

The Spectrum

Darwin Christy, Editor

JANUARY - FEBRUARY 1980

January meeting:----The next regular meeting will be held on January 11, 1980 at the New Science Building at Buffalo State, Elmwood Ave., Buffalo, N. Y. starting at 8:00 PM. Our speaker for the evening will be one of our own members on the subject of "Deep Sky Wonders." He has, in the recent past, talked to many other clubs of the NFCAAA. He is one amateur who has seen, as well as photographed, the entire Messier Catalogue. Director of our observatory at Beaver Meadow, let us welcome Tom Dessert.

?????????QUIZ?????????

- #1- How many elements are there to define a planetary orbit?
- #2- What are the planetary magnitudes?
- #3- What two planets can transit the Sun?

February meeting:----On February 8, 1980, our meeting place will change to the Museum of Science on Humboldt Parkway, Buffalo, N. Y. It will start at 8:00 PM, and we plan to have our speaker from the State University of New York at Buffalo. He is the professor of Astronomy and Physics. He has performed as our guest speaker many times before. With a topic in "Biological Astronomy," please welcome Dr. Lyle Borst.

MY HUSBAND THE ASTRONOMER

Esther L. Goetz

Celestial bodies throw down no rope
He has to climb them thru his 'scope
In finder's eye he hoards such things
As Jupiter's moons, as Saturn's rings
Diamond Venus Ruby Mars
His jewel case is filled with stars
While mine is bargain basement buys
I wish I weren't so penny-wis!

From her SORRY ABOUT THAT collection

An error was made in the last Spectrum - Dr. Fred Price's telephone number should be corrected to 878-5203

NOTICES

The Spring meeting of the NFCAAA will be hosted by the London Centre, RASC, London, Ontario, Canada. More details to follow.

The Syracuse Astronomy Society's Summer Seminar will be held July 11-13, 1980 at their observatory near Vesper, N. Y. about 12 miles south of Syracuse, off Interstate 81. They announce that nominations for SAS/NFCAAA recognition awards will be sent out before then.

-Membership Involvement-

Lillian VonGerichten has accepted the position of welcoming new members, Prospective members, and guests to our meetings. Thank you Lillian. I believe she will appreciate anyone caring to give her a helping hand.

Adrienne Kimble has been doing a fine job keeping the club members fattened up after the meetings with coffee, tea, hot cocoa and donuts. It was a tough job at first, but she is an old hand at it now. Thanks Adrienne.

Observations

Carl Milazzo observed Mira (4.2 mag.) on October 20, 1979 and on the same day counted 63 Sun spots. On October 31st at 6:30 AM EST, no rings were visible around Saturn as seen with a 3½ inch Questar.

SPY AND TELL

Edith L. Geiger

Orrin Christy arrived in Tokyo November 27th, to set up a printing press as a representative of Moore Business Forms. He installed the printing head of which he was instrumental in both the design and operation. While in Tokyo, he was invited to dinner where he was served sushi (raw fish) with chop sticks. What a gastronomical challenge! He also had the opportunity of meeting Darwin's friend, Shigeru Morikubo, a fellow micrometeorite specialist.

In November, Ken Biggie and family spent a weekend seeing Baltimore, and visiting Annapolis and the Naval Academy, and taking a four hour walk in Washington. A real "weekend special."

Bob Reilly is a snowmobile enthusiast and has relished the snow in the southern tier. He also has an ardent interest in antique cars.

Tom Dessert has been giving a number of lectures of late. He spoke to the Syracuse Astronomical Society on the benefits of an astronomy club to the astrophotographer. He spoke on the same subject as one of the speakers at the NFCAAA in Lockport. He spoke again to the Lockport Astronomical Society on the Messier list. In December, he will speak to the RASC Niagara Falls Center, and in April to the Astronomy Section in Rochester.

