DVESScapades

escapades: interesting, stimulating, exciting activities and adventures

Delaware Valley Earth Science Society Newsletter

April 8, 2009

Program: Mark your calendar for this exciting lecture. We will have the return of the previously popular teacher, Amy Carpinelli. This time her talk will be on the Tambora Volcano. Tell your friends !!! Make plans to attend !!! Bring visitors !!!

President's Message - by AnnLynne Benson, DVESS President and EFMLS Director
Happy Passover, Happy Easter and Happy Spring, Fellow Rockhounds and Fossil Fanatics!!

Soon our gray and dreary world will be bursting forth with new life - grasses the varied shades of malachite, dioptase, and prehenite, and rainbow gardens of flowers: sun-drenched daffodils and forsythia as yellow as sulfur, roses the delicate pink of rose quartz, hyacinths and irises as purple as amethyst, tulips and roses as red as rhodochrosite and cinnabar, hydrangea the pale blue hue of sodalite, Asiatic lilies and bird of paradise as orange as vanadanite and wulfenite, bluebells and cornflowers the electric blue of kyanite offset by warm brown "Silk Rose" morning glories and brown pom poms the shade of chrysoberyl, and gardenias and lilies as white as sun-bleached fossils.

Get out into the fresh air and take in a show. Six-year-old Garrett and I enjoyed the Delaware Mineralogical Society show in March; he reports:

"I won the door prize *(a $3 coupon for the club table)*, so I got to dig in the sand and look for stuff. I wanted marine fossils, I got a rib, a shell and lots of shark teeth."

Rockhounding is a growing family affair - my sister Loretta, a well-educated and well-respected Life Coach (among other disciplines) has contributed an article on the healing power of crystals. While I do not subscribe to this non-scientific theory, Gary has gently reminded me that religion is not based in science either, to which I had to add a humble "touché".

So whatever your religious preference or belief system, if it works for you, that's what's important. As we respect and have fun with each other, let's respect everyone's appreciation of minerals - ENJOY!!!

NEW CLUB BROCHURES - will *(finally!!)* be available at the April meeting. Plan on taking a few to have them on hand when you meet folks who would be interested in all DVESS has to offer.

POT LUCK DINNER is coming up soon - Sunday May 17. It will take place in the same location as the monthly meeting - the Education Building behind Centenary United Methodist Church on the White Horse Pike (Rt. 30) in Berlin - on May 17. Sign up will be by www.whoscoming/dvess **at a future date** (website is not up yet). Come on out and join the fun!
Our annual **Banquet** will take place in the same location as last year - Vitarelli's restaurant on Kings Hwy. in Cherry Hill. More details to follow later.

FIELD TRIP - Mutter Museum in Philadelphia - maybe in May.

GEOLOGY ROAD TRIP - Once again we have been invited to partake in wonderful, free, lectures put on by Rutgers geology museum in New Brunswick. Thursday, **April 16th**, at 8:00 p.m. Dr Raymond Murray, Professor Emeritus and former VP for research at the University of Montana, Missoula, will lecture on geological forensics. His presentation is titled "**GEOLOGY CSI: True Stories**". He has worked many years in the field and helped law enforcement many times to solve crimes containing geological items and will be sure to have many tales to tell. As always a free reception will follow in the Geology Museum with snacks and refreshments and load of rocks.

DAFFODILS - read Wordsworth's famous poem celebrating the trumpet of Spring elsewhere in this issue.

"Life is either a daring adventure or nothing." - Helen Keller

11 things you didn't know about money ! !

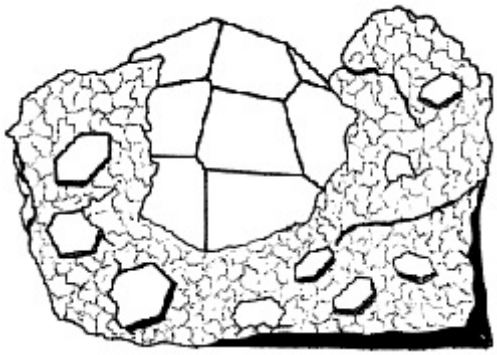
1. No escape: As you file your taxes this month, you can take solace in knowing that the ritual dates back almost 5,000 years, to a time when Egyptians started paying taxes in goods and labor.
2. Collecting taxes became a lot easier after Egypt and Mesopotamia began using silver ans gold bars as currency, around 2500 BC
3. Unfortunately, the invention os money also made theft a lot easier, consequently, temples became the first banks because they were sturdy.
4. By 1750 BC, Babylonian temple priests had branched out into issuing loans to locals.
5. Founded in Italy as a pawnshop in 1472 AD, the Banca Monte dei Paschi di Siena is the world's oldest surviving bank.
6. Paper money originated in China in the year 910 AD and amazed Marco Polo when he visited three centuries later. He also noted that the emperor Kublai Khan seemed to be printing an awful lot of notes.....
7. ....which ultimately wrecked the economy. Due to skyrocketing inflation caused by churning out so much money, paper bills had to be abolished in China in the 15th century.
8. Return of the funny money: The expense of the U.S. Civil war inspired the government to introduce paper "green-backs" in July 1861.
9. All the U.S. coins and bills in general circulation today have a total worth of about $829 billion. (What is TARP ? How much in $$$? Where will it come from?? Grandchildren!)
10. Two-thirds of that cash is held overseas. !!!!
11. Filthy Lucre: In a study last year, researchers found more cocaine residue on US bills than on any other currency. Also found on money: staphylococcus and fecal matter !!!

