



WALDEN MEDIA

JULY 11, 2008
VOLUME 1
ISSUE 1

SEVING THE GEOSCIENCES
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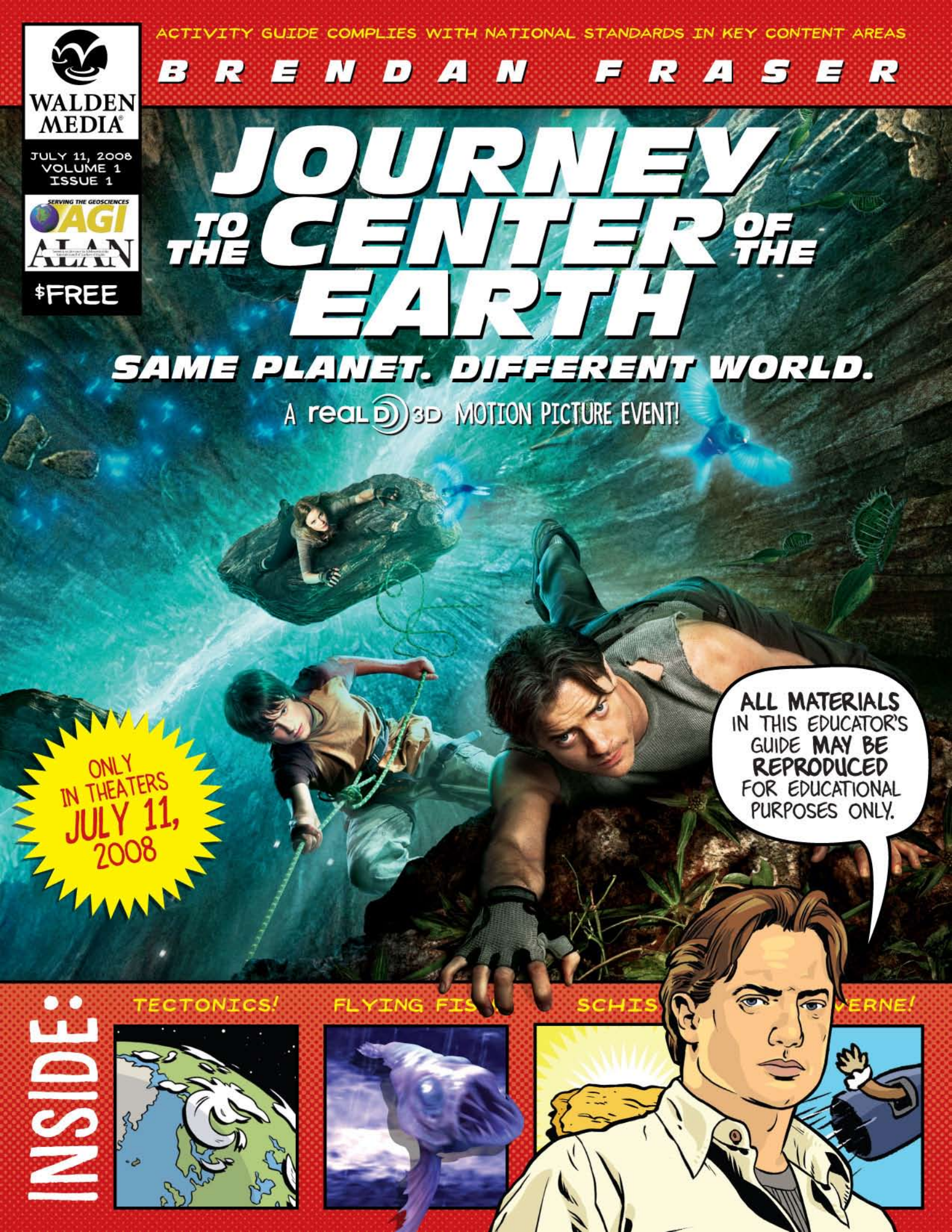
ACTIVITY GUIDE COMPLIES WITH NATIONAL STANDARDS IN KEY CONTENT AREAS

BRENDAN FRASER

JOURNEY TO THE CENTER OF THE EARTH

SAME PLANET. DIFFERENT WORLD.

A real  3D MOTION PICTURE EVENT!



ONLY
IN THEATERS
JULY 11,
2008

ALL MATERIALS
IN THIS EDUCATOR'S
GUIDE MAY BE
REPRODUCED
FOR EDUCATIONAL
PURPOSES ONLY.

INSIDE:

TECTONICS!



FLYING FISH!



SCHIS



VERNE!



A MESSAGE FROM WALDEN MEDIA

WALDEN MEDIA'S *JOURNEY TO THE CENTER OF THE EARTH* IS A HEART-STOPPING ADVENTURE, BRINGING TO REALITY WHAT JULES VERNE HIMSELF ONLY DREAMT ABOUT: MOVING PICTURES THAT LEAP OFF THE SCREEN AND HEAD STRAIGHT INTO THE AUDIENCE. IT IS A WILDLY IMAGINATIVE PRODUCTION MADE ALL THE MORE SO BY STATE-OF-THE-ART OPTICS THAT WILL LEAVE AUDIENCES DELIGHTED, AND RUNNING FOR COVER! WE HAVE TAKEN VERNE'S ORIGINAL PREMISE AND TURNED IT ON ITS HEAD. IN THE FILM, JULES VERNE'S NOVEL IS ITSELF A CHARACTER. WHAT IF, OUR FILM ASKS, VERNE'S BOOK WAS ACTUALLY A ROAD MAP FOR DISCOVERY AND EXPLORATION? OUR FILM BEGINS WHERE VERNE'S BOOK ENDS.

TO "DIG DEEPER" AND ENSURE THAT *JOURNEY* IS A MEANINGFUL AND IMAGINATIVE TEACHING RESOURCE, WE HAVE PARTNERED WITH THE *AMERICAN GEOLOGICAL INSTITUTE* (AGI), TAPPING THEIR EDUCATIONAL EXPERTISE AND THEIR UNDERSTANDING OF WHAT LIES DEEP BENEATH EARTH'S SURFACE. WITH AGI, WE HAVE CREATED LESSONS THAT WILL HELP PREPARE YOUR STUDENTS FOR THE FILM, EXAMINING ITS SCIENCE FACT AND FICTION TO DEEPEN THEIR APPRECIATION FOR THE IMPORTANCE OF EARTH SCIENCE. EVERYTHING WE DO EACH DAY IS CONNECTED IN SOME WAY TO PLANET EARTH: TO ITS LAND, OCEANS, ATMOSPHERE, PLANTS, ANIMALS, AND OTHER LIVING THINGS. BY 2025, EIGHT BILLION PEOPLE WILL BE LIVING ON EARTH. IF WE ARE TO CONTINUE EXTRACTING RESOURCES TO MAINTAIN A HIGH QUALITY OF LIFE, THEN WE, AS INDIVIDUALS AND CITIZENS, NEED TO KNOW MORE ABOUT OUR PLANET — ITS PROCESSES, ITS RESOURCES, AND ITS ENVIRONMENT. WE HOPE THAT OUR FILM *JOURNEY* ENCOURAGES STUDENTS TO RESPECT THIS PLANET WE ARE PRIVILEGED TO CALL HOME, AND, IN THE SPIRIT OF JULES VERNE, TO WONDER ABOUT EARTH'S IMAGINATIVE POSSIBILITIES.

ABOUT THE MOVIE

AN EXCITING ADVENTURE BASED ON THE CLASSIC JULES VERNE NOVEL, *JOURNEY TO THE CENTER OF THE EARTH* STARS BRENDAN FRASER (*CRASH, THE MUMMY*) AS A SCIENCE PROFESSOR WHOSE UNTRADITIONAL HYPOTHESES HAVE MADE HIM THE LAUGHING STOCK OF THE ACADEMIC COMMUNITY. BUT ON AN EXPEDITION TO ICELAND, HE AND HIS NEPHEW STUMBLE UPON A MAJOR DISCOVERY THAT LAUNCHES THEM ON A THRILLING JOURNEY DEEP BENEATH EARTH'S SURFACE, WHERE THEY TRAVEL THROUGH NEVER-BEFORE-SEEN WORLDS AND ENCOUNTER A VARIETY OF UNUSUAL CREATURES. *JOURNEY TO THE CENTER OF THE EARTH* IS DIRECTED BY ACADEMY AWARD®-WINNING VISUAL EFFECTS VETERAN ERIC BREVIG (*TOTAL RECALL, PEARL HARBOR*) FROM A SCREENPLAY BY MICHAEL WEISS AND JENNIFER FLACKETT & MARK LEVIN. THE FILM IS SCHEDULED FOR RELEASE JULY 11, 2008.

ABOUT THE BOOK

JULES VERNE'S CLASSIC NOVEL *A JOURNEY TO THE CENTER OF THE EARTH* TELLS THE STORY OF A PROFESSOR WHO LEADS HIS NEPHEW AND A HIRED GUIDE DOWN A VOLCANO IN ICELAND TO THE "CENTER OF THE EARTH." ALONG THE WAY THEY ENCOUNTER MANY ADVENTURES, INCLUDING PREHISTORIC ANIMALS AND NATURAL HAZARDS, EVENTUALLY COMING TO THE SURFACE AGAIN IN SOUTHERN ITALY. THOUGH VERNE'S NOVEL WAS FIRST PUBLISHED IN 1864, ITS HOLD ON THE IMAGINATION IS TIMELESS.

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REVIEWERS

DR. ANN E. BENBOW, DIRECTOR OF EDUCATION AND OUTREACH, AMERICAN GEOLOGICAL INSTITUTE

GEOFF CAMPHIRE, MANAGER, OUTREACH PROGRAMS AMERICAN GEOLOGICAL INSTITUTE

DR. EDWARD ROBECK, SALISBURY UNIVERSITY

ACKNOWLEDGEMENTS

WE ARE GRATEFUL TO THE AMERICAN GEOLOGICAL INSTITUTE, UNIVERSAL MILLENNIUM, AND BIG TIME ATTIC FOR THEIR INVALUABLE ASSISTANCE WITH THE CREATION OF THIS GUIDE. WE THANK PROFESSOR JOAN KAYWELL, UNIVERSITY OF SOUTH FLORIDA; PRESIDENT, FLORIDA COUNCIL OF TEACHERS OF ENGLISH, ALAN MEMBERSHIP SECRETARY, FOR HER ASSISTANCE WITH THE *JOURNEY* READING LIST.

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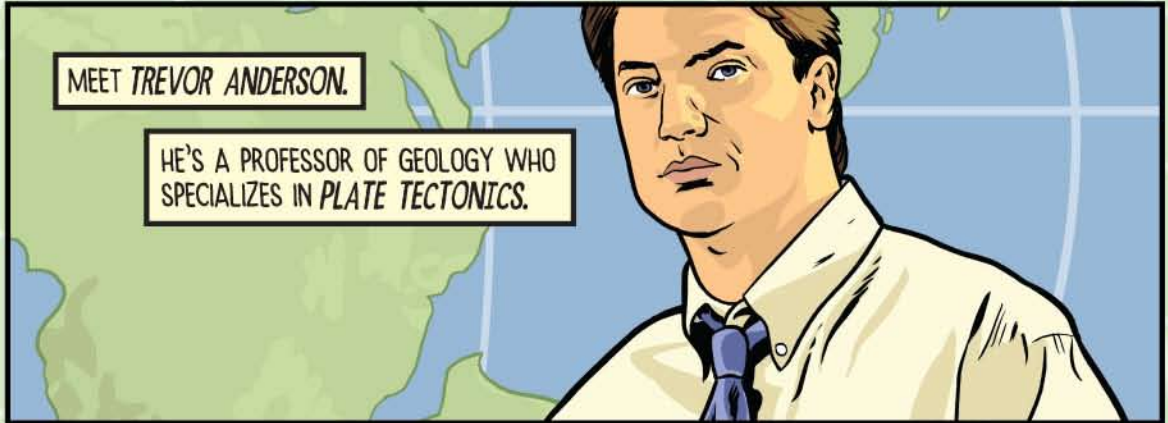
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ACTIVITY 1: MEET TREVOR ANDERSON, PROFESSOR OF — WHAT?!

MEET TREVOR ANDERSON, THE MAIN CHARACTER OF JOURNEY TO THE CENTER OF THE EARTH, AND LEARN ABOUT THE SCIENCE BEHIND HIS WORK.



MEET TREVOR ANDERSON.

HE'S A PROFESSOR OF GEOLOGY WHO SPECIALIZES IN *PLATE TECTONICS*.