Darwin Christy has removed his 8" telescope from his Honeyhouse Observatory to make room for his 12.5" which he is completing soon. (Completed December 24th)

5 YEARS AGO - Ernst Both spoke on "The Changing Face of Mars" in January and Dr. Antoinette Mann Paterson was scheduled to speak on "The Infinite Worlds of Giordano Bruno" in February. I think Dr. Paterson's talk was postponed because of illness.

The fund raising drive for the Beaver Meadow Observatory was gaining momentum at this time; \$1420 had been raised by January 1975. However, we saw by then that we couldn't raise enough money to buy a dome and so we settled for the roll-off roof design. Bob Mayer had just completed the unique mounting of the 4 1/4 inch guide scope that allows off-axis guidance in two dimensions.

10 YEARS AGO - "Orbital Mechanics" was the first topic of the new decade. The late Dr. Seville Chapman, Chief Scientist at Cornell Lab and BAA member, spoke at the February meeting. He was supposed to speak in January, but a snowstorm caused that meeting to be cancelled. Articles on the Zodiacal Light and on Pulsars by Ernst Both and Fred West respectively were featured in the Spectrum.

15 YEARS AGO - Our speaker for January 1965 was Walter Semerau whose topic was the construction of an automatic solar observatory. Fred Price spoke on "Lunar Ray Systems" at the February meeting.

The College of Fellows was inaugurated in January with four members elected to it. They were Ernst Both, Rudy Buecking, Ed Lindberg and Walt Semerau. We were working on the Newstead Observatory then, planning to purchase a mirror cell, a diagonal support system and an eyepiece focusing assembly. An anonymous article "Jupiter, Giant Among the Planets", appears in February's Spectrum. Who writes these anonymous articles anyway?

25 YEARS AGO - The February meeting was held at the Museum of Science as part of an open house. "Jumping Jupiter, By Gemini" was the topic; it was described as a special event--whatever that means. Was Jupiter in Gemini in 1955? Let's see--that's 25 years ago--just over two sidereal periods. It's in Leo now, subtract one sign of the Zodiac or a little more for the extra year and we wind up in Cancer. Pretty close!

STUDY GROUP

Ken Kimble

The study group met in November to discuss galaxies. Al K. gave a talk which was a review of Scientific American articles covering galaxies, followed by some of his own observations.

Tom Dessert brought his collection of photographs and the Hubble Atlas which we used as reference for a group discussion. John Raymonda explained methods used in acquiring data on our own galaxies.

Al K. and myself discussed plans for a club book lending system, consisting of a card file system which would be kept listing books & magazines which club members would be willing to lend to other members. You would NOT be required to lend books to qualify for borrowing. Enough study group members expressed interest so that we will go ahead with the system. For more information contact Al K. (694-1317) or Ken Kimble (692-5068).

We decided that planetary nebulae will be the topic for February. January will be a discussion on spectroscopy led by John Raymonda. Should be a good one. See you then.

Born in Cheektowaga, Al Kolodziejczak received his elementary school education at Our Lady Help of Christians Church School and during that time became an altar boy at the church. Being a deeply religious youth, he decided to study for the priesthood and entered a special high school, Divine Word Missionaries, in Girard, Pennsylvania. While in high school he took an active part in sports, especially football and track. After three and a half years in Girard, he returned to Buffalo to spend his last semester at Bishop Turner High School.

Al moved into an apartment when he was 18, and instead of going to the seminary, enrolled as a philosophy major at the University of Buffalo. His own philosophy took a turn and he gave up his intention of becoming a priest.

In his junior year he married Marie Catalano, and took the following year off from his studies. He returned to finish his senior year, during which time his daughter, Buffie, was born.

Along with his philosophy courses at U.B., Al took social science subjects, and went on to Buff State to get his Master's degree in social studies education. From college he went to his present position at Sweet Home High School, where he has been for nine years teaching social studies in grades 9 through 12. At present, he teaches four classes in Afro-Asian culture, and a science fiction class opened to any student from 9th to 12th grade. He also has an astronomy club and is advisor to the chess club.