Taken from an article in April DISCOVER Science, Technology and The Future magazine article by Jason Stahl.

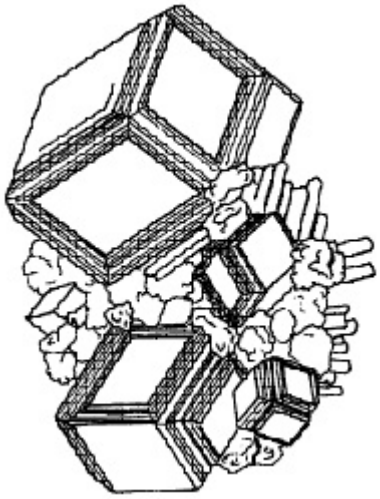
Why are people so tired on April 1st ?
Because they have just come thru a 31 day March !! (Baa - Boom !)

Why doesn't the baseball team want Cinderella on their team any more?
Because she is always running away from the ball.

Garnet

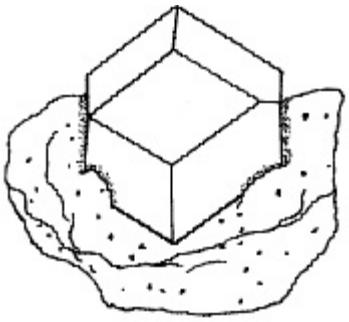


Chemical Formula: Silicate (Si3O12 in each type)
Crystal System: Isometric (cubic)
Hardness: 6 - 7.5
Specific Gravity: 3.5 - 4.3
Cleavage: None
Fracture: Conchoidal (shell-like)
Luster: Glassy
Color: Red, purple, brown, green, yellow, white, black
Streak: None
Uses: Gemstones. Some is crushed to make sandpaper.



Interesting Facts: The name "Garnet" refers to a group of minerals, not to a specific mineral. There are six minerals in this group and each has a slightly different chemical formula. They all contain silicon and oxygen (the silicate molecule). The different mineral names are pyrope, almandine, spessartine, uvarovite, grossular, andradite.

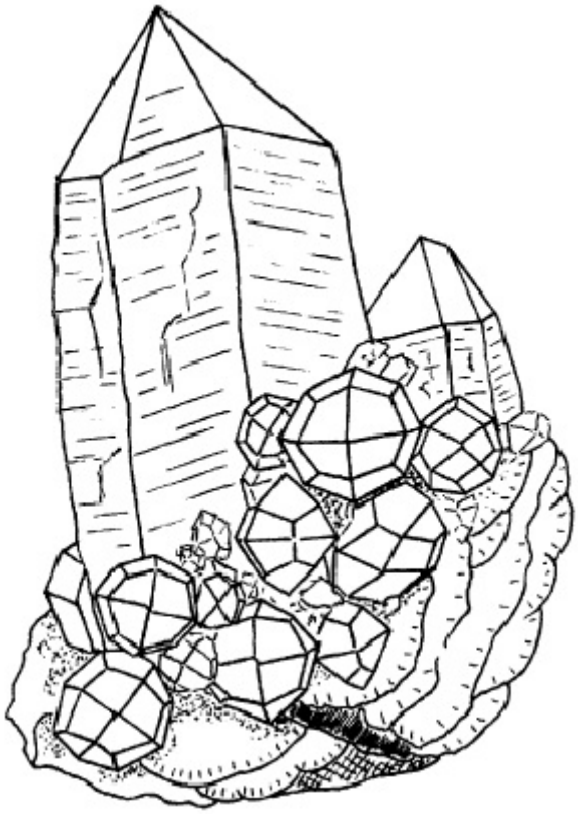
Name: Groups of small, red garnet crystals look like the seeds that are found in the inside of a pomegranate fruit. So, the group name garnet comes from the Latin word granatum which means a pomegranate. Garnet crystals often form together in groups. There are six different kinds of garnet. They are all similar because they have the same crystal system and they are silicate minerals. (Remember what you learned about silicate minerals last month?) They are different because their chemical formulas are a little different from each other. Also, each type has different colors. Let's look at each of them.



Pyrope garnet is purple or dark red. Its chemical formula is $Mg_3Al_2Si_3O_{12}$.
Almandine (also, almandite) is dark red. Its chemical formula is $Fe_3Al_2Si_3O_{12}$.
Spessartine is brown and sometimes has a tint of red or pink. Its chemical formula is
$Mn_3Al_2Si_3O_{12}$.