HE WORKS AT A UNIVERSITY IN THE *MAXWELL ANDERSON CENTER FOR THE STUDY OF PLATE TECTONICS*. MAXWELL IS TREVOR'S BROTHER. HE DISAPPEARED MYSTERIOUSLY TEN YEARS AGO.



THIS IS WHERE *JOURNEY* BEGINS. BUT FIRST, A WORD NOW ABOUT STUDYING... "PLATES"
HUH?

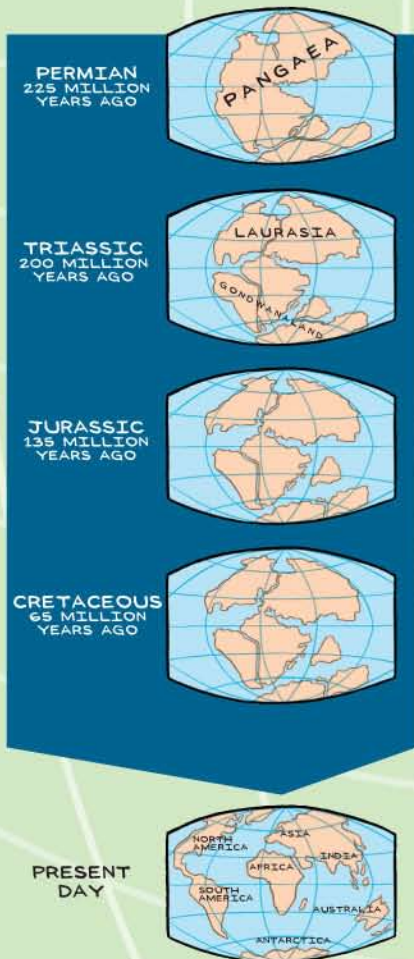
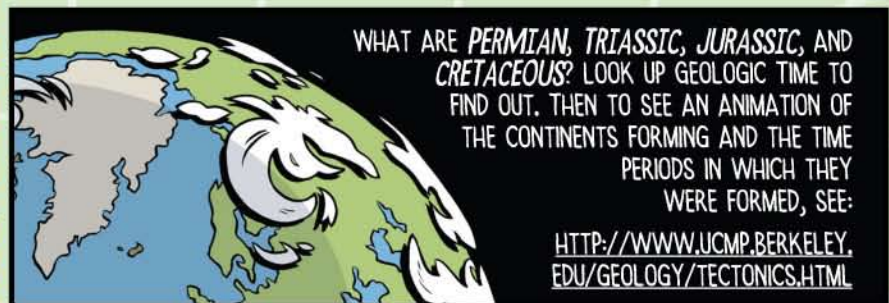


PLATE TECTONICS IS A *THEORY* ABOUT EARTH'S OUTERMOST LAYER, OR *CRUST*. THIS THEORY STATES THAT THE CRUST, WHICH IS MADE OF SOLID ROCK, IS BROKEN INTO FIFTEEN OR MORE LARGE AND SMALL "PLATES" THAT MOVE IN RELATION TO ONE ANOTHER AS THEY RIDE ON TOP OF ROCK MATERIAL THAT IS HOTTER, SOFTER, AND MORE MOVABLE THAN THE PLATES THEMSELVES. FORCES IN THE SOFTER ROCK BELOW THE CRUST MOVE THE PLATES IN DIFFERENT DIRECTIONS. THE MOVING PLATES CAUSE HUGE GEOLOGICAL CHANGES, INCLUDING EARTHQUAKES, MOUNTAIN BUILDING, AND VOLCANIC ACTIVITY.

THE EARTH DIDN'T ALWAYS LOOK LIKE IT DOES TODAY. AT ONE TIME, THE CONTINENTS WERE JOINED INTO ONE SUPERCONTINENT THAT HAS BEEN NAMED *PANGAEA*. BETWEEN 225 AND 200 MILLION YEARS AGO, PANGAEA BROKE UP INTO SEVERAL SMALLER PLATES THAT TOGETHER CARRY ALL THE LAND AND OCEANS OF EARTH. THROUGH THE MOVEMENT OF THE PLATES OVER TIME, THE CONTINENTS HAVE MOVED AND BEEN SHAPED INTO THE FORMS AS WE KNOW THEM TODAY. [SEE ILLUSTRATION]

THE THEORY OF PLATE TECTONICS HAS PROVIDED EXPLANATIONS TO QUESTIONS THAT SCIENTISTS HAVE WONDERED ABOUT FOR CENTURIES, SUCH AS WHY EARTHQUAKES AND VOLCANIC ERUPTIONS OCCUR IN VERY SPECIFIC AREAS AROUND THE WORLD, AND HOW AND WHY GREAT MOUNTAIN RANGES LIKE THE ALPS AND THE HIMALAYAS FORM.

DIG DEEPER



WHAT ARE *PERMIAN*, *TRIASSIC*, *JURASSIC*, AND *CRETACEOUS*? LOOK UP GEOLOGIC TIME TO FIND OUT. THEN TO SEE AN ANIMATION OF THE CONTINENTS FORMING AND THE TIME PERIODS IN WHICH THEY WERE FORMED, SEE:

[HTTP://WWW.UCMP.BERKELEY.EDU/GEOLOGY/TECTONICS.HTML](http://www.ucmp.berkeley.edu/geology/TECTONICS.HTML)

Illustration of the breakup of Pangaea is from: <http://www.rain.org/campinternet/southwest/index-intro-southwest-2.html>

Text adapted from: *Plate Tectonics, the Way the Earth Works* by Kevin Cuff with Ian Carmichael and Carolyn Willard, Berkeley, CA: Lawrence Hall of Science, University of California, 2002.

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ACTIVITY 2: JULES VERNE'S SCIENCE FACT AND FICTION

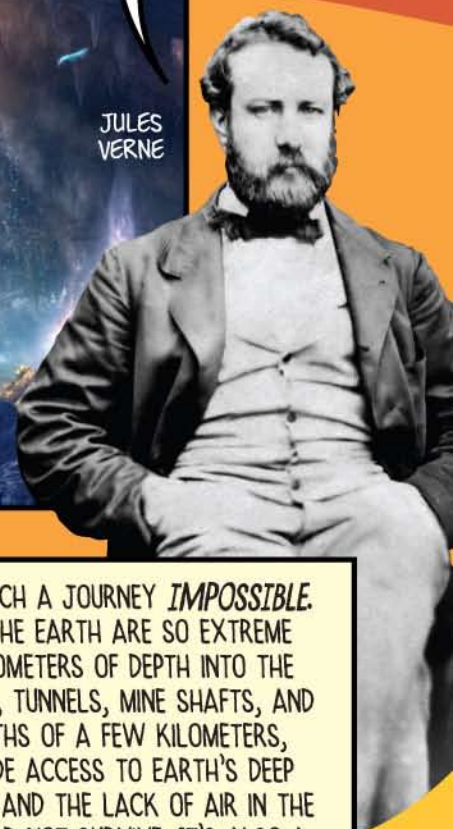
READ ABOUT THE SCIENCE FACT AND SCIENCE FICTION CONTAINED IN JULES VERNE'S STORY, A JOURNEY TO THE CENTER OF THE EARTH.

IN THE TIME WHEN JULES VERNE LIVED, THERE WAS MUCH SCIENTIFIC AND POPULAR INTEREST IN WHAT WAS INSIDE OF THE EARTH. THE DETAILS OF EARTH'S INTERIOR HAD NOT YET BEEN DISCOVERED. ALTHOUGH VOLCANIC ERUPTIONS SHOWED THAT AT LEAST PART OF EARTH'S INTERIOR WAS HOT ENOUGH TO MELT ROCKS, TEMPERATURES WITHIN THE EARTH AND THE EXISTENCE OF RADIOACTIVITY WERE UNKNOWN. VERNE'S BOOK, *A JOURNEY TO THE CENTER OF THE EARTH* (1864, ORIGINALLY PUBLISHED IN FRANCE AS *VOYAGE AU CENTRE DE LA TERRE*), BUILT ON THIS INTEREST IN THE STRUCTURE OF EARTH WITH AN EXCITING SCIENCE FICTION STORY THAT IS STILL POPULAR TODAY. VERNE'S STORY INTRODUCED US TO A DEDICATED AND QUIRKY PROFESSOR AND HIS NEPHEW, WHO TRAVEL TOGETHER INTO THE EARTH'S DEEP INTERIOR BY ENTERING INTO AN OPENING IN ICELAND.



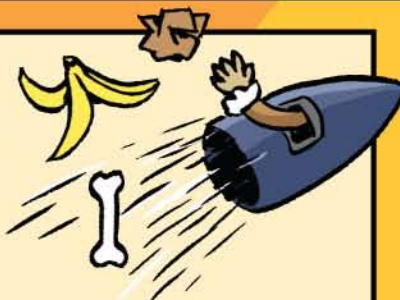
JULES VERNE

"ANYTHING ONE PERSON CAN IMAGINE, OTHER PEOPLE CAN MAKE REAL."



TODAY, THE CURRENT LIMITS OF TECHNOLOGY MAKE SUCH A JOURNEY *IMPOSSIBLE*. THE TEMPERATURE AND PRESSURE CONDITIONS WITHIN THE EARTH ARE SO EXTREME THAT HUMANS COULD NOT SURVIVE BELOW A FEW KILOMETERS OF DEPTH INTO THE 6371 KM RADIUS EARTH. EXCEPT FOR NATURAL CAVES, TUNNELS, MINE SHAFTS, AND DRILL HOLES THAT EXTEND FROM THE SURFACE TO DEPTHS OF A FEW KILOMETERS, WE KNOW OF NO LARGE OPENINGS THAT COULD PROVIDE ACCESS TO EARTH'S DEEP INTERIOR. THE VERY HIGH TEMPERATURE AND PRESSURE AND THE LACK OF AIR IN THE DEEP EARTH CREATE CONDITIONS IN WHICH PEOPLE COULD NOT SURVIVE. IT'S ALSO A *LONG JOURNEY* – 6371 KILOMETERS (APPROXIMATELY 3,950 MILES) TO THE EARTH'S CENTER. IF A PERSON WERE ABLE TO WALK DIRECTLY TO THE EARTH'S CENTER, IT WOULD TAKE ABOUT 53 DAYS (AT 5 KM/HR, APPROXIMATELY 3.1 MILES PER HOUR, 24 HOURS PER DAY) OF WALKING. AND THEN THERE WOULD BE THE WALK BACK!

VERNE'S WRITING APPLIED NEW DISCOVERIES AND IDEAS FROM HIS TIME TO NEW STORIES AND SETTINGS. FOR EXAMPLE, UNDERSEA VESSELS HAD BEEN UNSUCCESSFULLY ATTEMPTED WHEN VERNE WROTE *TWENTY THOUSAND LEAGUES UNDER THE SEA* IN 1869. SOME THINGS VERNE GOT ALL WRONG. HIS MOON-ROCKET IS A GIANT SHELL SHOT FROM A GUN. THE ROCKET'S INTERIOR HAS FANCY STUFFED ARMCHAIRS AND CUPBOARDS. VERNE'S 1860S ASTRONAUTS EVEN OPEN THE WINDOWS OF THEIR SPACE VEHICLE TO THROW OUT THE GARBAGE AND ADMIRE THE VIEW! YET IN ALL OF VERNE'S WRITING, HE TRIED TO BRIDGE THE DISTANCE BETWEEN FACT AND FICTION USING THE TOOLS OF IMAGINATION.



DIG DEEPER

TAKE A SHORT, INTERACTIVE QUIZ ABOUT SPACE TRAVEL AND LIFE ON OTHER PLANETS!

SEE: [HTTP://PLANETQUEST.JPL.NASA.GOV/GALLERY/PQUIZ.HTML](http://planetquest.jpl.nasa.gov/gallery/pquiz.html).