After school hours, Al works with a voluntary group of students doing stimulating large scale projects. These young people are constructing a 19 foot geodesic dome modeled on the icosahedron of Buckminster Fuller. The students are heating the dome with solar panels. They are also building a 200 watt wind generator (windmill), the tower of which is 15 feet high. This generator will power a pump that will run water through the solar collectors thus heating the dome.

Al has a variety of interests, one being kite flying. He has, through his skill, managed to fly kites a mile out (not up) with his guiding hands. He had a 10 speed cycle with which he took numerous jaunts. One was a junket to Erie, Pennsylvania, while he was in 7th grade.

He is an inveterate traveler, using the hitchhiking technique. Between high school and college, he went on a three week hitchhiking trip to California via the northern route, returning by way of the southern route. In college he hitchhiked to Florida for his Christmas vacation. One of the people who responded to his thumb was a youth who ran out of gas when arriving in Saint Augustine. As Al gazed around this oldest city in the United States, he became so impressed that he decided that this was the ideal spot for his vacation. He has continued to return again and again to this picturesque town touched by much of our early history. The Saint Augustine chronicle does not end here, as this city was also to change the lives of his parents. His folks had never taken a vacation, but through Al's gentle persuasion, they agreed to fly to Saint Augustine, while Al traveled using his usual method. They were reunited in Saint Augustine where Al proceeded to show them the beauty and resources of the city. They, like Al, were so impressed that as of now they have been permanent residents in this beautiful, very old city, for 10 years.

Today most of his peregrinations are planned with an art gallery in the chosen city as the focal point of his trip. Al is deeply

engrossed in art appreciation over a broad spectrum of styles and periods. He is enthralled by the Renaissance artists and the French impressionists. He is captivated by the Rembrandt masterpieces and the works of Picasso and Dali. His favorite sculptors are Constantin Brancusi, one of the great abstract sculptors of the 20th century, Alexander Calder, noted for his hanging sculptures and outdoor sculptures of large sheets of steel, and Kenneth Snelson, famous for his free standing structures. Architectural favorites are those of Frank Lloyd Wright, and the stark futuristic styles of today's architectural designs. He hopes someday to fulfill his dream of visiting the Louvre.

Along with Al's interest in art, he has a great love of music. He enjoys relaxing with a fine recording rather than hearing a live performance. He is deeply impressed by the works of Beethoven, especially his Ninth Symphony, Bach, Brahms, Rachmaninoff, Debussy, Stravinsky, and some of the atonal music of composers such as Lucas Foss and John Cage. WNED's musical offerings provide Al with many hours of enjoyment.

Much of his time is spent in reading current events, political articles, magazines such as Scientific American and Time, and the science fiction of Isaac Asimov.

Al is greatly concerned about three major problems facing humanity: that of world poverty, world development and world population. He hopes that in some way he will be able to help.

His marriage was dissolved in 1977, but he sees his nine year old daughter often. She is an excellent student at St. Andrews and is also a fine young artist.

Al first became interested in astronomy through science fiction. Then, as a result of viewing the 1978 B.A.A. exhibit at Erie Community College South Campus, and the suggestion of a girl friend that astronomy would make a fine hobby, he decided to pursue the subject further. He has a 20 x 60mm monocular and has access to a celestron 8. He has spent many hours at Beaver Meadow observing deep-sky objects, and has attended meetings of our study group. A trip to Scout Haven, where several B.A.A. members assisted with an astronomy program, proved to be most enjoyable.

Al is a member of western New York's Peace Center and the American Civil Liberties Union. He received an outstanding honor by being accepted into Mensa, an organization for people with high IQs. He has the distinction of being in the top 1% of the world.

Though Al has been a member of the B.A.A. for a short time, he has made many friends and has been active in our various activities. He is serving his first term on our Board of Directors, and assists our association wherever possible. Al is an indefatigable gentleman with a keen mind and a zest for living, and is a noteworthy member of the B.A.A.