Color the page's diagrams above with the info given. A cubic crystal cutout model follows.

Uvarovite is dark, emerald-green. Its chemical formula is $Ca_3Cr_2Si_3O_{12}$.
Grossular is light green, pink, or white. Its chemical formula is $Ca_3Al_2Si_3O_{12}$.
Andradite is pale brown and black, but not red. Its chemical formula is $Ca_3Fe_2Si_3O_{12}$.
Now, visit this website: http://www.periodicvideos.com/. It is a chart of all of the elements (called The Periodic Table of Elements). The cool thing about this Periodic Table is that there is a video showing some of the cool properties of each of the elements. (I bet you'll end up looking at the whole thing!) Using this chart, name all of the elements in each of the types of garnet. You will want to use a clean piece of paper.

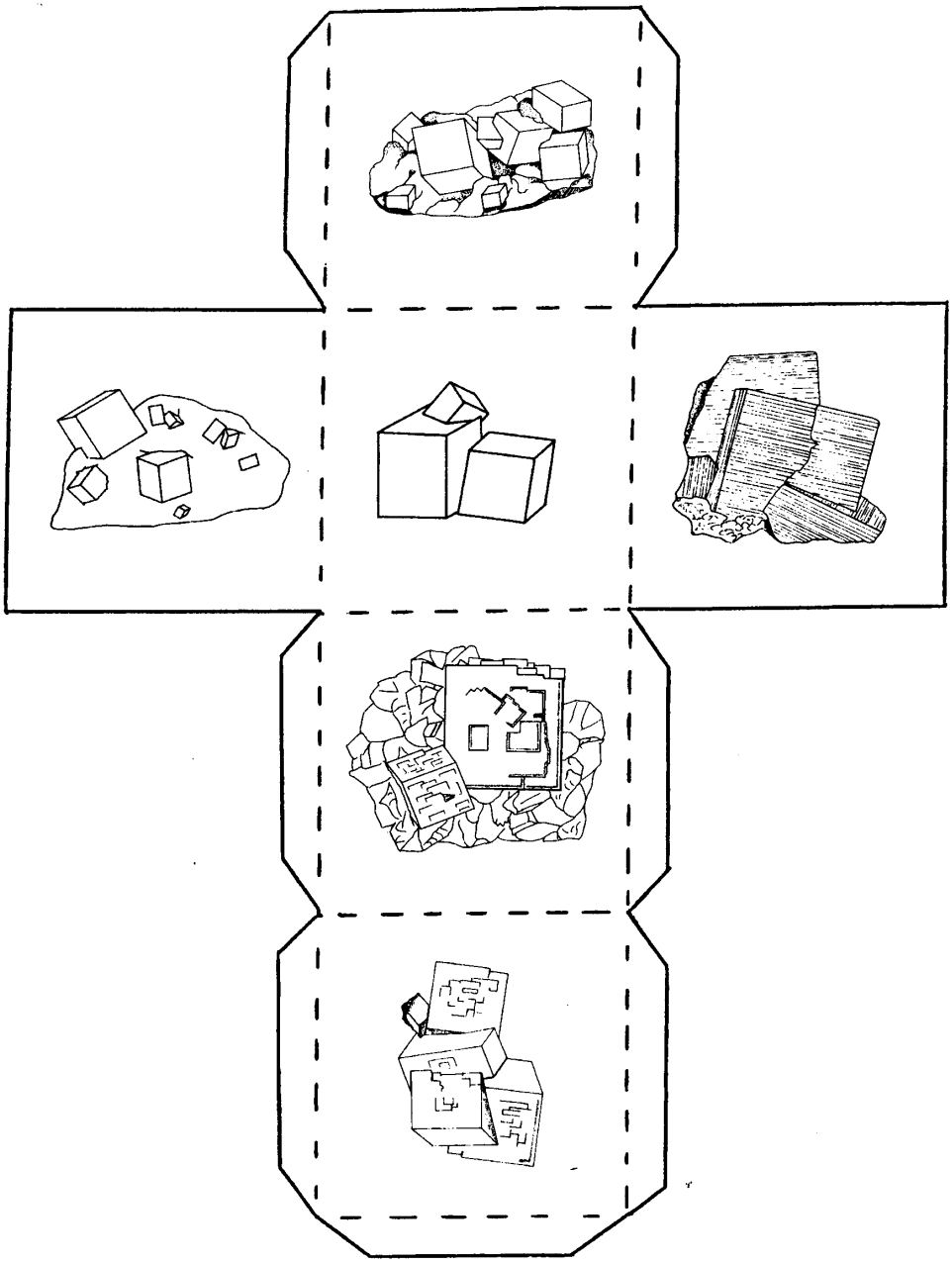


Now study what you discovered. Did you see that the six garnet types are in two groups of three above? How are the three garnets in each group similar to each other? Mineralogists put these garnets in two groups based on their chemical formulas. They have a special name for each group. The first group is called the Pyralspite garnets. This name came from Pyrope, Almandine, Spessartine. See? PyrAlSp + ite. The second group is called the Ugrandite garnets. This name came from Uvarovite, Grossular, Andradite. See? UGrAnd + ite.

Are you a member of the Mineral of the Month Club yet? www.mineralofthemonthclub.org

©2008 Diamond Dan Publications. All pictures and articles in this newsletter are property of Diamond Dan Publications and can not be copied or reused in any format (printed or electronic) without written permission of Diamond Dan Publications, P.O. Box 143, Manchester, New York 14504 or diamonddan@rochester.rr.com. Subscriptions: 12 issues (1 year) $19.95. 24 issues (2 years) $36.95. Make checks payable to Diamond Dan Publications.

Cubic Crystal Cutout Model



The drawings on this cube are of the minerals *halite, fluorite, and pyrite*.

"Daffodils" (1804)
By William Wordsworth (1770-1850)

I wandered lonely as a cloud
That floats on high o'er vales and hills,
When all at once I saw a crowd,
A host, of golden daffodils;
Beside the lake, beneath the trees,
Fluttering and dancing in the breeze.

Continuous as the stars that shine
And twinkle on the Milky Way,
They stretched in never-ending line
Along the margin of a bay:
Ten thousand saw I at a glance,
Tossing their heads in sprightly dance.

The waves beside them danced; but they
Out-did the sparkling waves in glee:
A poet could not but be gay,
In such a jocund company:
I gazed – and gazed – but little thought
What wealth the show to me had brought:

For oft, when on my couch I lie
In vacant or in pensive mood,
They flash upon that inward eye
Which is the bliss of solitude;
And then my heart with pleasure fills,
And dances with the daffodils.

GEMSTONE READINGS
By Loretta M. Vasso, M.S., CAC, CCP

After 20 years in the helping professions, as a counselor, trainer and teacher, I have recently decided to "come out of the closet" on the fact that I'm an intuitive as well. I have spent about 10 years pursuing studies in meditation, metaphysics, mediumship, divination tools and now use my natural intuitive abilities in service to my clients.

I recently visited a rock shop at Columbus Farmers Market seeking semi-precious gemstones and crystals for use in a meditation class focusing on the Chakra System. Chakras are energy centers inside our bodies.

Each chakra has its own color and vibration corresponding to colors and minerals (Peschek-Bohmer, 2002) which are used in the treatment of energy centers and related organs. The chakras and their related minerals are:

Root or Base Chakra (red) –at the base of the spine, relates to our physical selves: **Garnet, hematite, red jasper, coral, onyx, rhodonite, ruby and black tourmaline.**

Sacral Chakra (orange) – located in the sexual organs, governs creativity:
Orange beryl, orange jasper, carnelian and citrine.

Solar Plexus Chakra (yellow) – located, obviously, in the solar plexis, is the seat of our personal power: **Tiger's eye, topaz, yellow tourmaline and citrine.**

Heart Chakra (green or pink) – lies in the middle of the chest and is the center through which we feel love: **Aventurine, chrysocolla, chrysopras, jade, moss agate, olivine, emerald and tourmaline, coral, rhodonite, rhodochrosite and rose quartz.**

Throat Chakra (blue) – the center of expression, communication and judgement.
Aquamarine, chalcedony, celestine, chrysocolla, moonstone, opal, pearl, turquoise and blue topaz.

Third Eye or Forehead Chakra (indigo-a vibrant combination of red and blue) – lies in the center of the forehead, just above the nose. This is the center through which we consider our spiritual nature, as well as our intuition.
Sodalite, amethyst, sapphire, rock crystal and fluorite.

Crown Chakra (usually associated with white - the combination of all colors - however, violet - the color with the highest vibrational frequency - and gold - the light of life force - are frequently visualized as well) -- located at the top of the head, and connects us with Source, Spirit, God, Infinite Intelligence: **Amethyst, rock crystal, diamonds and violet fluorite.**

While wrist-deep in a sea of gemstones, my friend retrieved a lovely piece of polished bronzite. Almost reflexively I declared, "There's a warrior in there." As we investigated more closely, in fact, the bronze colored striations of the stone formed a shape like a cave drawing of a warrior, taking an aggressive action against an enemy. I intuited that the fighter represented my friend who had been drawn to the stone and who was currently engaged in her own personal battle of sorts.

Since then, I have incorporated gemstone reading into the intuitive work I do with clients and at psychic fairs and house parties. While reading Tarot cards, I have the querent select a stone from a velvet bag and hold it in their palm; then I use my intuition to read the stone. This has proven interesting and exciting for my clients and myself.

Since I'm the sister of the Selenite Queen, you know there had to be a selenite connection! Gemstones for readings are cleansed weekly or monthly. One way to accomplish this is to keep a piece of selenite in the bag with the other crystals; the selenite attracts energy that needs to be cleared from the gemstones. This was made clear to me (*pun, ed.)* when a piece of selenite was chosen by a person for whom I was doing reading; when I looked for a scene or picture, I was distracted by the "junk" on the selenite - it seemed "dirty" and I wasn't able to see a clear picture.

While gemstones have been used in healing for eons, using them as a divination tool is, to the best of my knowledge, a new phenomenon in our place and time. I feel blessed that I have been gifted with this ability and I am pleased to use it in service to those who find enlightenment through my process.

Loretta has been trainer since 1987 and a counselor in private practice since 1989. She holds a Master's Degree in Counseling and a Certificate of Competency in Compulsive Gambling, is a Certified Addictions Counselor and a Certified Coach Practitioner, and is trained in Federal Department of Transportation regulations for Return-To-Duty Process as a DOT/SAP. Loretta has expanded her professional training in recent years to incorporate metaphysical and alternative methods in her work with clients, whom she sees in their homes or places of business, and in her offices at Transformative Human Services Psycho-Spiritual Counseling & Life Coaching in Wyncote, PA. She can be reached at 215-692-2753

Don't forget there are more pages in your e-mailed newsletter because of mailing constraints. Look for photos of our meetings, coming soon

MEMBERSHIP Thank you to all of those who already renewed your membership for 2009 – this is a good start to the new year. I would like to get filled out renewal forms for all renewals this year to put in a Membership Binder so I have current records for everyone. I have attached a renewal form with this issue of the DVESS Newsletter for that purpose, and I would appreciate all of you renewing, including those of you who have already renewed, but make sure I get a filled out Renewal form with current information. It can be copied and emailed to me at either of the e-mail addresses in the info box Thank you. CDC. Editor, DVESScapades

PROGRAMS:
A number of other speakers are being lined up, including Chet Lemanski (After February 2009 Tucson show). Since we will have meetings at the Centenary United Methodist Church in Berlin, NJ during the summer, Gary will show/plan additional programs.

DVESS General Meeting Future Dates 2009, May 13, June 10; July 8,;
Aug. 12; Sept. 9, Oct. 14; Nov. 11, Dec. 9
NOTE NEW DATES NOW INCLUDED, **FOR JULY AND AUGUST**

FIELD TRIPS: April 25, 2009 Sterling Hill Dig, Sterling Hill tour for DVESS will in September 2009.

There are only THREE WEEKS left before the diggg... if you are not yet registered, and plan to come, please take care of registering right away... it's easy, from the link on the website at http://www.UVworld.org and PayPal takes credit cards, so you don't have to have a Paypal account to sign up. But we NEED to have at least 100 registered by the on-line registration cutoff date of 11:59pm on April 19th in order to cover the expenses of running the Diggg. So please, take care of registering right away -- it takes only a few minutes.
Jim Cooper webmaster for UVworld.org

Other Happenings:
Hadrosaurus foulkii - THE DINOSAUR THAT CHANGED THE WORLD special exhibit at the Academy of Natural Sciences opens on November 22nd and runs thru April 19th, 2009, or six months to celebrate the 150th anniversary of the discovery of this important fossil. 1868 the Academy became the first museum in the world to display the complete skeleton of a dinosaur. See Hadrosaurus foulkii again, remounted and reinterpreted for the 21st century and learn of its fascinating discovery 150 years ago. Academy Of Natural Sciences, Philadelphia

UPCOMING EVENTS
New Jersey State Museum Sunday Science Lecture Series

April 5	**Dr. Chung Shih,** Infineum USA **"Silent Stories - Fossil Treasures from Liaoning, China"**
May 3	**Dr. Kenneth Miller,** Rutgers University **"Sea-level & Climate Change: Should I Sell My Shore House?"**
June 14	**Robert Denton,** Discoverer and leading paleontologist of the famous Ellisdale Fossil Site

Space is limited. Reserve your seats early!

WHAT YOU NEED TO KNOW Free Admission - Free Parking, Museum Auditorium
Each lecture begins at 4pm. Light refreshments will be served. For more information, or to make reservations, please call (609) 292-8594

DVESS MEETING LOCATION : Centenary United Methodist Church, 151 South White Horse Pike, (route 30) in Berlin, 856-767-3881 or 856-767-7453. Located between Estaugh Ave and W Taunton Ave on your left, the church is on the right hand side.

MEMBERSHIP INFORMATION

Regular members are entitled to participate in all DVESS activities. Sponsoring members are entitled to the same plus a specially chosen mineral specimen. Dues are renewable each year in January. Membership rates for the Society:

Regular Membership:

$15.00 for the 1st family member + $5.00 for each additional family member
$10.00 for the 1st Senior (65+) member + $5.00 for each additional family member

Sponsoring Memberships (each additional family member - $5.00):

"Silver" $50.00 for 1st family member - receive a Geode Specimen
"Gold" $75.00 for 1st family member - receive a Native Gold Specimen
"Platinum" $100 for 1st family member - receive a Premium Specimen

SOCIETY INFORMATION

The **D**elaware **V**alley **E**arth **S**cience **S**ociety, Inc., (DVESS), a non-profit organization, was founded in 1956 and incorporated in the state of New Jersey in 1957.
The Society:

* promotes interest , knowledge and the development of skills in the "earth sciences". These interests include mineralogy, paleontology, lapidary arts, archeology and local preservation.
* supports the conservation of natural resources, advocates the availability of collecting sites and maintains close contact with those in the academic field.
* is a member club of the Eastern Federation of Mineralogical and Lapidary Societies (http://www.AmFed.org/EFMLS)

MEETINGS

The Society meets the 2nd Wednesday of each month throughout the year at Centenary United Methodist Church, 151 South White Horse Pike, (route 30) in Berlin

Anyone with info for the newsletter please share with me. You can be published!
Stuff you did in school, on a trip etc., see my info below.

Editor's Notes: Editor is not responsible for authenticity of information in any articles submitted for publication. Nor are the opinions expressed in the "DVESScapades" necessarily those of the officers of the Delaware Valley Earth Science Society, Inc., and/or the editor.

To submit an article for publication in the DVESScapades contact the Newsletter Editor. decuzzic@comcast.net, or Delaware Valley Earth Science Society Inc., DVESS, P O Box 372 Maple Shade, New Jersey 08052 or DVESS Website: http://www.dvess.org garyskyrock@comcast.net

AFMS CODE OF ETHICS (American Federation of Mineralogical Societies)

I will respect both private and public property and will do no collecting on privately owned land without the owner's permission.

I will keep informed on all laws, regulations of rules governing collecting on public lands and will observe them.

I will to the best of my ability, ascertain the boundary lines of property on which I plan to collect.

I will use no firearms or blasting material in collecting areas.

I will cause no willful damage to property of any kind - fences, signs, buildings.

I will leave all gates as found.

I will build fires in designated or safe places only and will be certain they are completely extinguished before leaving the area.

I will discard no burning material - matches, cigarettes, etc.

I will fill all excavation holes which may be dangerous to livestock.

I will not contaminate wells, creeks or other water supply.

I will cause no willful damage to collecting material and will take home only what I can reasonably use.

I will practice conservation and undertake to utilize fully and well the materials I have collected and will recycle my surplus for the pleasure and benefit of others.

I will support the rockhound project H.E.L.P. (Help Eliminate Litter Please) and will leave all collecting areas devoid of litter, regardless of how found.

I will cooperate with field trip leaders and those in designated authority in all collecting areas.

I will report to my club or Federation officers, Bureau of Land management or other authorities, any deposit of petrified wood or other materials on public lands which should be protected for the enjoyment of future generations for public educational and scientific purposes.

I will appreciate and protect our heritage of natural resources.

I will observe the "Golden Rule", will use "Good Outdoor Manners" and will at all times conduct myself in a manner which will add to the stature and Public "image" of rockhounds everywhere.

DVESS Directory 2008	**President Ann Lynne Benson 856-783-0969 SeleniteQueen@gmail.com**
1st Vice President Gerald Feigin gfeigin@co.gloucester.nj.us	**2nd Vice President Richard Murray bearich@snip.net**
Jr. Rockhound Coordinator Mel LeCompte 856-783-0969 works-in-faith@comcast.net	**Recording Secretary Grant Elliott 856-728-1731 gle@verizon.net**
Website Coordinator Terry Wilson 609-714-1309 terry@dvess.org	**Special Events Coordinator Ann Lynne Benson 856-783-0969 SeleniteQueen@gmail.com**
Treasurer, Program Chair, Membership Chair Gary Weinstein 856-234-0708 - home 856-795-5077 - work garyskyrock@hotmail.com	**DVESS Newsletter Editor Carol De Cuzzi 856-428-0621 - home decuzzic@comcast.net or DVESS@int-pro.com**

** NOTE E-MAIL ADDRESS CHANGES **
DUE TO COMCAST'S MESSING AROUND WITH THEIR E-MAIL ACCOUNTS

WORD PUZZLE #13

by Ed Lovejoy and

C	E	C	A	K	C	S	E	T	I	R	O	U	L	F	C
E	H	M	H	C	Y	H	U	B	T	N	I	L	F	H	H
E	T	A	E	O	E	N	R	O	X	I	D	E	A	E	A
T	K	I	L	R	N	S	O	Y	E	C	D	L	Y	R	B
I	P	T	R	C	A	D	A	D	S	C	C	E	A	K	A
D	L	G	B	H	O	L	R	R	E	O	A	F	L	I	Z
B	E	R	R	O	T	P	D	O	P	C	C	T	C	M	I
Y	I	K	E	H	U	Y	H	Y	D	O	L	O	E	E	T
L	S	A	C	T	I	N	R	A	R	I	S	A	L	R	E
O	T	E	C	I	S	I	D	E	N	E	T	Y	H	L	C
M	O	R	I	C	T	U	J	A	T	I	A	E	R	C	A
I	C	T	A	E	L	K	L	T	R	I	T	L	M	H	X
R	E	S	P	E	R	I	T	E	E	Y	N	E	G	A	C
R	N	A	I	N	O	S	H	T	I	M	S	A	R	A	N
E	E	T	I	L	E	D	I	E	R	P	O	O	Y	R	R
F	R	O	C	K	H	O	U	N	D	A	B	C	T	K	S

BORAX
BRECCIA
CHABAZITE
CHALCEDONY
CHALCOPHANITE
CHALCOPYRITE
CHONDRODITE
CHRYSOCOLLA
CHRYSOPRASE
CLAY
COMET
CRETACEOUS
EMERALD
ERYTHRITE
ESPERITE
FERRIMOLYBDITE
FLINT
FLUORITE
FRIEDELITE
HERKIMER
ICE
KTBOUNDARY
KYANITE
LUSTER
OXIDE
PLEISTOCENE
REALGAR
ROCK
ROCKHOUND
SMITHSONIAN
STREAK

Delaware **V**alley **E**arth **S**cience **S**ociety, Inc. (DVESS)
P.O. Box 372
Maple Shade, N.J. 08052
DVESS Website : http://www.dvess.org

RETURN SERVICE REQUESTED

What happens when you find a feathered dinosaur that really isn't meant to have feathers? That's the question set by a spectacular new fossil that adds a confusing dimension to the origin of feathers.

The concept of dinosaurs with feathers is no longer surprising. Birds certainly have them and they are now considered to be living dinosaurs. The infamous *Velociraptor* and its relatives were covered in plumes, which ranged from the simple quills of *Sinosauropteryx* to the flight-capable plumes on *Microraptor's* four wings. We know about these prehistoric feathers through the beautiful fossil impressions they have left behind, but a new set of impressions may be the most impressive yet.

They were discovered by Chinese scientists led by Xiao-Ting Zheng, who named their new discovery *Tianyulong confuciusi*, after the museum that Zheng works in and the famous Chinese philosopher. Its small, agile body, about the size of a cat, was covered in long, hollow filaments that closely resemble the primitive "proto-feathers" (or colloquially, "dinofuzz") of other dinosaurs. What makes *Tianyulong* unique is that it is a very distant relative of all these other feathered species.

So far, all feathered dinosaurs are theropods, a group of two-legged and (mostly) carnivorous animals that included *Tyrannosaurus* and *Velociraptor*, and indeed, modern birds. The theropods belong one of the two major groups of dinosaurs, the Saurischia. *Tianyulong*, however, is a clear member of the other dinosaur lineage, the Ornithischia, which include the various armoured, horned, spiked and duck-billed species. This is the first time that anyone has discovered an ornithischian with feather-like structures all over its body.

More specifically, *Tianyulong* is a heterodontosaur, a group of small plant-eaters that are the most primitive of the ornithischians. Its position in the dinosaur family tree raises big questions about the origins of feathers. If its filaments are related to the proto-feathers of the theropods (which is possible but not certain), they either evolved independently or were derived from filaments that covered the very earliest of dinosaurs.

Judging by the state of its bones, Zheng's specimen was probably a young adult that measured 70cm in length (and most of that in its tail). Even without the potential feathers, it would be an interesting find, for most other heterodontosaurs lived in Africa during the Jurassic period. Tianyulong, on the other hand, hailed from Cretaceous China, making it a "living fossil" that was removed from other members of its family in both time and space.

On its skeleton, Zheng found three patches of filaments on the underside of the neck, the back and the tail. Unlike the more complex structures of birds and some other dinosaurs, Tianyulong's filaments were single structures that never branched. They were very gently curved but otherwise

rigid - no bends or waves were found. Those on the tail were especially prominent, measuring about 7cm in length (about a tenth of the creature's entire body) and about half a millimetre in width. Some of them also had a dark stripe down their middle, a classic sign that they were hollow tubes.

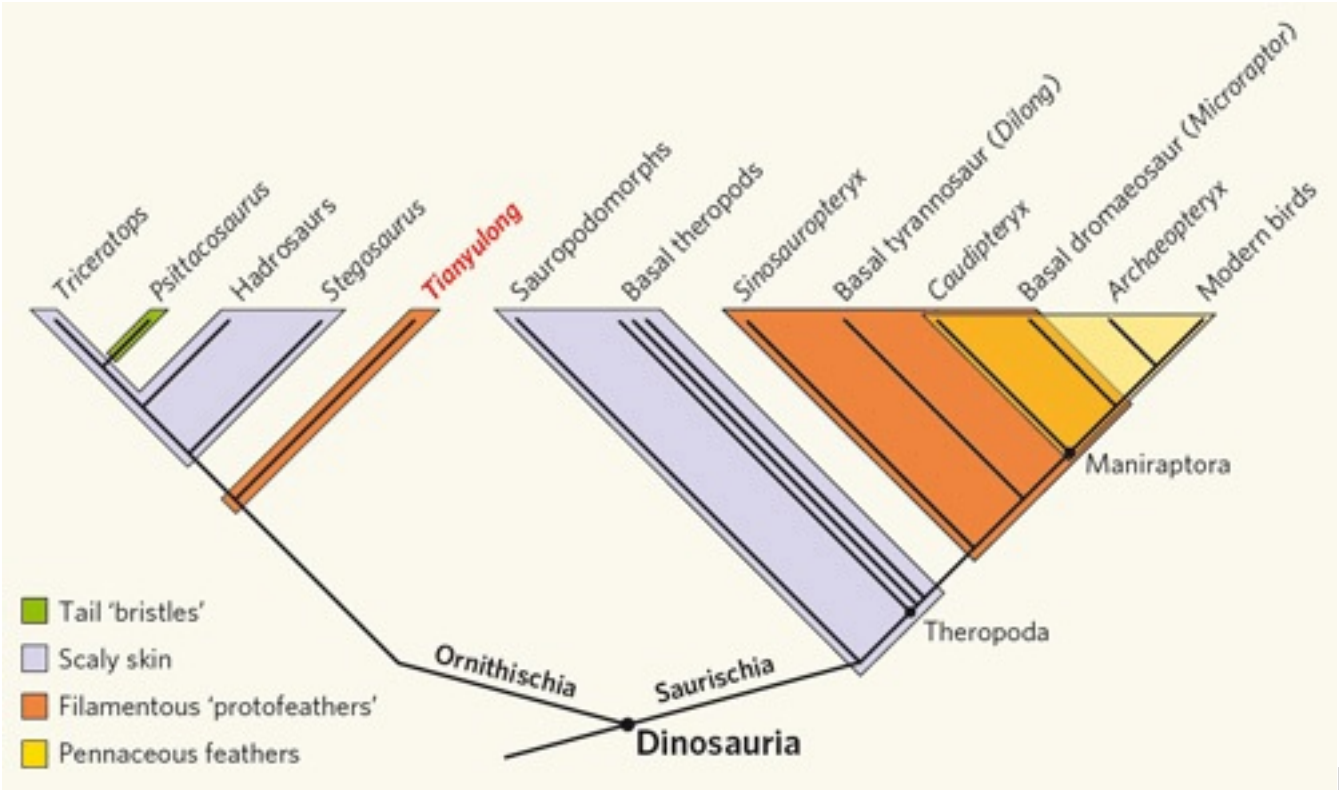
Some scientists have argued that other dinosaur proto-feathers are actually fibres of collagen that have come loose from the animals' skins. That would certainly make them less interesting, but collagen fibres are solid structures; based on the long, hollow nature of *Tianyulong*'s filaments, Zheng rejects this explanation. To him, they clearly stuck out from the animal's skin.

The big question is whether *Tianyulong*'s filaments were actually related to the proto-feathers of the theropods. Zheng can't be sure based on a single specimen, but he notes that there are definitely similarities. Among the theropods, the proto-feathers of *Sinosauropteryx* were most similar to those of *Tianyulong* - they were shorter and more slender, but they also didn't branch. They also have similarities to the feathers recently found on *Beipaiosaurus*, which were hailed as the simplest yet discovered.

It's possible that *Tianyulong*'s filaments evolved independently from those of theropods. Indeed, no one has found evidence of proto-feathers in the earliest species of theropods, which suggests that the last common ancestor of this group didn't have them.

The more intriguing idea is that *Tianyulong*'s filaments were a direct part of the evolutionary lineage that led to true feathers, which would mean that the common ancestor of saurisichians and ornithischians was fuzzy. It could have had simple filaments that were retained by *Tianyulong*, developed into true feathers by the theropods, and lost in many other lineages. Zheng thinks that the similarities between *Tianyulong*'s filaments and those of *Beipaiosaurus* supports this idea.

Only one other ornithischian, an early horned dinosaur called *Psittacosaurus*, had similar structures but its filaments were sparser, more rigid and only found on its tail. Perhaps these too were elaborate versions of some ancestral filament, borne by the earliest dinosaurs some 230 million years ago.



In a related editorial, Lawrence Witmer says:
"Perhaps the only clear conclusion that can be drawn... is that little *Tianyulong* has made an already confusing picture of feather origins even fuzzier. Such an outcome is common in palaeontology. But the prospects of new fossils, new molecular and imaging techniques, and even new ideas, offer the hope of bringing the evolutionary picture into sharper focus -- and that picture may well end up being of fuzzy dinosaurs."

Reference: Zheng, X., You, H., Xu, X., & Dong, Z. (2009). An Early Cretaceous heterodontosaurid dinosaur with filamentous integumentary structures Nature, 458 (7236), 333-336 DOI: 10.1038/nature07856
Image: Reconstruction by Li-Da Xing