Text adapted from: "Journey to the Center of the Earth" by Lawrence W. Braille and Sheryl J. Braille: <http://web.ics.purdue.edu/~braille/cduomod/journey/journey.htm>

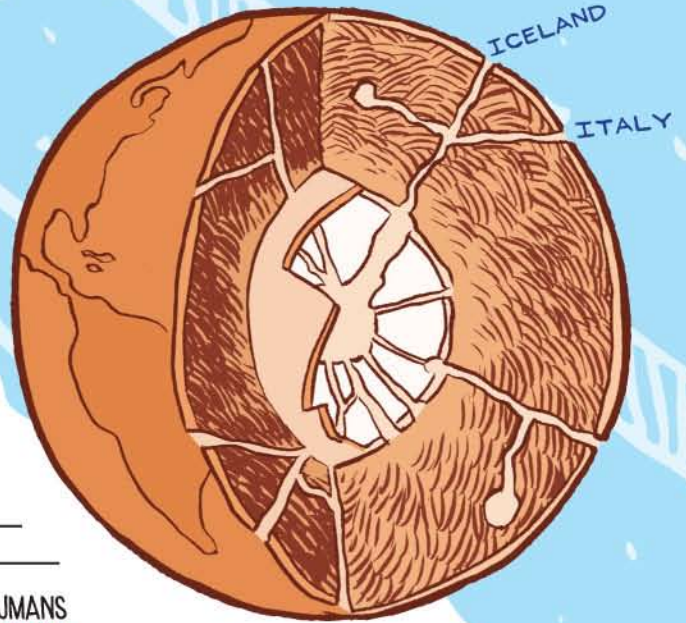
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ACTIVITY 2: JULES VERNE'S SCIENCE FACT AND FICTION

NAME _____

DATE _____

NOW THAT YOU'VE LEARNED ABOUT JULES VERNE'S "SCIENCE FACT AND FICTION," DECIDE WHETHER EACH OF THE STATEMENTS BELOW IS FACT OR FICTION. CIRCLE THE WORD *FACT* OR *FICTION* AFTER EACH STATEMENT. THEN FIND THE STATEMENT(S) FROM THE READING THAT SUPPORT(S) YOUR ANSWER AND WRITE IT/THEM ON THE LINES PROVIDED.



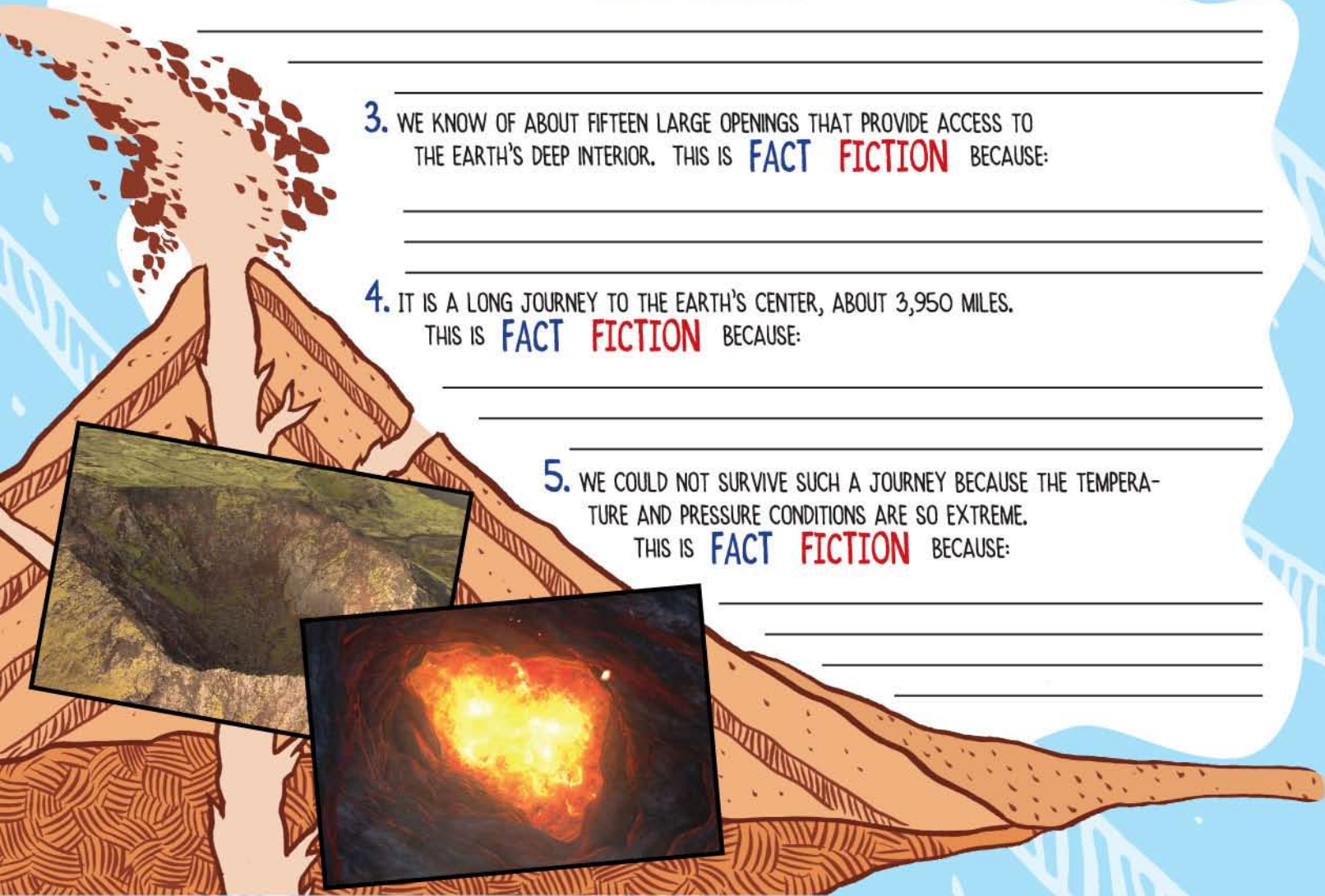
1. IN JULES VERNE'S TIME THERE WAS LITTLE INTEREST IN WHAT WAS INSIDE THE EARTH. THIS IS **FACT** **FICTION** BECAUSE:

2. A JOURNEY TO THE CENTER OF THE EARTH TODAY IS VERY POSSIBLE. HUMANS COULD SURVIVE WELL BELOW A FEW KILOMETERS. THIS IS **FACT** **FICTION** BECAUSE:

3. WE KNOW OF ABOUT FIFTEEN LARGE OPENINGS THAT PROVIDE ACCESS TO THE EARTH'S DEEP INTERIOR. THIS IS **FACT** **FICTION** BECAUSE:

4. IT IS A LONG JOURNEY TO THE EARTH'S CENTER, ABOUT 3,950 MILES. THIS IS **FACT** **FICTION** BECAUSE:

5. WE COULD NOT SURVIVE SUCH A JOURNEY BECAUSE THE TEMPERATURE AND PRESSURE CONDITIONS ARE SO EXTREME. THIS IS **FACT** **FICTION** BECAUSE:



ACTIVITY 3: CREATE YOUR OWN (EARTH) SCIENCE FICTION COMIC BOOK

JULES VERNE MADE USE OF WHAT WAS KNOWN ABOUT EARTH SCIENCE DURING HIS TIME TO WRITE **JOURNEY TO THE CENTER OF THE EARTH**. NOW IT'S YOUR TURN.

USE ANY OR ALL OF THESE EARTH SCIENCE FACTS TO CREATE YOUR OWN SCIENCE FICTION COMIC BOOK. YOU CAN ALSO RESEARCH YOUR OWN EARTH SCIENCE FACTS! PHOTOCOPY THIS PAGE TO CREATE YOUR (EARTH) SCIENCE FICTION COMIC BOOK.

NAME _____

DATE _____

Deepest Place in the Ocean

Challenger Deep, which is in the Marianas Trench located off the Marianas Islands in the South Pacific. It is 35,838 ft. or 10,923 meters straight down. It takes almost 5 hours to free-fall through the water all the way to the very bottom.

Lowest Elevation in the World

The Dead Sea is located in the Middle East, between Jordan and Israel. The surface of the Dead Sea is over 1,300 feet (396 meters) below sea level. The very bottom of the sea, in the deepest part, is over 2,300 feet (701 meters) below sea level. The Dead Sea has some of the saltiest water on earth. The water's salinity can be as much as 35%.

Hottest Place on Earth

El Azizia is located on the northern part of the African continent. On September 13, 1922 the thermometer reached a blistering 136° F/57.8° C.

Greatest Volcanic Eruption on Earth

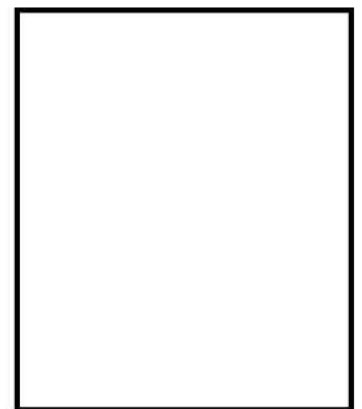
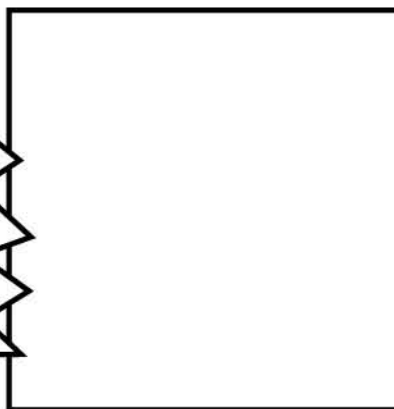
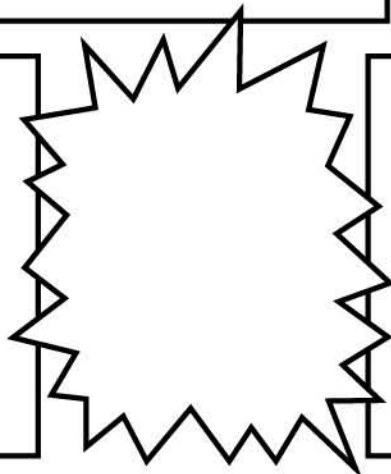
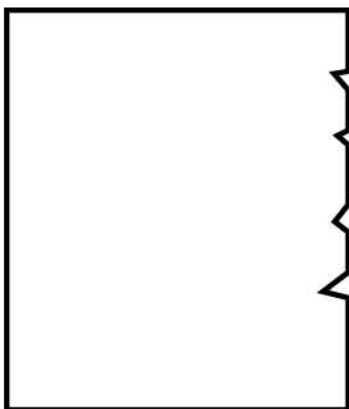
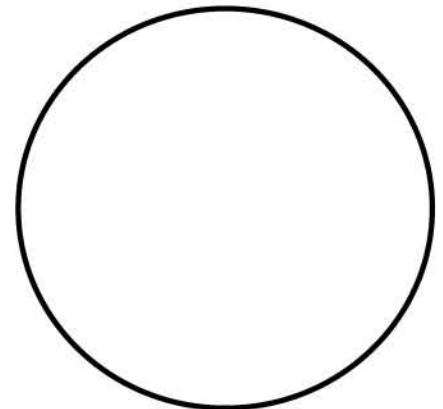
Yellowstone Volcano's first eruption of 2.1 million years ago was 2,500 times more powerful than the Mt. St. Helens eruption and perhaps was the largest, most violent volcanic eruption in the history of Earth. Enough ash and volcanic debris exploded from the eruptions of Yellowstone Volcano to cover the entire western half of the United States with a layer that would be about four feet deep.

Deepest Cave in the World

In the western Caucasus Mountains of the Georgian Republic, there is a cave, named Voronja or "Crow's Cave," that has officially been verified to be 7,021 feet (2,140 m) deep.

To find more extreme facts, go to where we journeyed to find these: <http://www.extremescience.com/earthsciport.htm>

USE THE PANELS BELOW TO CREATE YOUR COMIC!



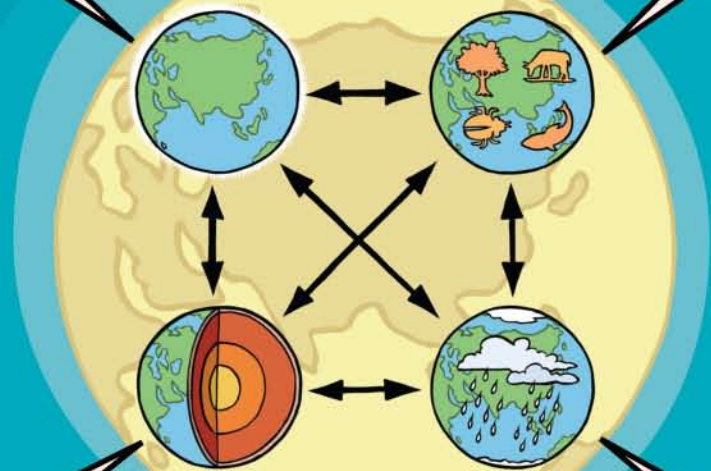
ACTIVITY 4: DISCOVER THE EARTH SYSTEM

DISCOVER SOME OF THE BASIC EARTH SCIENCE AT THE VERY "CENTER" OF JOURNEY. IT WILL TAKE YOU INTO THE HEART OF MOVIE CHARACTER TREVOR ANDERSON'S STUDIES AND HIS AMAZING ADVENTURES.

THE EARTH SYSTEM IS MADE UP OF A SET OF MORE LIMITED, CLOSELY LINKED SYSTEMS THAT WORK TOGETHER IN MAKING THE WORLD WE KNOW. EARTH'S PROCESSES ARE POWERED BY TWO SOURCES: THE **SUN** AND EARTH'S OWN **INNER HEAT**. FOUR OF THESE IMPORTANT SYSTEMS ARE:

THE ATMOSPHERE
THIS PART OF THE EARTH SYSTEM IS MADE OF THE MIXTURE OF GASES THAT SURROUND THE PLANET.

THE BIOSPHERE
THIS PART OF THE EARTH SYSTEM IS MADE OF ALL LIVING THINGS, INCLUDING PLANTS, ANIMALS, AND OTHER ORGANISMS.



THE GEOSPHERE
THIS PART OF THE EARTH SYSTEM IS MADE OF THE CRUST, MANTLE, AND INNER AND OUTER CORE. THIS IS ALL ROCK MATERIAL, EITHER SOLID OR MOLTEN.

THE HYDROSPHERE
THIS PART OF THE EARTH SYSTEM IS THE PLANET'S WATER, INCLUDING OCEANS, LAKES, RIVERS, GROUND WATER, ICE, AND WATER VAPOR.

CHANGE IN ANY ONE OF THE EARTH SYSTEMS AFFECTS THE OTHERS. THIS IS WHY WE THINK OF EARTH AS MADE OF SEVERAL INTERRELATED SYSTEMS. WE DEPEND ON EARTH'S RESOURCES; RESOURCES THAT ARE BOTH MINED AND GROWN. KNOWING ABOUT THE DYNAMIC EARTH WILL HELP YOU TO UNDERSTAND THE PAST AND PREPARE YOU FOR THE FUTURE.

THESE SYSTEMS, AND OTHERS, HAVE BEEN WORKING TOGETHER SINCE EARTH'S BEGINNINGS, MORE THAN 4.5 BILLION YEARS AGO. THEY ARE STILL WORKING BECAUSE THE GEOLOGY OF THE EARTH IS *DYNAMIC*, WHICH MEANS "POWERFUL, OR ACTIVE." EVEN THOUGH WE CANNOT ALWAYS OBSERVE CHANGES IN THE EARTH SYSTEMS, THERE ARE MANY CHANGES TAKING PLACE ALL THE TIME. EVERY FEATURE OF OUR PLANET CHANGES, ON TIME SCALES THAT RANGE FROM MINUTES TO MILLIONS OF YEARS. THE DEEPEST OCEANS AND THE HIGHEST MOUNTAINS AS WE SEE THEM NOW ALL REPRESENT BUT A SINGLE PAGE IN THE BOOK THAT IS EARTH'S HISTORY. MOUNTAINS HAVE BEEN DESTROYED, RECYCLED, AND REBORN. OCEANS HAVE RISEN AND FALLEN. THESE PROCESSES ARE AT WORK TODAY, EVEN THOUGH THEY ARE, FOR THE MOST PART, HAPPENING TOO SLOWLY FOR US TO RECOGNIZE THEM IN ACTION. KNOWLEDGE ABOUT PRESENT-DAY VOLCANIC ERUPTIONS AND EARTHQUAKES GIVE CLUES ABOUT THE PAST. ROCKS, LANDFORMS, AND FOSSILS ALSO PROVIDE EVIDENCE OF EARTH'S LONG AND COMPLICATED HISTORY.

DIG DEEPER

GEOLOGY IS A WAY OF STUDYING THE EARTH AND READING ITS STORY. THE STUDY OF PLANET EARTH INVOLVES INVESTIGATING THE MATERIALS OF WHICH IT IS MADE, THE PROCESSES THAT ACT ON THOSE MATERIALS, THE PRODUCTS FORMED BY THOSE PROCESSES, AND THE HISTORY OF THE PLANET AND ALL ITS LIFE FORMS SINCE IT BEGAN. THE CHANGES ON EARTH OVER TIME HAVE LEFT A RECORD OF ITS HISTORY IN THE ROCKS AROUND US. GEOSCIENTISTS STUDY THIS RECORD AND ANALYZE IT TO UNDERSTAND WHAT IT MEANS FOR THE EARTH TODAY.

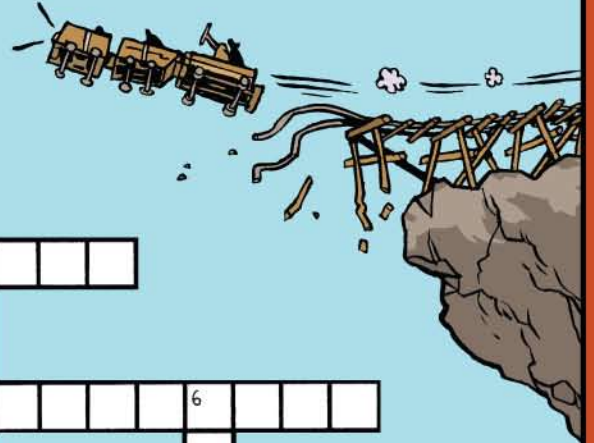
ACTIVITY 4: DISCOVER THE EARTH SYSTEM CROSSWORD

COMPLETE THE CROSSWORD PUZZLE. THE WORDS YOU'LL NEED ARE LISTED. YOU MAY ALSO WANT TO USE A DICTIONARY TO HELP YOU.

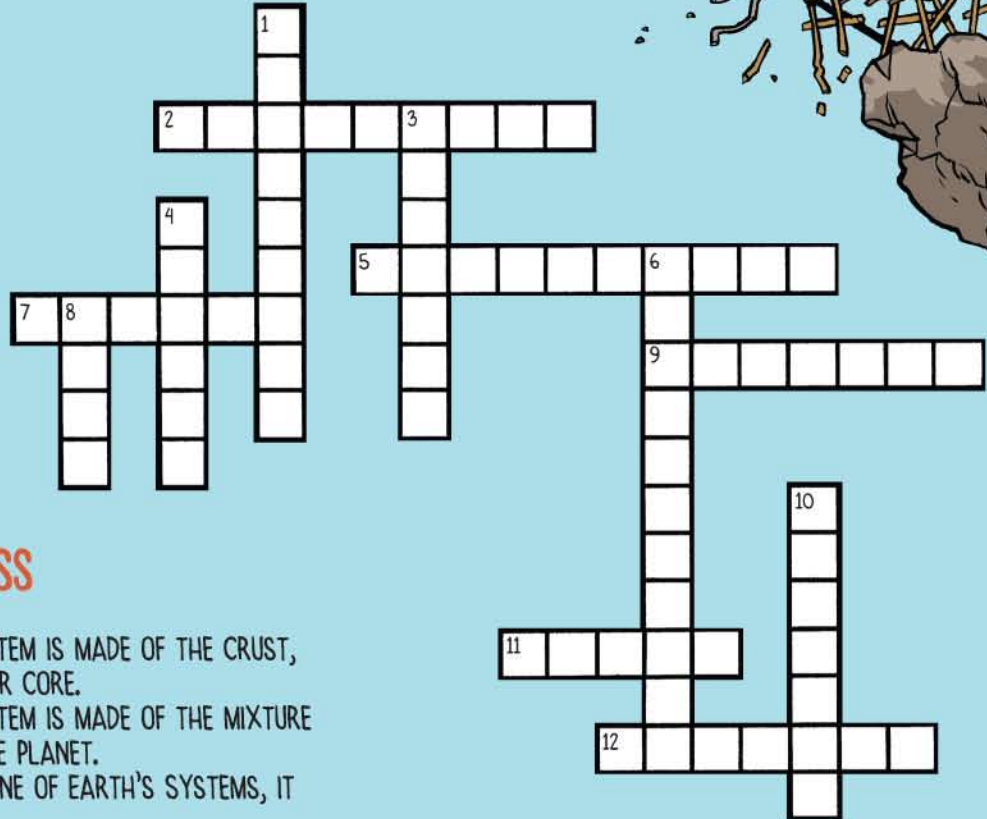
EARTH SCIENCE WORDS

NAME _____

DATE _____



- GEOLOGY
- ATMOSPHERE
- HEAT
- CHANGE
- HYDROSPHERE
- BIOSPHERE
- MINED
- GEOSPHERE
- BILLION
- HISTORY
- DYNAMIC
- MANTLE



ACROSS

- 2 THIS PART OF THE EARTH SYSTEM IS MADE OF THE CRUST, MANTLE, AND INNER AND OUTER CORE.
- 5 THIS PART OF THE EARTH SYSTEM IS MADE OF THE MIXTURE OF GASES THAT SURROUND THE PLANET.
- 7 WHEN THIS HAPPENS IN ANY ONE OF EARTH'S SYSTEMS, IT AFFECTS THE OTHERS.
- 9 IT MEANS POWERFUL OR ACTIVE.
- 11 ONE OF TWO KINDS OF EARTH'S RESOURCES, NOT GROWN BUT _____; ALSO MEANS TO HAVE REMOVED FROM THE EARTH'S INTERIOR.
- 12 IT IS A WAY OF LOOKING AT THE EARTH.

DOWN

- 1 THIS PART OF THE EARTH SYSTEM IS MADE OF ALL LIVING THINGS, INCLUDING PLANTS, ANIMALS, AND OTHER ORGANISMS.
- 3 GEOLOGICAL CHANGES OF EARTH OVER TIME HAVE LEFT A RECORD OF ITS _____.
- 4 THE PORTION OF THE EARTH, ABOUT 1800 MILES (2896 METERS) THICK, BETWEEN THE CRUST AND THE INNER AND OUTER CORE.
- 6 THIS PART OF THE EARTH SYSTEM IS THE PLANET'S WATER, INCLUDING OCEANS, LAKES, RIVERS, GROUND WATER, ICE, AND WATER VAPOR.
- 8 THE EARTH'S OWN INNER _____ IS ONE OF TWO SOURCES THAT POWERS EARTH'S PROCESSES.
- 10 THE EARTH'S BEGINNINGS CAN BE TRACED TO ALMOST 4.5 _____ YEARS AGO.



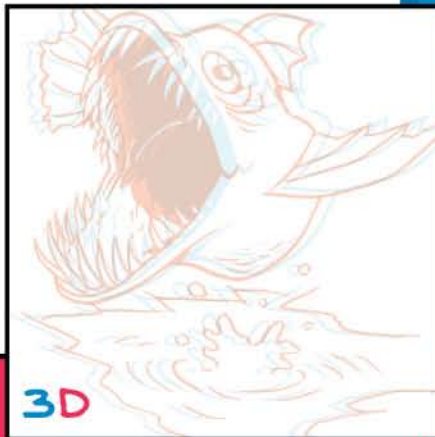
ACTIVITY 5: LOOK INTO 3D!

NOT YOUR FATHER'S SUNGLASSES

YOU'RE IN THE MOVIE THEATER WEARING THE SPECIAL GLASSES YOU WERE GIVEN WHEN YOU BOUGHT YOUR TICKET. SUDDENLY A GIGANTOSAURUS COMES STOMPING OUT OF THE MOVIE SCREEN, HEADING STRAIGHT AT YOU! HOW CAN IMAGES ON A FLAT TWO-DIMENSIONAL SCREEN SEEM *THREE-DIMENSIONAL (3D)*? HOW CAN WEARING WHAT LOOKS LIKE A PAIR OF SUNGLASSES MAKE THINGS APPEAR SO REAL THEY CAUSE YOU TO DUCK UNDER YOUR SEAT?

CUTTING EDGE: realD 3D

REAL D USES A SINGLE DLP CINEMA® PROJECTOR. IT ALTERNATELY PROJECTS THE RIGHT-EYE FRAME AND LEFT-EYE FRAME. IT *CIRCULARLY POLARIZES* THESE FRAMES, CLOCKWISE FOR THE RIGHT-EYE AND COUNTERCLOCKWISE FOR THE LEFT-EYE. *REAL D* USES A LIQUID-CRYSTAL SCREEN PLACED IN FRONT OF THE PROJECTOR LENS. CIRCULARLY POLARIZED GLASSES MAKE SURE EACH EYE SEES ONLY "ITS OWN" PICTURE, EVEN IF THE HEAD IS TILTED.



OLD SCHOOL: 3D

IN FILM, THE TERM *3D* IS USED TO DESCRIBE ANY VISUAL PRESENTATION SYSTEM THAT ATTEMPTS TO CREATE MOVING IMAGES OF THE THIRD DIMENSION; THAT IS, CREATING THE ILLUSION OF DEPTH, AS SEEN BY THE VIEWER. IN A MOVIE THEATER, THE REASON WHY YOU WEAR 3D GLASSES IS TO FEED SLIGHTLY DIFFERENT IMAGES TO YOUR EYES. THE SCREEN ACTUALLY DISPLAYS TWO IMAGES, AND THE GLASSES YOU WEAR CAUSE ONE OF THE IMAGES TO ENTER ONE EYE AND THE OTHER IMAGE TO ENTER THE OTHER EYE. TWO IMAGES ARE DISPLAYED ON THE SCREEN, ONE IN RED AND THE OTHER IN BLUE (OR SOMETIMES GREEN). THE FILTERS ON THE GLASSES ALLOW ONLY ONE IMAGE TO ENTER EACH EYE, AND OUR BRAIN PUTS THE TWO IMAGES TOGETHER, WITH SOME OBJECTS IN THE IMAGE SEEMING CLOSER THAN OTHERS, WHICH GIVES THE ILLUSION OF DEPTH!

HOW AND WHY WE SEE OPTICAL ILLUSIONS

SEEING TWO-DIMENSIONAL IMAGES IN "3D" IS WHAT'S KNOWN AS AN *OPTICAL ILLUSION*. WE SEE OPTICAL ILLUSIONS BECAUSE:

- 1 OUR EYES ARE TRICKED; OR BECAUSE
- 2 WHAT OUR EYES SEE IS REAL, BUT THE MESSAGE THAT GETS SENT TO OUR BRAIN GETS MIXED UP. AND, SOME REALLY SURPRISING ILLUSIONS ALSO HAPPEN BECAUSE
- 3 WE HAVE TWO EYES THAT EACH SEE THINGS JUST A LITTLE BIT DIFFERENTLY. THIS IS THE FEATURE OF OUR VISION THAT WE ARE USING WHEN WE ARE SEEING IN "3D".

PEOPLE (AS WELL AS SOME OTHER ANIMALS) HAVE A *BINOCULAR* VISION SYSTEM. THE WORD BINOCULAR MEANS "REFERRING TO BOTH EYES AT THE SAME TIME." OUR TWO EYES, WHICH ARE SPACED ABOUT TWO INCHES APART, SEE THE WORLD FROM SLIGHTLY DIFFERENT PERSPECTIVES. THE BINOCULAR SYSTEM IN THE BRAIN USES THE DIFFERENCE IN THE IMAGES WE SEE TO FIGURE OUT DISTANCE (BY SENSING THE ANGLE BETWEEN YOUR EYES WHEN THEY ARE FOCUSED ON THE SAME OBJECT). YOUR BRAIN ALSO HAS THE ABILITY TO *SYNCHRONIZE* THE TWO IMAGES IT SEES, SO THAT WE *THINK* WE'RE SEEING ONE IMAGE, EVEN THOUGH WE ARE ACTUALLY SEEING TWO SLIGHTLY DIFFERENT IMAGES.

THREE-DIMENSIONAL

HAVING, OR *SEEMING TO HAVE*, THE DIMENSION OF DEPTH AS WELL AS WIDTH AND HEIGHT.

SYNCHRONIZED

CAUSED TO GO ON, MOVE, OPERATE, WORK, ETC., AT THE SAME RATE AND/OR AT EXACTLY THE SAME TIME.

OPTICAL ILLUSION

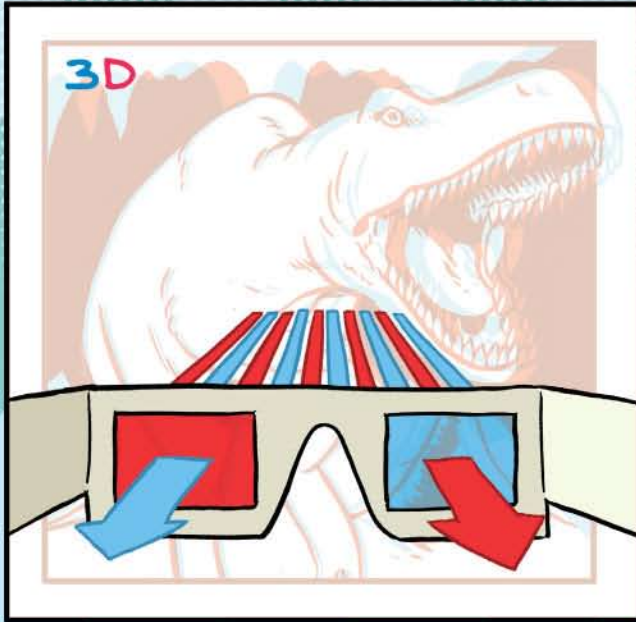
SOMETHING WE SEE THAT DECEIVES, TRICKS, OR FOOLS US BY PRODUCING A FALSE OR MISLEADING IMPRESSION OF REALITY.

Text above from HOWSTUFFWORKS.COM. Learn how to make your own 3D pictures with a digital camera! Go to: http://www.metacafe.com/watch/807300/make_3d_pictures_from_any_digital_camera/

Turn the page to learn more about realD 3D

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ACTIVITY 5: WHAT'S THE DIFFERENCE BETWEEN **real D** 3D, 3D, AND OTHER KINDS OF 3D?



HAVING TWO EYES SPACED AS THEY ARE ON THE FRONT OF OUR HEADS GIVES US THE ABILITY TO SEE THE WORLD IN THREE-DIMENSIONAL SPACE. OUR BRAIN INTERPRETS THE SLIGHTLY DIFFERENT IMAGES FROM EACH EYE AND TELLS US THAT CERTAIN OBJECTS ARE CLOSER TO US THAN OTHERS.

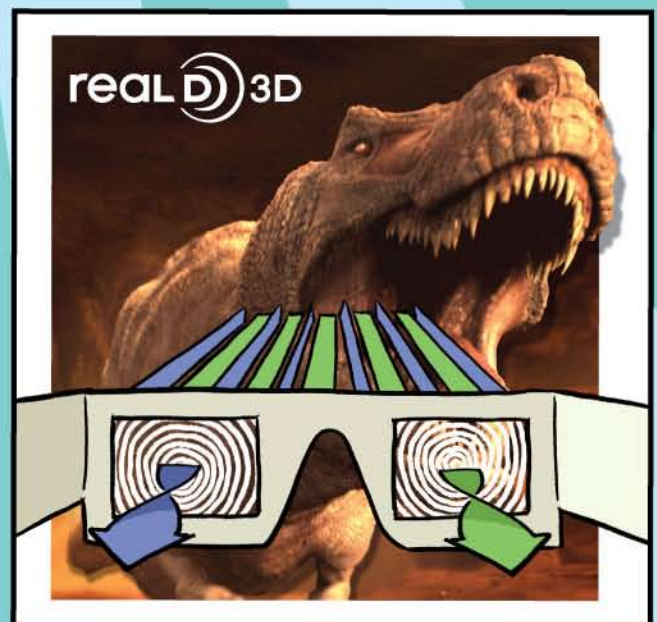
3D MOVIES FROM THE PAST USED THE SCIENCE OF COLOR FILTRATION TO ALLOW A VIEWER'S RIGHT EYE TO SEE A SLIGHTLY DIFFERENT IMAGE FROM THEIR LEFT, THROUGH COLORED GLASSES. MOVIES WERE PRINTED ACCORDINGLY, AND WHEN A 3D MOVIE WAS SHOWN, IT WAS ACTUALLY BEING PROJECTED FROM TWO DIFFERENT PROJECTORS. AUDIENCES HAD SUCH A GOOD TIME EXPERIENCING THE 3D DEPTH THAT THEY FORGAVE FILMMAKERS FOR FORCING THEIR EYES TO WATCH IMAGES THAT SOMETIMES FLASHED FROM ONE COLOR TO ANOTHER AND OFTEN APPEARED TO BE BLACK AND WHITE. THIS OFTEN GAVE PEOPLE A HEADACHE OR MADE THEM FEEL SICK TO THEIR STOMACHS!

TODAY, MOVIE THEATERS OFTEN SHOW MOVIES ON ONE DIGITAL PROJECTOR RATHER THAN OFF OF TWO MOVIE PRINTS ON LARGE SPOOLS OF FILM. THE IMAGE IS SHARP, CLEAN, AND BRIGHT AND THERE ARE NO PRINTS ON SPOOLS STORED IN "CANS" TO CARRY UP STAIRS INTO A PROJECTION BOOTH, OR TO REPLACE WHEN THEY WEAR OUT. **REAL D** 3D CINEMA TAKES ADVANTAGE OF DIGITAL PROJECTOR TECHNOLOGY. RATHER THAN USING COLOR FILTERS IN FRONT OF YOUR EYES, IT USES THE SCIENCE OF POLARIZED LIGHT TO SEPARATE THE MOVIE INTO A RIGHT EYE AND A LEFT EYE IMAGE. POLARIZATION HAS BEEN USED FOR YEARS IN FANCY SUNGLASSES, AS STUDIES HAVE SHOWN THAT CONTROLLING THE DIRECTION OF LIGHT HELPS PROTECT THE WEARER'S EYES. IT IS ALSO USED IN JET PLANE COCKPITS TO PROTECT PILOTS FROM DEADLY GLARE IN FLIGHT.

THE RESULT OF CLEVER COMBINATION OF POLARIZED LIGHT AND DIGITAL PROJECTORS IN THE MOVIES IS THAT **REAL D** VIEWERS EXPERIENCE A 3D IMAGE MORE REALISTIC THAN ANYONE HAS SEEN TO DATE IN A THEATER: DEEP AND EVENLY COLORED SKIES, ACCURATE SKIN AND EYE COLOR, AND OBJECTS THAT CAN APPEAR TO FLY AROUND THE THEATER. POLARIZING GLASSES ARE MORE COMFORTABLE BECAUSE EACH EYE IS SEEING EXACTLY THE SAME BRIGHTNESS AND COLORS JUST LIKE IN REAL LIFE. IF THE MOVIE IS EXCITING LIKE *JOURNEY*, YOU FORGET YOU'RE WEARING THEM. AND NO MORE HEADACHES OR MOTION SICKNESS!

STEREOSCOPIC VISION

CLOSE YOUR LEFT EYE. NOW CLOSE YOUR RIGHT. SEE HOW THINGS LOOK A LITTLE DIFFERENT IN EACH EYE? THIS IS CALLED **STEREOSCOPIC VISION**.



MORE ABOUT POLARIZATION

FOR A COMPLETE DISCUSSION OF POLARIZATION WITH HELPFUL VISUAL EXAMPLES, SEE: [HTTP://WWW.COLORADO.EDU/PHYSICS/2000/POLARIZATION/INDEX.HTML](http://www.colorado.edu/physics/2000/polarization/index.html)

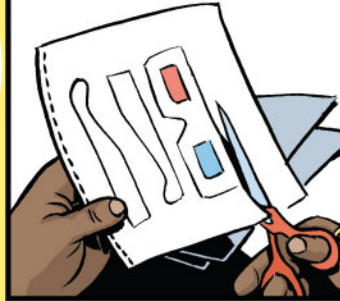
WE CAN'T MAKE A PAIR OF REAL 3D GLASSES, BUT WE CAN HAVE A LOT OF FUN MAKING THE RED AND BLUE KIND!



ACTIVITY 5: LOOK INTO 3D!

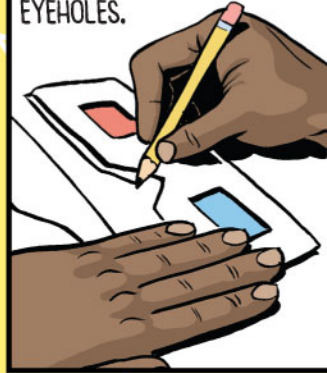
STEP 1

CUT OUT THE SAMPLE PATTERN (INCLUDING EYEHOLES) FOR YOUR 3D GLASSES AND TAPE THE SIDES TO THE CENTER SECTION. YOU NOW HAVE YOUR STENCIL FOR THE ACTUAL GLASSES.



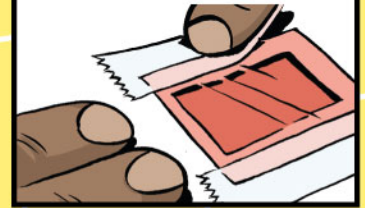
STEP 2

TRACE THE STENCIL ON THE OAK TAG OR STURDY POSTER BOARD. CUT THE GLASSES OUT, MAKING SURE TO ALSO CUT OUT THE EYEHOLES.



STEP 3

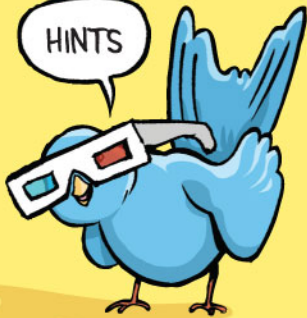
TAPE THE RED (LEFT) AND BLUE (RIGHT) ACETATE PIECES TO COVER THE EYEHOLES. MAKE SURE TO CUT THE ACETATE PIECES A LITTLE LARGER THAN THE OPENING FOR THE EYES. **DO NOT GET TAPE ON PARTS OF THE ACETATE VISIBLE THROUGH THE EYEHOLE.**



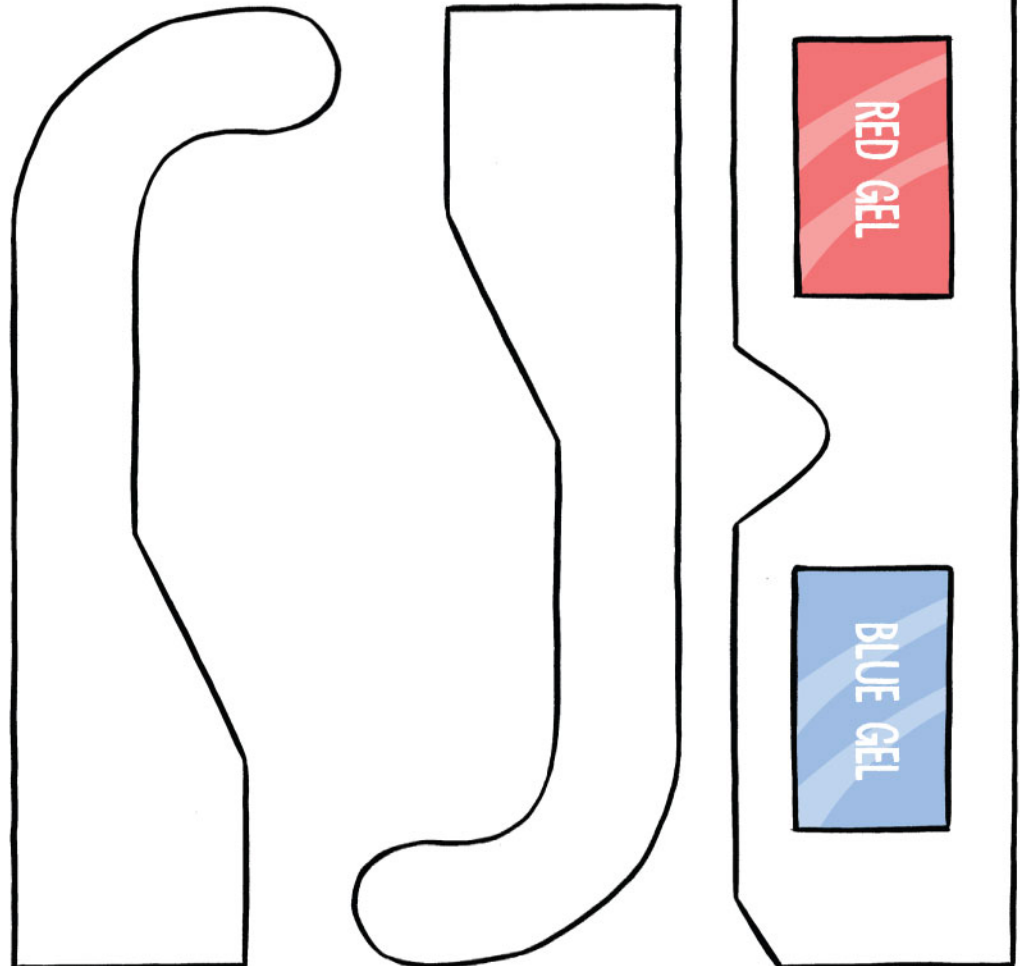
MATERIALS NEEDED

- OAK TAG (STURDY POSTER BOARD)
- SAFETY SCISSORS
- CLEAR TAPE
- BASIC PATTERN FOR GLASSES (SEE BELOW)
- SHEETS OF RED AND BLUE ACETATE (AVAILABLE AT ART SUPPLY STORES)

HINTS



Use this pattern to make your own 3D glasses



1. YOU CAN DECORATE THE GLASSES USING ANY MATERIALS ON HAND. BE AS CREATIVE AS POSSIBLE!

2. THE PATTERN PROVIDED IS JUST ONE POSSIBLE STYLE. VARY THE OUTER SHAPE OF THE GLASSES TO MAKE THEM UNIQUE.

3. TAKE A PICTURE OF YOUR WHOLE CLASS WEARING THEIR GLASSES. OR, EVEN BETTER, USE THE CLASS WEARING THEIR GLASSES AS THE SUBJECT OF YOUR OWN 3D PHOTO! [THIS ACTIVITY COMES FROM: [HTTP://STEREO.GSFC.NASA.GOV/CLASSROOM/GLASSES.SHTML](http://stereo.gsfc.nasa.gov/classroom/glasses.shtml)]

ACTIVITY 6: INVESTIGATING DIFFERENT TYPES OF ROCKS

TO UNDERSTAND WHAT MIGHT AWAIT TREVOR, HANNAH, AND SEAN ON THEIR JOURNEY INSIDE EARTH, IT'S IMPORTANT TO FIRST UNDERSTAND SOME THINGS ABOUT THE OUTSIDE OF EARTH, AND ABOUT LEARNING TO OBSERVE AND RECORD YOUR OBSERVATIONS. THE OBSERVATIONS SEAN'S FATHER'S MAX RECORDED IN HIS COPY OF JOURNEY TO THE CENTER OF THE EARTH HELP TREVOR, HANNAH, AND SEAN MAKE SOME OF THEIR DISCOVERIES.



PART I

WE LIVE ON THE TOPMOST LAYER OF THE EARTH, THE *CRUST*, WHICH IS MADE OF SOLID ROCK. THINK ABOUT WHAT YOU ALREADY KNOW ABOUT ROCKS. WHAT ARE ROCKS MADE OUT OF? ARE ALL ROCKS FORMED IN THE SAME WAY? TO FIND OUT, HERE'S AN INVESTIGATION YOU CAN DO WITH MEMBERS OF YOUR CLASS.

MATERIALS NEEDED

- SAMPLES OF ROCKS*
- HAND LENS
- 5 X 7 INDEX CARDS (ENOUGH FOR EACH PERSON PARTICIPATING IN THIS INVESTIGATION)
- PENS AND COLORED MARKERS

PROCEDURES

1. TAKE ONE OF THE ROCK SAMPLES.
2. OBSERVE YOUR ROCK SAMPLE VERY CLOSELY. YOU CAN USE A HAND LENS TO HELP YOU MAKE YOUR OBSERVATIONS. TRY TO NOTICE EVERY DETAIL ABOUT YOUR ROCK. USE YOUR SENSE OF SIGHT AND TOUCH TO DO SO.
3. WRITE DOWN YOUR NAME AND ALL YOUR OBSERVATIONS ON ONE SIDE OF AN INDEX CARD.
4. AFTER EVERYONE HAS DONE THE SAME THING, HAVE ONE PERSON COLLECT ALL THE ROCK SAMPLES AND PLACE THEM IN A LONG LINE, AT RANDOM.
5. WHEN EVERYTHING IS READY, GO OVER AND LOOK AT THE LINE OF ROCKS. USE YOUR PREVIOUS OBSERVATIONS TO FIND YOUR ROCK. WHEN YOU HAVE FOUND IT, TAKE IT BACK TO YOUR GROUP.
6. IN YOUR GROUP, DISCUSS HOW EASY OR DIFFICULT IT WAS TO FIND YOUR ROCK. CONSIDER WHAT YOU COULD ADD TO YOUR DESCRIPTION TO MAKE IT MORE ACCURATE. THINK ABOUT WHETHER THERE IS A BETTER METHOD OF RECORDING YOUR DESCRIPTION. REVIEW YOUR OBSERVATIONS TO SEE IF YOU INCLUDED FEATURES SUCH AS COLOR, SIZE AND ARRANGEMENT OF CRYSTALS OR GRAINS, FRACTURES OR BREAKS IN THE ROCK, LAYERING, OR HARDNESS.
7. ADD ANY NEW DESCRIPTIONS TO YOUR INDEX CARD.
8. HAVE SOMEONE AGAIN COLLECT THE ROCKS AND PLACE THEM IN A LONG, RANDOM LINE.
9. THIS TIME TRADE YOUR INDEX CARD WITH ANOTHER MEMBER OF YOUR GROUP.
10. USE THE INFORMATION ON THE NEW INDEX CARD TO FIND THE ROCK IT DESCRIBES.
11. YOU CAN REPEAT THIS PROCEDURE SEVERAL TIMES.

*[Teacher or youth group leader: please see important directions on the Educator's Pages under ACTIVITY 4]

DIG DEEPER

HOW EASY OR DIFFICULT WAS IT TO FIND ANOTHER PERSON'S ROCK USING HIS OR HER INDEX CARD? WHAT DOES THIS TELL YOU ABOUT MAKING AND RECORDING OBSERVATIONS? WHAT CONCLUSIONS CAN YOU NOW DRAW ABOUT ROCKS BASED ON THE EVIDENCE YOU HAVE COLLECTED?

ACTIVITY 6: INVESTIGATING DIFFERENT TYPES OF ROCKS Cont'd.

PROCEDURES

PART II

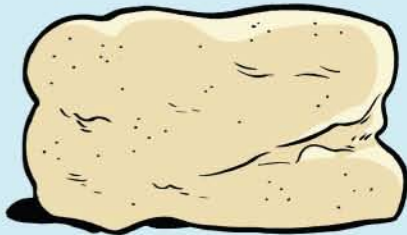
1. THE TYPES OF ROCK SAMPLES YOU HAVE BEEN OBSERVING ARE CALLED *SEDIMENTARY* ROCK. HOW ARE THESE ROCKS ALIKE AND DIFFERENT FROM EACH OTHER?
2. YOU WILL NOW BE GIVEN SAMPLES OF DIFFERENT ROCK TYPE. THESE ARE CALLED *IGNEOUS* ROCKS. OBSERVE THEM CLOSELY. LOOK TO SEE HOW THEY ARE DIFFERENT FROM, AND SIMILAR TO, THE *SEDIMENTARY* ROCK SAMPLES.
3. LIST ANY DIFFERENCES AND SIMILARITIES THAT YOU FIND BETWEEN THE *IGNEOUS* AND *SEDIMENTARY* ROCKS.
4. FINALLY, YOU WILL BE GIVEN SAMPLES OF ANOTHER DIFFERENT ROCK TYPE. THESE ARE CALLED *METAMORPHIC* ROCKS. OBSERVE THEM CLOSELY TO SEE HOW THEY ARE DIFFERENT FROM, AND SIMILAR TO, THE *SEDIMENTARY* AND *IGNEOUS* ROCK SAMPLES.
5. AGAIN LIST THE DIFFERENCES AND SIMILARITIES THAT YOU FIND.



THREE TYPES OF ROCKS

THIS INFORMATION ABOUT DIFFERENT KINDS OF ROCK WILL HELP YOU INVESTIGATE THE ROCK FOUND IN YOUR AREA, IN THE NEXT ACTIVITY.

SEDIMENTARY ROCKS



SEDIMENT IS MADE UP OF LOOSE PIECES OF MINERALS AND ROCKS (IN THE FORM OF GRAVEL, SAND, SILT AND CLAY). OFTEN IT CONTAINS THE REMAINS OF LIVING THINGS AS WELL. IN CERTAIN CONDITIONS, AND OVER A LONG PERIOD OF TIME, *SEDIMENT* BECOMES COMPACTED AND CEMENTED INTO *SEDIMENTARY* ROCK. USUALLY THIS HAPPENS AS *SEDIMENT* IS BURIED MORE AND MORE DEEPLY BETWEEN NEW LAYERS OF *SEDIMENT* THAT ARE DEPOSITED LATER. BURIAL INCREASES THE TEMPERATURE IN THE *SEDIMENT*, AND THE PRESSURE ON IT. AS THAT HAPPENS, MINERALS ARE DEPOSITED AROUND THE GRAINS OF *SEDIMENT*, CEMENTING THEM INTO SOLID ROCK. TWO WAYS TO TELL IF A ROCK SAMPLE IS *SEDIMENTARY* IS TO SEE IF IT IS IN LAYERS AND TO SEE IF IT CONTAINS PARTIALLY WORN GRAINS.

IGNEOUS ROCKS



IGNEOUS ROCKS COME FROM MELTED ROCK CALLED *MAGMA*. *MAGMA* IS FORMED DEEP BENEATH EARTH'S SURFACE AT CERTAIN TIMES AND PLACES. AS *MAGMA* MOVES UPWARD TOWARD THE SURFACE, SOME OF IT IS OFTEN FORCED OUT TO THE SURFACE IN THE FORM OF LAVA AND ASH, WHICH IN TURN FORM A VOLCANO.

METAMORPHIC ROCKS



METAMORPHIC ROCK IS ROCK THAT HAS BECOME CHANGED FROM SOME ORIGINAL ROCK BY HIGH TEMPERATURE OR PRESSURE (USUALLY BOTH) AS IT IS BURIED. *METAMORPHIC* ROCKS ARE OFTEN LAYERED, WITH DIFFERENT LAYERS HAVING DIFFERENT MINERAL COMPOSITION.

WHAT IS SCHIST?

IT'S MENTIONED IN *JOURNEY* BUT WHAT IS *SCHIST*?



SCHIST IS ANY CLASS OF CRYSTALLINE *METAMORPHIC* ROCKS WHOSE MINERAL GRAINS HAVE A MORE OR LESS PARALLEL OR FOLIATED ARRANGEMENT. *SCHIST* ROCKS CAN BE FORMED FROM *BASALT*, AN *IGNEOUS* ROCK; *SHALE*, A *SEDIMENTARY* ROCK; OR *SLATE*, A *METAMORPHIC* ROCK.

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ACTIVITY 7: WHAT KIND OF ROCK IS FOUND WHERE YOU LIVE?

WHAT KINDS OF ROCKS MIGHT YOU FIND IN THE PART OF THE EARTH'S CRUST ON WHICH YOU LIVE? THIS INVESTIGATION WILL HELP YOU TO FIND OUT.



PART I

MATERIALS NEEDED



ROCK SAMPLES FROM YOUR AREA



HAND LENS



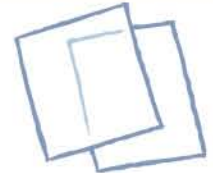
ROCK IDENTIFICATION SHEETS OR GUIDEBOOK



PENS AND COLORED MARKERS



TOPOGRAPHIC AND GEOLOGIC MAPS OF YOUR AREA



TRACING PAPER

PROCEDURES

- LOOK AT THE TOPOGRAPHIC MAP OF YOUR REGION TO ANSWER THESE QUESTIONS:
 - WHERE ARE THE HIGH AND LOW ELEVATIONS FOUND IN YOUR AREA?
 - WHERE ARE THE STEEPEST AND GENTLEST SLOPES IN YOUR AREA?
- GEOLOGISTS DO FIELD WORK IN AN AREA OR REGION AND DESCRIBE EACH KIND OF ROCK THEY FIND. THEY PUT THIS INFORMATION ON A GEOLOGIC MAP. LOOK CLOSELY AT A GEOLOGIC MAP OF YOUR AREA. COMPARE THE NAMES OF THE ROCKS IN YOUR AREA TO THE ROCK IDENTIFICATION SHEETS OR GUIDEBOOKS YOU HAVE ON HAND:
 - WHERE CAN YOU FIND THE THREE DIFFERENT ROCK TYPES IN YOUR AREA (SEDIMENTARY, IGNEOUS, AND METAMORPHIC ROCKS)?
- PLACE A PIECE OF TRACING PAPER OVER THE MAP. ANCHOR THE TRACING PAPER SO THAT IT WILL NOT MOVE BUT WILL BE EASY TO REMOVE WHEN YOU ARE DONE.
- MAKE AN OVERLAY SHOWING THE MAJOR KINDS OF ROCK IN YOUR AREA. GIVE EACH OF THE ROCK TYPES A SEPARATE COLOR. ON THE TRACING PAPER, SHADE IN THE DIFFERENT COLORS FOR EACH ROCK TYPE. WHERE THERE IS A MIXTURE OF TWO KINDS OF ROCKS, USE LINES OF TWO COLORS TO SHOW THIS.
- LOOK AT THE EXAMPLES OF ROCKS FROM YOUR AREA.
 - USING YOUR ROCK IDENTIFICATION GUIDEBOOK, IDENTIFY AND RECORD EACH TYPE OF ROCK SAMPLE.
 - MATCH ANY LOCAL ROCK SAMPLES YOU HAVE IDENTIFIED WITH THE TRACED GEOLOGIC MAP OF YOUR AREA.
 - WHAT DO YOU THINK ARE THE CONNECTIONS BETWEEN THE KINDS OF ROCKS YOU FOUND IN YOUR AREA AND THE LANDFORMS ON THE TOPOGRAPHICAL MAP?
- WHAT NEW INFORMATION ABOUT THE THREE DIFFERENT CATEGORIES OF ROCKS IN YOUR AREA DID YOU DISCOVER IN THIS INVESTIGATION?
- HOW DO THE FINDINGS FROM THIS INVESTIGATION RELATE TO THE EARTH'S CRUST?



ACTIVITY 7: WHAT KIND OF ROCK IS FOUND WHERE YOU LIVE? Cont'd.



WHERE TO GET TOPOGRAPHICAL AND GEOLOGICAL MAPS

TOPOGRAPHY IS THE TERM USED TO DESCRIBE THE SHAPE OF THE LAND SURFACE. TO ORDER TOPOGRAPHICAL MAPS OF THE AREA WHERE YOU LIVE, GO TO: [HTTP://WWW.USGS.GOV/](http://www.usgs.gov/). THEN CLICK ON MAPS, IMAGERY, AND PUBLICATIONS.

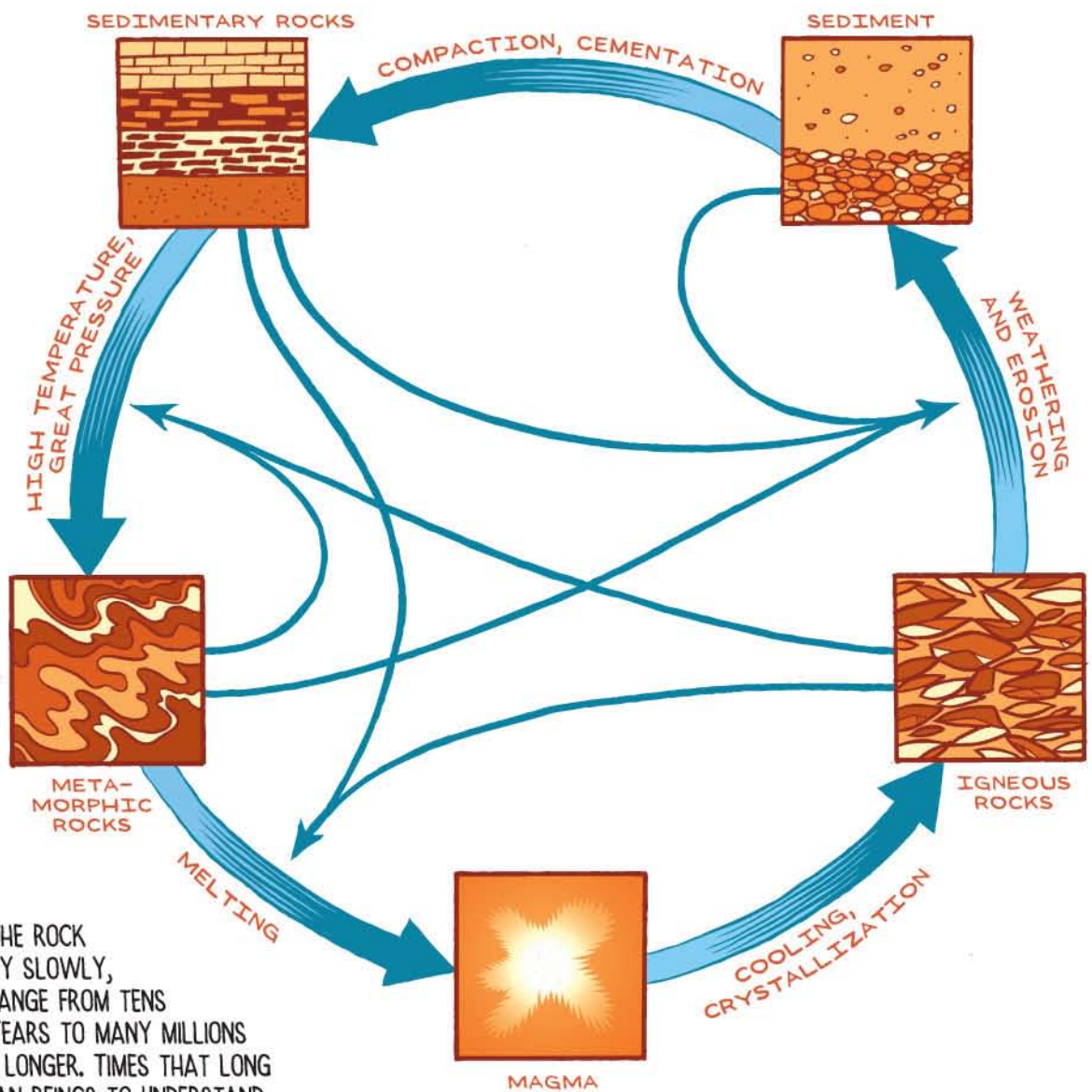
GEOLOGIC MAPS SHOW THE BOUNDARIES OR CONTACTS BETWEEN THE ROCK BODIES THAT ARE PRESENT IN THE AREA OF THE MAP.

TO ORDER GEOLOGIC MAPS OF YOUR AREA, PLEASE SEE: [HTTP://NGMDB.USGS.GOV/NGMDB/NGM_PNSEARCH.HTML](http://ngmdb.usgs.gov/ngmdb/ngm_pnsearch.html)

THE ROCK CYCLE

THE ROCK CYCLE IS THE COMBINATION OF ALL PROCESSES THAT ACT TO BREAK DOWN ROCKS, MOVE SEDIMENTARY MATERIALS FROM PLACE TO PLACE, AND PRODUCE NEW ROCKS. IT IS SHOWN BEST IN THE FORM OF A DIAGRAM, LIKE THIS ONE.

THE PROCESSES IN THE ROCK CYCLE OPERATE VERY SLOWLY, OVER TIMES THAT RANGE FROM TENS OF THOUSANDS OF YEARS TO MANY MILLIONS OF YEARS, OR EVEN LONGER. TIMES THAT LONG ARE HARD FOR HUMAN BEINGS TO UNDERSTAND.



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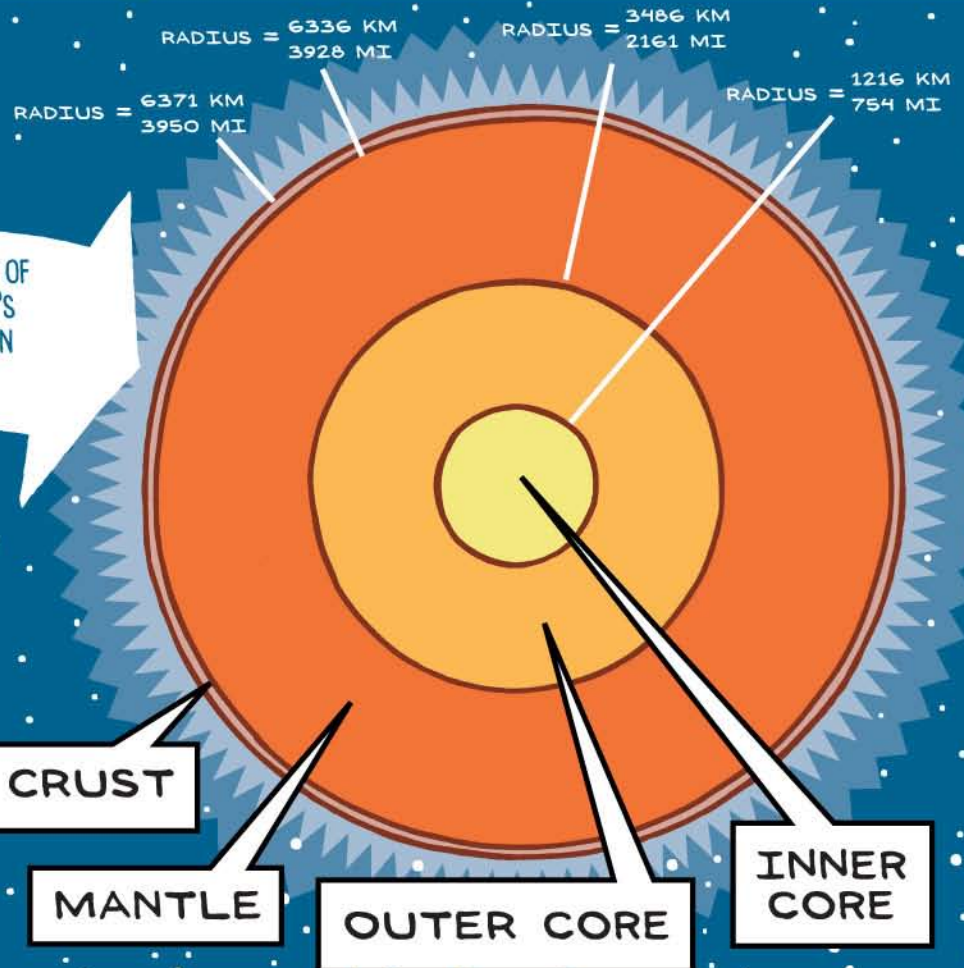
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ACTIVITY 8: SO WHAT'S IN THE CENTER OF THE EARTH?

WHAT'S REALLY IN THE CENTER OF THE EARTH? YOU MAY BE SURPRISED BY WHAT YOU FIND.

HERE'S A DRAWING OF THE INSIDE OF THE EARTH. IN THIS DRAWING IT'S AS THOUGH THE EARTH HAS BEEN SPLIT DOWN THE MIDDLE.

EARTH IS MADE UP OF THREE MAIN LAYERS: THE VERY THIN, BRITTLE **CRUST**, THE **MANTLE**, AND THE **CORE**. THE CORE IS DIVIDED INTO TWO PARTS. ALTHOUGH THE CORE AND MANTLE ARE ABOUT EQUAL IN THICKNESS, THE CORE ACTUALLY FORMS ONLY 15 PERCENT OF THE EARTH'S VOLUME, WHEREAS THE MANTLE OCCUPIES 84 PERCENT. THE CRUST MAKES UP THE REMAINING 1 PERCENT.



[From "The Interior of the Earth" by Eugene C. Robertson: <http://pubs.usgs.gov/gip/interior/> Drawing of Earth and text also taken from: "Journey to the Center of the Earth" by Lawrence W. Braile and Sheryl J. Braile: <http://web.ics.purdue.edu/~braile/edumod/journey/journey.htm>]

OUR KNOWLEDGE OF THE LAYERING AND CHEMICAL COMPOSITION OF THE EARTH IS STEADILY BEING IMPROVED BY EARTH SCIENTISTS DOING LABORATORY EXPERIMENTS ON ROCKS AT HIGH PRESSURE AND ANALYZING EARTHQUAKE RECORDS ON COMPUTERS.

THE EARTH'S CRUST IS MADE UP PRIMARILY OF *SILICIC* (A HIGH PERCENTAGE OF SILICON AND OXYGEN) *CRYSTALLINE* (DISTINCT CRYSTALS OF INDIVIDUAL MINERALS ARE VISIBLE) ROCKS. THE MANTLE CONSISTS OF IRON- AND MAGNESIUM-RICH SILICATE ROCKS. THE CORE IS MOSTLY IRON, WITH A SMALL PERCENTAGE OF NICKEL. THE OUTER CORE IS MOLTEN AND THE INNER CORE IS SOLID.

DIG DEEPER

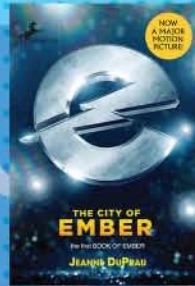
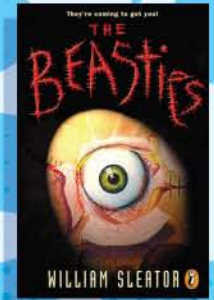
NOW WRITE YOUR OWN BRIEF VERSION OF A *JOURNEY TO THE CENTER OF THE EARTH* BASED ON MORE ACCURATE INFORMATION ABOUT THE NATURE OF THE EARTH'S INTERIOR. HOW WILL THE STORY CHANGE?



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JOURNEY READING LIST

FOR OTHER ADVENTURES IN READING, TRY READING ANYTHING BY GARY PAULSEN (*DOGSONG*, *HATCHET*, AND *BRIAN'S SAGA* AT WWW.RANDOMHOUSE.COM/FEATURES/GARYPAULSEN/LIBRARY) AND WILL HOBBS (*LEAVING PROTECTION*, *WILD MAN ISLAND*, *JASON'S GOLD*, AND OTHERS AT WWW.WILLHOBBSAUTHOR.COM) FOR REALISTIC ADVENTURES AND ANYTHING BY BILL SLEATOR (*THE BEASTIES*, *THE BOY WHO REVERSED HIMSELF*, AT WWW.TYCHO.ORG/SLEATOR.SHTML#BOOKS) AND T.A. BARRON (*THE LOST YEARS OF MERLIN EPIC* AND *THE GREAT TREE OF AVALON TRILOGY* AT WWW.TABARRON.COM/TABARRON) FOR SOME GOOD SCIENCE FICTION/FANTASY.



JEANNE DUPRAU'S *CITY OF EMBER*

RANDOM HOUSE BOOKS FOR YOUNG READERS
ISBN-10: 0375822739 / ISBN-13: 978-0375822735

SET IN A FUTURISTIC SOCIETY WHERE THERE IS NO MOON OR STARS BUT ONLY FLOODLIGHTS TO ILLUMINATE THE CITY, TWO 12-YEAR-OLDS APPEAR TO BE THE ONLY ONES CONCERNED ABOUT THE DWINDLING FOOD SUPPLY AND THE MALFUNCTIONING GENERATOR.



RICK RIORDAN'S *THE LIGHTNING THIEF*

MIRAMAX
ISBN-10: 064172344X / ISBN-13: 978-0786856299

SET IN THE 21ST CENTURY WHERE THE GREEK GODS AND GODDESSES ARE ALIVE AND WELL, READERS MEET AN ORDINARY 12-YEAR-OLD KID WHOSE GEEKY LIFE CHANGES THE MOMENT HE DISCOVERS THAT POSEIDON IS HIS FATHER.



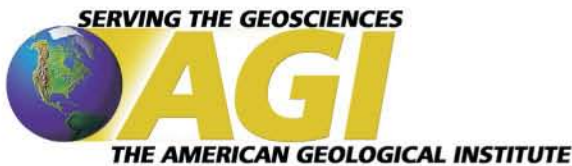
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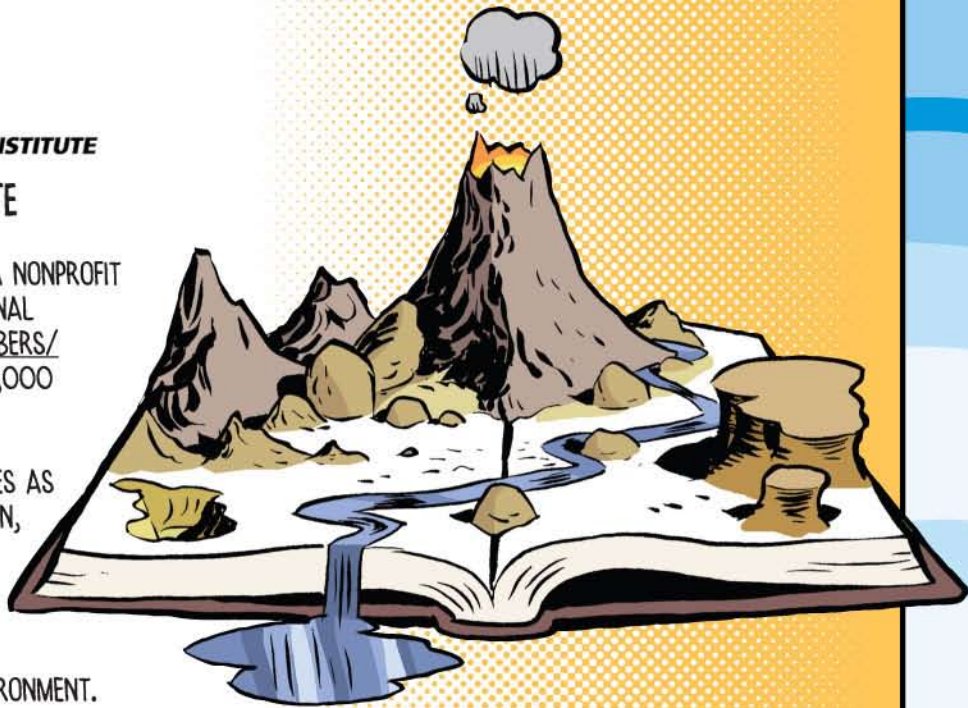
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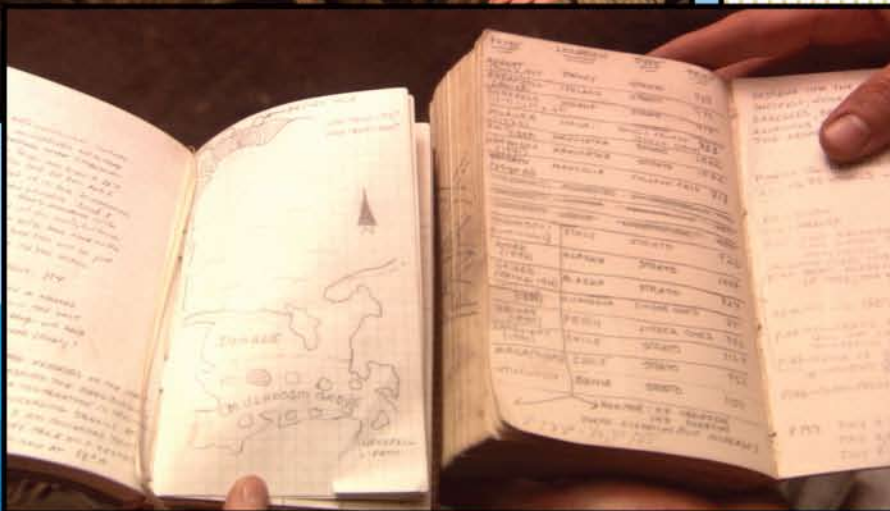
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- ACTIVITY 3: CREATE YOUR OWN (EARTH) SCIENCE FICTION COMIC BOOK
- ACTIVITY 4: DISCOVER THE EARTH SYSTEM
- ACTIVITY 5: LOOK INTO 3D!
- ACTIVITY 6: INVESTIGATING DIFFERENT KINDS OF ROCKS*
- ACTIVITY 7: WHAT KIND OF ROCK IS FOUND WHERE YOU LIVE?
- ACTIVITY 8: SO WHAT'S IN THE CENTER OF THE EARTH?

	ACTIVITY 1	ACTIVITY 2	ACTIVITY 3	ACTIVITY 4	ACTIVITY 5	ACTIVITY 6	ACTIVITY 7	ACTIVITY 8
NCTE/IRA ENGLISH/LANGUAGE ARTS STANDARD 1: READING FOR PERSPECTIVE	◆							
NCTE/IRA STANDARD 2: READING FOR UNDERSTANDING		◆		◆				
NCTE/IRA STANDARD 3: EVALUATION STRATEGIES		◆		◆				
NSES EARTH & SPACE SCIENCE STANDARDS, GRADES 5-8: EARTH'S HISTORY						◆	◆	◆
NSES EARTH & SPACE SCIENCE STANDARDS, GRADES 5-8: STRUCTURE OF THE EARTH SYSTEM		◆		◆				
NSES SCIENCE AND TECHNOLOGY STANDARDS, GRADES 5-8: UNDERSTANDING ABOUT SCIENCE AND TECHNOLOGY					◆			
NSES SCIENCE AS INQUIRY STANDARD A: ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY						◆	◆	
NSES SCIENCE AS INQUIRY STANDARD B: UNDERSTANDING OF PROPERTIES AND CHANGES OF PROPERTIES IN MATTER; MOTIONS AND FORCES; TRANSFER OF ENERGY						◆	◆	
NCSS SOCIAL STUDIES STANDARD 2: TIME, CONTINUITY, AND CHANGE	◆							
NCSS STANDARD 8: SCIENCE, TECHNOLOGY, AND SOCIETY		◆	◆		◆			
NCSS STANDARD 9: GLOBAL CONNECTIONS				◆				
NAEA VISUAL ARTS: STANDARD 1: UNDERSTANDING AND APPLYING MEDIA, TECHNIQUES, AND PROCESSES			◆		◆			
NAEA STANDARD 2: USING KNOWLEDGE OF STRUCTURE AND FUNCTIONS					◆			



* PLEASE NOTE: FOR THIS ACTIVITY YOU WILL NEED CLASS-SIZED SETS OF SEDIMENTARY, IGNEOUS, AND METAMORPHIC ROCKS.

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