JANUARY CONSTELLATION

There are two dogs in the skies, one of which is Canis Major (the greater dog) and has a star with a magnitude of -1.4, Sirius. This constellation is bordered on the north by Monoceros, the East by Puppis, the west by Lepus and the southeast by Columba. It is entirely below the celestial equator. About 4 degrees south of the Dog Star Sirius is one of Messier's objects, M-41 which is visible to the naked eye. Even though this constellation is quite conspicuous in the sky, few objects are within its bounds. Besides Sirius being a double star (binary), Nu 1, Mu, and Epsilon Canis Minoris are double stars. It is

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within rich star fields of the Milky-Way and worth your efforts to observe with a pair of binoculars.

FEBRUARY CONSTELLATION

The other dog in the sky is Canis Minoris (the lesser dog) and it, too, has a star of first magnitude, Procyon. This constellation is less conspicuous and has few objects to observe. It is bounded on the north by Gemini, the east by Cancer and Hydra, the west and south by Monoceros. Its entirety is in the northern celestial sphere. Objects of interest are Eta Canis Minoris, a double star; R and S being variable stars. This constellation borders on the Milky-Way and does have rich field star background.

METEOR SHOWERS

January	3 - Quadrantids
	17 - Kappa Cygnids
	17 - Coma Bereniciads
February	9 - Aurigids

By the time of publication, the Quadrantids will be history, but for we here in the northeast US of A would not have seen them anyway. They only last about 6 hours and were maximum at 1:00 PM. The Kappa Cygnids which are greatly composed of Fireballs will give up maybe 3 or 4 hourly; but spectacularly. Mixed with these will be the Coma Bereniciads which will be insignificant this year even though it will be New Moon.

The Aurigids in February will be the shower to watch in the cold weather. It should produce about 30 2nd to 3rd magnitude meteors for two or three nights preceding and following the maximum on the 9th. It might be worth the while to brave the cold during this meteor shower.

ON THE ACCURACY OF LUNAR MAPS AND DRAWINGS

Fred W. Price

Amateur lunar observers spend much of their time searching for fine detail on the moon's surface and recording it in the form of charts or drawings. Observers often take considerable pains to delineate lunar detail accurately; yet oddly, this is often inserted on a background of coarse detail that is frequently carelessly and inaccurately drawn. Careful comparison of the representations of various lunar formations in several lunar maps and charts often reveals astonishing lack of agreement among themselves and inaccuracy in the mapping of even quite large formations on the lunar surface.

Several years ago, Henry Brinton, writing in the British Astronomical Association's periodical 'The Moon' (vol 9 (1) page 6) pointed out the lack of agreement in the various lunar maps in the charting of the Nasmyth-Phocylides-Wargentia area of the moon. Compared with a photograph of the region, the maps of Neison, Elger, Goodacre and Wilkins all differed from the photograph and among themselves with regard to the relative sizes and positions of these three objects and the distances between them. Since this area of the moon lies very close to the limb, the perspective is foreshortened and is strongly subject to librational effects so that perhaps there is some excuse for these discrepancies in the maps. After all, the authors had undertaken the task

of mapping the entire lunar surface as seen from the earth and were not especially concentrating on this single area. One might imagine, therefore, that large formations close to the apparent centre of the moon's earthward hemisphere would be the most accurately charted because there is no foreshortening and the effect of libration on the apparent topography is minimal. Let us see.

One of the largest formations on the moon's earthward hemisphere is the great walled plain Ptolemaeus (diameter over 90 miles), located near the centre of the apparent disc. Photographs of Ptolemaeus show that under late morning and early evening illumination it is an almost perfect regular hexagon with well-defined vertices. Yet when we consult different lunar maps and compare the delineations of Ptolemaeus, considerable deviations from the hexagonal shape are seen in most of them as compared with the photograph and much disagreement among themselves as a glance at the accompanying drawing will show. (The gross outline of Ptolemaeus has been emphasized in each of the separate sketches rather than the intricate detail of its complex walls.)

