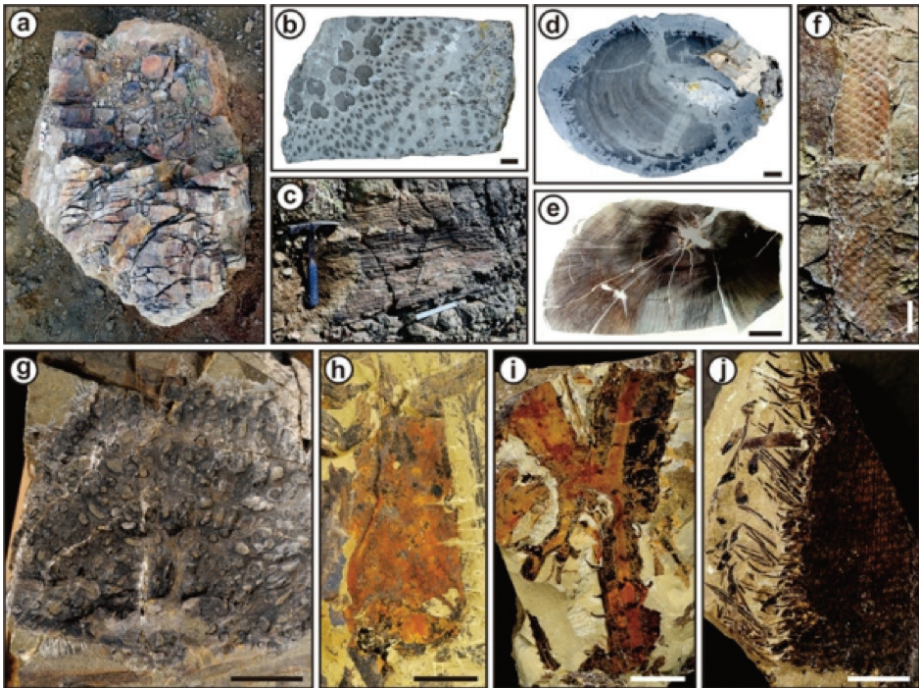
As one of the five major extinction events in Earth's history, the Frasnian-Famennian boundary (FFB) crisis caused dramatic reductions in marine and terrestrial diversity.

The effects of this event on terrestrial ecosystems are not well understood due to the limited preservation of terrestrial sedimentary rocks and the relative scarcity of plant fossils. Besides, the stratigraphic position of the FFB remains unclear.

Professor Xu Honghe from the Nanjing Institute of Geology and Palaeontology at the Chinese Academy of Sciences (NIGPAS) and Doctor Zheng Daran from the University of Hong Kong conducted detailed paleontology and isotope chronology studies in several Devonian terrestrial outcrops in West Junggar, northwestern China. Related results were published in *Palaeogeography, Palaeoclimatology, Palaeoecology.*

They investigated four plant-rich fossil-bearing Zhulumute Formation sections. The Zhulumute flora mainly contained Lycopsida, Archaeopteridales, and Cladoxylopsida, which are typical for constructing Middle-Late Devonian forests. Their widespread distribution in the West Junggar indicates the range of forests in this region.

Through precise zircon uranium-lead (U-Pb) dating on the plant fossil layer in the Salba section, the researchers limited the age of the Zhulumute flora to the earliest Famennian (371.5 ± 0.9 Ma). This indicated that the Zhulumute flora constituted the oldest-known forest in China.



Representative Frasnian-Famennian fossil plants in West Junggar, Northwest China [IMAGE: NIGPAS]

Field photo of the Saerba Section of the Zhulumute Formation in West Junggar, Northwest China [IMAGE: NIGPAS]

The new U-Pb ages generated in this study refined the placement of the FFB in West Junggar to within the Zhulumute Formation, instead of the Hongguleleng Formation as previously thought.

Although the floral assemblages of the lower Famennian Zhulumute Formation did not represent in-situ growth, the presence of abundant arborescent taxa was inferred to represent the earliest known forest in the West Junggar region.

These fossil assemblages showed the same taxonomic composition as those confidently ascribed to Late Devonian forest ecosystems elsewhere globally.

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Chinese engineers open the re-entry module of the prototype of China's new-generation manned spacecraft that returned to Earth in early May, distributing items inside it to their owners on May 29, 2020. [IMAGE: CHINA DAILY]

Tibetan plants return from orbit for study

Items from Tibet that were carried into space on a manned spacecraft last month are now available for testing in labs, China Tibet Online has reported.

The 11 items — including barley, forage grass, rose rhodiola, lemon, and graphene — that were carried by the re-entry module returned in early May. They are of interest in studies of the germination characteristics of seeds, crop outputs and plant growth cycles.

Wang Junjie, a researcher at the National Astronomical Observatory of China, said the 11 items were taken to space to determine whether they would mutate in an environment of cosmic radiation, charged particles and zero gravity.

"This is to study whether species unique to Tibet will embrace variations in outer space," Wang said. "This will help boost livelihoods in the region, as well as its economy and technology."

Wang added that an increase in barley yields is expected to benefit thousands of farmers in Tibet.

"If ornamental plants such as the rose rhodiola happen to mutate in the spacecraft, there will be improvement in both its ornamental and pragmatic value."

Source: China Daily

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In West Junggar, the stratigraphic position of the FFB remains tentative. The FFB was controversially interpreted to have occurred in the lower part of the marine Hongguleleng Formation. Numerous studies have debated the age of the Hongguleleng Formation. Its conodont biostratigraphy has been interpreted as Famennian, late Frasnian-Famennian, or Famennian-Tournaisian in age.

This interpretation differs from long-held interpretations regarding placement of the FFB in NW China. Specifically, their age data indicated that the FFB was present in the terrestrial Zhulumute Formation and not within the marine Hongguleleng Formation.

Together with paleontological evidence, this new chronostratigraphic constraint indicated that forest development occurred synchronously with or immediately following the Upper Kellwasser crisis in West Junggar. These findings were consistent with the possibility of a major floral turnover at the FFB, although further investigation will be required to test this hypothesis.

This research was supported by the Strategic Priority Research Program of the Chinese Academy of Sciences, the HKU Seed Fund for Basic Research, and the National Natural Science Foundation of China.

Source: Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences