

PCPG Newsletter

Communicating Key Information & Concerns
to Geologists and Environmental Professionals

Issue 1 / 2020

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MESSAGE FROM THE PRESIDENT

RE-IGNITE YOUR PASSION

Welcome to a new year with PCPG! I am very honored to serve as PCPG President this year and would like to thank Martin Helmke for his excellent leadership as President in 2019. I am looking forward to continuing to implement our strategic plan that was developed under his leadership.

This year we welcome David Crotley, Emily Glick and Steve Zbur to the Board of Directors and welcome back Vince Carbone and Tiffani Doerr who were reelected. I would also like to congratulate Tiffani, who was elected President Elect by the board. Many thanks to Valerie Holliday and Rick Wardrop whose terms ended on December 31st along with Jim LaRegina, outgoing Education Chair, for their many years of dedication and service to PCPG.

I invite you now to think back to how you probably collected rocks or "crystals" as a little kid and thought dinosaurs were really cool. Who can forget exploding a volcano as an elementary school project? Many people don't really understand what geologists do. They think we just play with rocks and old dinosaur bones. One of the problems identified in our Strategic Planning workgroup was that the public and general business community have limited awareness of the importance of professional geologic work. People don't seem to think geology is very applicable to today's society. I'd like to challenge that notion, because what geologists do is extremely important to many aspects of people's lives.

Who hasn't driven on a bridge over a stream, ridden in a car filled with gasoline, had a glass of water at a restaurant, typed on a keyboard made of plastic, used a cell phone with a lithium battery, put their garbage on the curb for pick-up, or walked into a building made with steel? Geologists identify weak layers in soil/rock borings for bridge construction, investigate and remediate leaking gasoline tanks at fuel stations, permit safe public drinking water supplies, develop feedstock for the plastics industry, explore for trace minerals used in renewable energy, monitor landfills for gas from our waste, and mine coal used in the coking process to make steel. Geologists are on the front line, making sure that today's necessities from the Earth are properly evaluated, permitted, extracted, managed, monitored, and reclaimed



Continued on Page 5

UPCOMING PCPG EVENTS

February 25, 2020

[PCPG Annual Meeting Program,](#)
[Student Poster Competition, Networking](#)
Harrisburg, PA

May 15, 2020

[The Big Picture: Geologic and Environmental](#)
[Applications of Drones](#)
Cranberry Township, PA

**For a complete list of
upcoming events or to register
online, check our
[HOME PAGE](#) event calendar,
or visit
[PCPG'S COURSES AND EVENTS](#)
web page.**

STRATEGIC OBJECTIVES: PCPG PROGRESS REPORT

By Tiffani Doerr, P.G., Strategic Planning Chair

PCPG has developed a spreadsheet for college students who are unsure which college courses are most applicable to various industries or career paths. The PCPG Pathfinder spreadsheet is a suggested guide for helpful courses based on PCPG members' knowledge and experience. Geologists will often draw on knowledge learned from many different courses depending on the particular site geology. You can find the Pathfinder spreadsheet in the student section of our website.

PCPG is now rolling out our newly developed informational series called, "What Does a Professional Geologist Do?" for various geoscience disciplines. This series includes 1-2 page descriptions of what a PG does during a typical workday and is aimed at students and young professionals to learn what specific activities and responsibilities may be part of our daily jobs in various geoscience disciplines. In our next newsletter you will find the first, "What does a Professional Geologist Do?" segment.

Did you know PCPG does college visits to Geoscience Departments across the state? Upon invitation, PCPG board members will spend about an hour talking to students about the organization, PG licensing requirements and process, talk about our own jobs and experiences, discuss various industries and job sectors for geologists, and much more. We visit high schools, too. If your school has a career fair, why not have a table for Geologists? If you are interested in having a PCPG board member(s) visit your school, or would like to assist with a school presentation, email PCPG Membership Services Chair Vincent Carbone.

We're in the final stages and almost ready to launch our new web site. Enhancements will include new member profile functionality, network opportunities, blog, and later in the year our podcast series (in development).

If you would like to contribute to this series, please let us know. Email ideas to PCPG President [Barb Dunst](#).

STUDENT RESOURCE: CAREER PATHFINDER

PCPG has developed a spreadsheet for college students who are unsure which college courses are most applicable to various industries or career paths. The PATHFINDER spreadsheet is a suggested guide for helpful courses based on PCPG member input and experience. Geologists will often draw on knowledge learned from many different courses depending on the particular site geology. Find the PATHFINDER spreadsheet by visiting the [Colleges and Students](#) web page.

TRENCH RESCUE AND THE DANGERS OF THE SAPROLITE TRANSITION ZONE

Martin F. Helmke, Ph.D., P.G.

Geologists frequently support construction projects utilizing trenching or excavation of soil or rock, sometimes serving as the person in responsible charge of the operation. According to the US Occupational Safety and Health Administration (OSHA, 2020), excavations and trenches are among the most hazardous work environments in the US, causing between 10 and 23 fatalities per year since 2012. Trench collapses are often fatal as a result of blunt-force trauma or asphyxiation by burial. Even if only buried to the waist for an hour, victims may die after extrication due to complications from crush syndrome. For decades, OSHA has required the use of sloping/benching, shoring, or shielding to protect workers in trenches five feet or deeper. Although these forms of mitigation are usually sufficient, geologic conditions such as a shallow water table, fractures, and heaving sands may pose additional challenges beyond the design limits of protective systems.

In June 2019 a worker became trapped in a 14-foot deep trench in Chester County, Pennsylvania. First-arriving emergency personnel noted that the worker was protected by a trench box and was confined to his knees. Moments later, saturated soil flowed up into the trench box, trapping the worker to his waist. A specialized team of trench rescue technicians used panels and pneumatic struts to stabilize the trench walls while removing saturated soil with a vacuum truck (Figure 1). During the operation a subsequent collapse of the north wall, liquefaction, and entrainment occurred before the worker was safely removed from the trench three hours into the incident. Thanks to the existing trench box, efforts of highly-trained personnel with specialized equipment, and excellent care by rescue paramedics, the worker was soon released from the hospital and returned to work two days later.

The combination of soil liquefaction and near-vertical, cohesive slump failure of soil adjacent the trench box indicated that this incident was unusual. The worker confirmed he had never seen this type of soil behavior in his decades of experience. The trench was excavated within fractured saprolite of Mesoproterozoic felsic gneiss and the base of the trench intercepted the saprolite transition zone approximately two feet below the water table. The saprolite transition zone (Landis, 2019) is defined as the boundary between bedrock and saprolite where initial weathering takes place (Figure 2). This zone includes weathered bedrock,

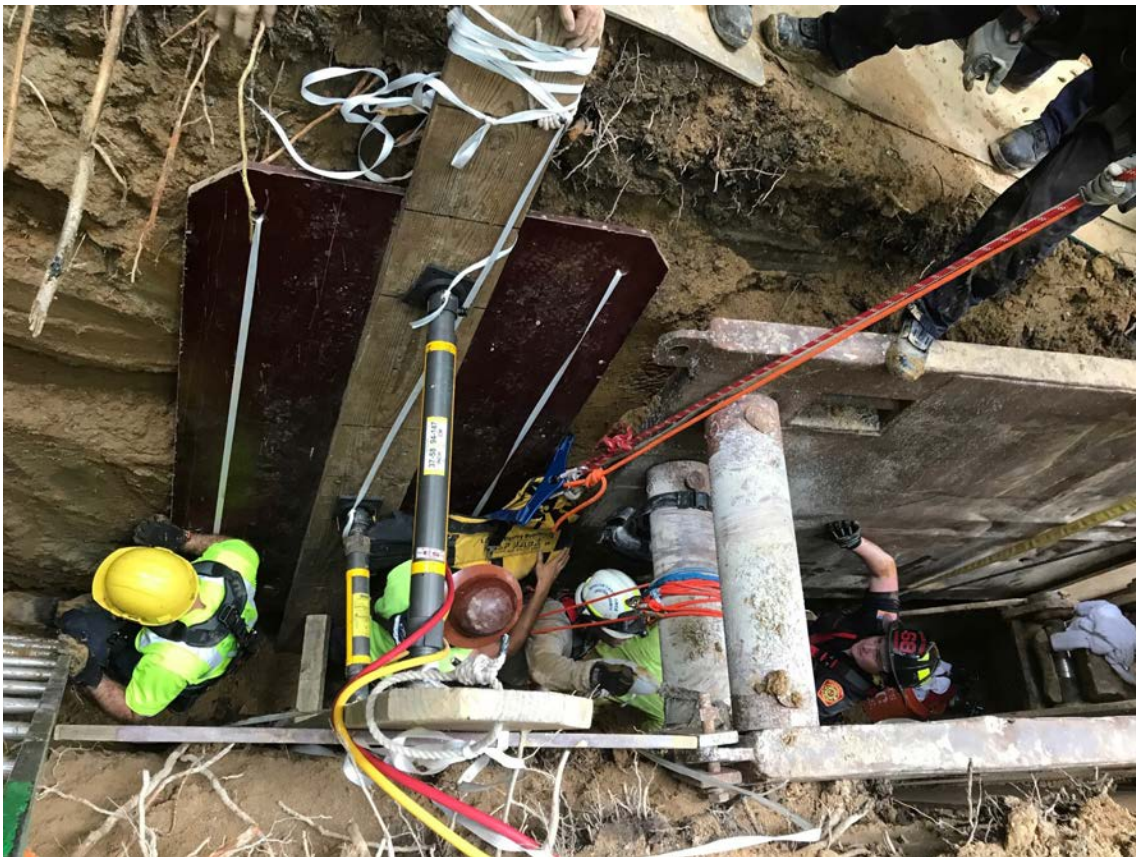


Figure 1. Rescue technicians use pneumatic struts, shoring, and a vacuum truck to stabilize a collapsed trench and extricate a worker in Chester County.

Continued on Page 4

TRENCH *Continued from Page 3*

which is often highly fractured yet intact, overlain by a coarse, angular sand generated from incipient weathering and dissociation of mineral grains. The transition zone is often characterized by increased hydraulic conductivity, partially confined by older and cohesive upper saprolite containing clay generated by hydrolysis. Fractures and foliation of the parent rock persist through the saprolite sequence, further reducing structural stability.

A reconstruction of geologic events suggests that the worker disturbed the angular sands of the saprolite transition zone while digging underneath the trench box. Angular sands are thixotropic, initially stable due to their interlocking grain facets, but behave as a fluid once mobilized under saturated conditions. Hydraulic head, maintained by the permeable transition zone, reduced the effective strength of the sand causing liquefaction and heaving. Once undermined, the cohesive but fractured upper saprolite outside the trench box failed along vertical discontinuities, pushing the liquefied sands into the box where the worker was trapped. Kinematic analysis of fractures in a nearby outcrop (Figure 3) revealed near-vertical conjugate sets of joints (strike 33° , dip 78° ; strike 271° , dip 80°) and foliation (strike 72° , dip 75° ; strike 247° , dip 78°). One joint set was oriented near-parallel to the trench walls (97°), providing a plane of discontinuity for the observed failure.

The properties of the saprolite transition zone, hydrogeologic conditions, and structural relationship between fractures and the excavation face appear to have led to a “perfect storm” for trench collapse last June. If a geologist had been on staff during construction they might have identified these hazards and could have suggested mitigation measures such as dewatering and use of an engineered shoring system. This event also illustrates the role geologists may play during emergency response operations, either as on-call consultants or fully-trained members of a technical rescue team.

Dr. Helmke is a Professor of Hydrogeology at West Chester University, PCPG Past President, and the Trench Manager of the Chester County Rescue Task Force.

References

Allmendinger, R. W. 2017. Stereonet Mobile for iOS v. 3.0. Cornell University. 39 p.

Landis, I. 2019. An Evaluation of Preferential Groundwater Flow through the Saprolite Transition Zone in Southeast Pennsylvania. Master's thesis, Helmke, M. advisor, West Chester University of Pennsylvania. 32 p.

US Occupational Safety and Health Administration. 2020. Fatality Inspection Data, January 2017 to December 2019. <https://www.osha.gov/fatalities>, accessed 2/11/2020.

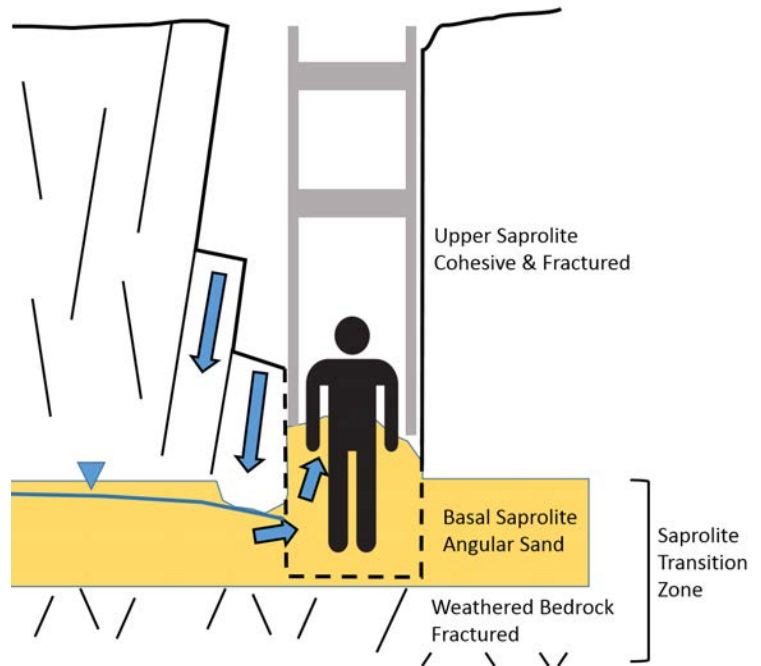


Figure 2. The trench failed by liquefaction of the basal saprolite (angular sand) and vertical slumping of upper saprolite (cohesive, fractured, clay-rich soil) that pushed saturated soil into the trench box, trapping the worker. The basal saprolite was saturated by groundwater within the saprolite transition zone, the boundary where incipient weathering occurs at the soil/bedrock interface.

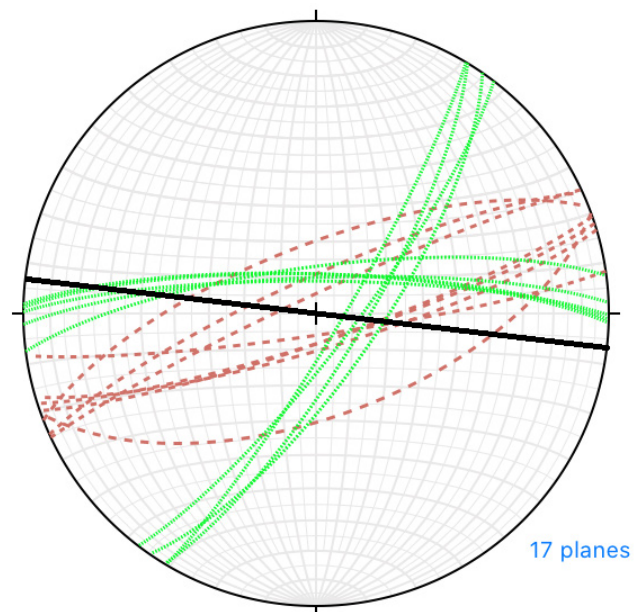


Figure 3. A stereonet projection of the trench cut face (black line), fractures (green lines), and foliation (red dashes) collected in a nearby outcrop of Mesoproterozoic felsic gneiss. One fracture set strikes 271° , nearly parallel to the excavation face at 97° . Planar data were measured and plotted using Stereonet Mobile (Allmendinger, 2017).

PRESIDENT'S MESSAGE *Continued from Page 1*

in the most environmentally safe way to best avoid threats to the environment. Geologists also help clean up past problems, in order to make our world better for next generations. Pennsylvania's licensed PGs are held to high standards, and we take our responsibility to the public very seriously.

I know there are ups and downs in every career, good and bad days to every job and we are often tangled in government regulations, client budgets, business development or even corporate strategy but let's get back to basics: Why did you first love geology?

I first loved knowing the science behind the scenery. As a professional, I understand how that scenery and the processes that created it impact life in today's society; with both benefits and hazards. Now, I enjoy doing outreach to college students, especially for PCPG, because it reminds me of how I felt as a geology student with endless possibilities ahead.

I am truly passionate about geology and I challenge everyone to re-ignite the passion you first found when you became a geology student. Help others understand that geology is far

more than just crystals and dinosaurs. In this sentiment, I have started an initiative titled What Does a Geologist Do? Read more about it in the strategic plan update on page 2 and send me an email if you want to help. I am looking forward to a great year as PCPG president and hope that you will join me to stand up, speak out and show everyone that the professional geologist is very relevant to today's society.

Very truly yours,

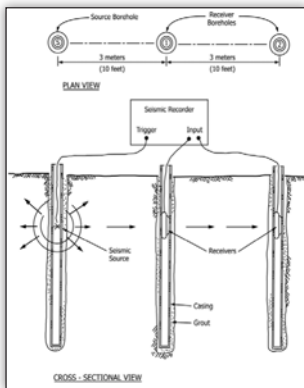


Barbara J. Dunst, P.G., C.P.G.

P.S. I would also enjoy hearing why you fell in love with geology! Please email your story to me. With your permission, we'll publish it in a future newsletter and/or online.



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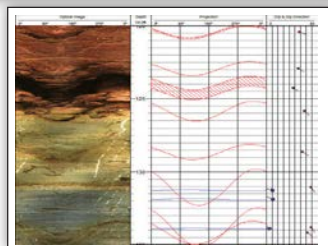


Poisson's Ratio, Shear Modulus, Young's Modulus

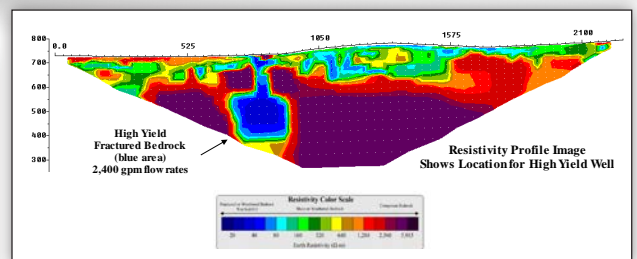
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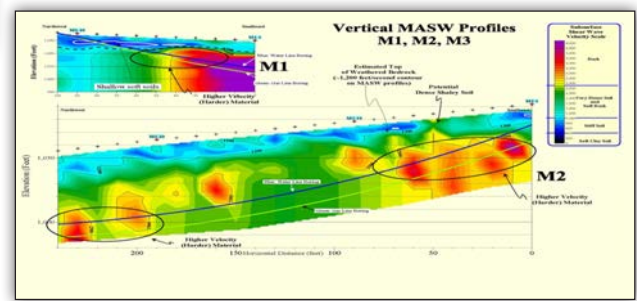
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Borehole Geophysics



Water Supply Development

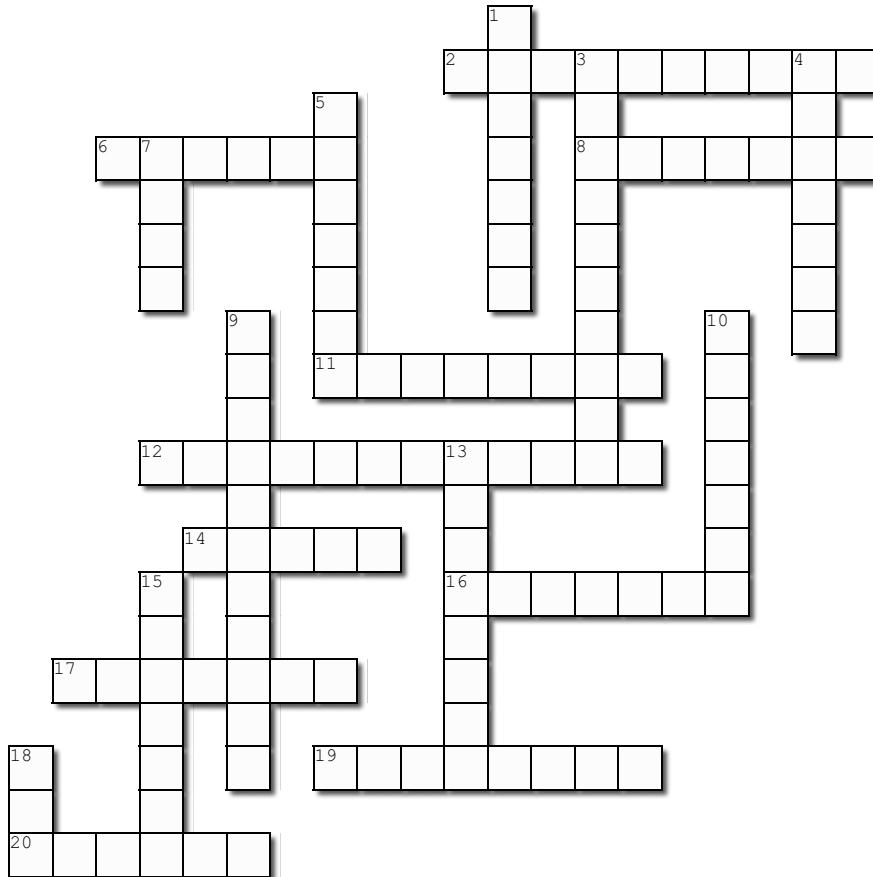


Horizontal Directional Drilling Support

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Trench Safety

Excavating is recognized as one of the most hazardous construction operations. Properly classifying soil in areas to be excavated is extremely important to the safety of workers both inside and around trenched areas. The following information was obtained from OSHA's recently revised Subpart P, Excavations, of 29 CFR 1926.650, 29 CFR 1926.651, and 29 CFR 1926.652.



Created using the Crossword Maker on TheTeachersCorner.net

Horizontal

2. You can test this quality of soils by molding a moist sample into a ball and attempting to roll it into a thin thread.
6. _____ rock is natural solid mineral matter that can be excavated with vertical sides and remain intact when exposed.
8. An unsupported excavation can create unbalanced stress in the soil, causing _____ of the vertical face of the trench. .
11. Tension cracks may also cause _____, which occurs when the vertical face shears along the crack and falls into the excavation.
12. Direct reading, spring-operated instrument used to determine the unconfined compressive strength of saturated cohesive soils.
14. Soils that are cohesive and have unconfined compressive strength of 1.5 tons/ft² or greater. Often clay or silty/sandy clay.
16. Requires installing supports to prevent soil movement and cave-ins.
17. _____ or sluffing, may occur as a result of tension cracks.
19. Soils are considered _____ if a sample that has been hand-rolled into a thread does not break or tear.
20. _____ concentration must be between 19.5% and 23.5% to safely enter an excavation (or other confined space).

Vertical

1. Cutting back the trench wall at an angle inclined away from the excavation.
3. An unsupported excavation can create unbalanced stress in the soil, causing _____ at the surface.
4. _____ cracks usually form at a horizontal distance of 0.5-0.75 times the depth of the trench.
5. Where layered geologic structure exists, soil must be classified on the basis of the classification of the _____ layer.
7. Soil _____ dictates the maximum allowable sidewall slope for excavations less than 20 feet deep when benching or sloping.
9. Required maximum distance in feet to any access/egress device when inside an excavation, include the dash.
10. Bottom _____ is caused by the downward pressure of adjoining soil, creating a bulge in the bottom of the excavation.
13. Increases or decreases in _____ content can adversely affect the stability of a trench or excavation.
15. The upward flow of water into the bottom of a trench. Can occur even when shoring or trench boxes are used.
18. Minimum distance that spoils may be placed from the edge of an excavation.

Answer Key on Page 7

DEADLINE FOR OUR NEXT NEWSLETTER IS APRIL 30, 2020

For more information, contact our PCPG Newsletter Editor and Communications Committee Co-Chair - Tiffani Doerr, P.G., by [eMail](mailto:tdoerr@pcpg.org) or telephone at 302-477-1305.

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Elk Environmental
Contact: Jestyn Newswanger
Phone: (610) 372-4760

Crossword Puzzle Answer Key:

Horizontal	Vertical
2. Plasticity	1. Sloping
6. Stable	3. Subsidence
8. Bulging	4. Tension
11. Toppling	5. Weakest
12. Penetrometer	7. Type
14. TypeA	9. Twenty-five
16. Shoring	10. Heaving
17. Sliding	13. Moisture
19. Cohesive	15. Boiling
20. Oxygen	18. Two



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