Several other examples may be quoted; on two consecutive evenings in November 1978, I observed with my 8-inch reflector and made drawings of the crater Godin (diam. 27 miles) under morning illumination at the time. The shape of this formation is an irregular pentagon. On comparing my delineation of Godin with those in the various maps I found discrepancies. Elger shows it as roughly elliptical, the N-S axis being the longer, Neison shows it as diamond-shaped which is almost correct, Goodacre as a somewhat distorted circle and Wilkins as perfectly circular. Lohrmann shows one half of the wall as consisting of three straight sections, the remainder as a semicircle.

Two other formations that I have observed carefully are the craters Pytheas (diameter 12 miles) in the south part of Mare Imbrium and Calippus (diameter 19 miles) located in the Caucasus mountains. I find that Pytheas is decidedly rhomboidal in shape in agreement with Wilkins's description ('The Moon', 1955) although in his map he shows it as elliptical with the N-S axis the longer. R.A. McIntosh also depicts it as roughly elliptical in three observational drawings (B.A. A. Moon, vol. 9 (1) p. 17, 1960).

Calippus is quite obviously irregular in shape. Wilkins describes it as 'somewhat deformed being decidedly oval from east to west' and shows it as elliptical in his map. In an observational drawing R.A. McIntosh gives a better representation of the true shape but still not absolutely correctly (B.A.A. 'Moon' vol. 9 (2) p.28, 1961).

One could continue almost indefinitely on this subject. Why do lunar observers make such mistakes in delineating the shapes of sizeable lunar formations? Since we cannot attribute the effects of foreshortening and libration as causative of the discrepancies in the various representations of Ptolemaeus, what other causes can there be? It would be foolish to suggest that simple error is the reason in the case of selenographers of the stature and reputation of Maedler especially; but what is one to think? It seems unlikely that the use of photographs or 'modern technics' can entirely account for the greater reliability of modern lunar maps such as that produced by the U.S.A.F. because Wilkins used photographs and worked in fairly recent times like many others. Perhaps preconceived notions of how lunar craters were

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formed may unconsciously affect the way in which an observer draws crater shapes; an impact enthusiast may be inclined to draw an awkwardly shaped irregular crater with a more 'believable' circular outline.

However, it is not the purpose of this short article to attempt a complete analysis or explanation of the reasons for errors in the work of lunar cartographers for the simple reason that in my present state of knowledge of the possible psychological or even physiological factors involved, it would be imprudent to speculate further. But I hope that by documenting these few examples of errors in lunar maps, some of our lunar enthusiasts may be stimulated to make similar comparative studies of the reliability of lunar charts. An interesting investigation would be to ascertain whether some lunar formations are erroneously depicted more than others and if so to try and determine why. This whole subject provides food for thought and any ideas about, or discussion, of the possible causes of errors in lunar mapping would make interesting reading in future issues of the 'Spectrum'.

NOTE FROM THE EDITOR: We were unable to include the drawings which accompanied Dr. Price's article, however, copies will be available at Edith Geiger's desk at the January meeting.

SEEING STARS AND PLANETS IN THE DAYTIME

Carl Milazzo

For me, it all started by accident one morning back in November 1970, when I was just a beginner in astronomy. I woke up early that morning to look at the planet Venus with a 2.4 inch telescope. It was about an hour before sunrise, and the color of the sky was changing from dark to gray, to orange and finally turning to deep blue. Besides the telescope, I was also using binoculars and the unaided eye, watching Venus rise higher above the eastern horizon. Then suddenly I realized that the Sun had just risen and yet Venus could still be easily seen by the unaided eye. So technically, I was seeing Venus in the daytime. After that I walked away from the telescope to continue with my daily activities but returned every hour or so. Each time Venus moved 15 degrees farther west as I returned. The telescope I had, had no motor drive to follow Venus automatically, so to help find Venus again, I would estimate 15 degrees by using two extended arms with clenched fists, this method equals about fifteen degrees, and Venus was visible even at noon with the unaided eye. One problem in the daytime is that the eye is out of focus when one stares at a blank sky, making Venus look like a faint blob. To make your eye focus at infinity, align a distant object such as a tree, flag pole or utility pole, or even a tall house or building; even the crescent Moon with Venus and standing in the shadow of those objects is helpful to correct the blurredness. A slight haze or thin clouds will make it nearly impossible to find, so a deep blue sky is necessary, which is more common in the mornings. If you first use binoculars to locate Venus, this makes it easier to find with the unaided eye. Besides seeing Venus in the daytime, over the years I have seen the planets Mars, Jupiter, Mercury, and Saturn. At night, the yellowed colored planet Saturn as seen through a telescope has its usual black background, but in the daytime, the background is a beautiful blue. I have not yet had a chance to look for stars in the daytime, but there is not any problem seeing them. Many people, for years, have found stars during the daytime and I hope to in the near future.

During the month of August '79 while Marty was at Audubon West, my two boys, Donald and Bob, and I took advantage of our temporary freedom by way of a rather extensive road tour to the land of astronomical publishers. I had wanted to do this for some time as I seemed to be getting nowhere by submitting pictures. The thought behind the tour was to find out what kind of material the various editors were looking for.

First we did the "24 hours of Boston." It was an endurance trip of 450 miles to Boston, a 6 hour visit with Dennis di Cicco, Asst. Editor at Sky and Telescope, and 450 miles back home. Dennis was interested in our equipment and accomplishments and has requested a list of all the objects I have photographed thus far, well over 1000. As even I don't have all my pictures cataloged yet he may have to wait a bit.

The following week, we took off on the grand tour. Leaving Buffalo at 5 P.M., we arrived at Ludington, Michigan at 2:30 A.M. to board the auto ferry for a 6 hour trip across Lake Michigan. We reserved a stateroom and managed to get 4 hours sleep before having breakfast and then arriving at Milwaukee. Without too much trouble, we located AstroMedia Corp., home of Astronomy magazine and spent a very pleasant day in the company of Richard Berry, Editor, and his staff. Richard gave us the grand tour of their modern computer assisted facilities. After reviewing the material we brought with us, he suggested that I prepare a feature on my most unusual galaxy photos for a two page spring edition special. I told him I would be pleased to do so and am working on the project currently. We left Milwaukee at 4 P.M. and with the capable assistance of my co-pilot and navigator, Bob and Don, arrived at my brother's home at Dayton, Ohio at midnight. We were able to visit David Eicher, editor of Deep Sky Monthly, at his home outside Cincinnati, Ohio the next day. David is about 18 yrs. old and I was very impressed with his enthusiasm and responsible manner. He requested over 100 pictures, since he has not as yet developed an extensive photo file. I am working on getting him the pictures a little at a time. After resting at my brother's home and visiting the Air Force Museum at Wright Patterson AFB, we headed out for Triange, Virginia and the home of Robert and Susan Price, publishers of the Astrograph. Over 500 miles from Dayton, we arrived about 6 P.M. and once again displayed all our wares. Bob Price was more interested in articles on the "how to" variety and so I find myself explaining to others the "secrets of the successful astrophotographer." Simply put: to have a willing and helpful club behind you.

The trip lasted about 10 days and we traveled over 3000 miles (150 on water). We found that each editor had different requirements for his magazine. We went out to meet the people in charge and get their views and gave them ours.

It was very much a success. My articles now regularly appear in all the magazines where I hope to influence others to try, as I did, to seek advice and assistance from their various organizations to achieve success in their interests in astronomy.

BOYSCOUTS AND THE B.A.A.

Ken Kimble

Last spring the BAA was engaged to put on a presentation for the Boy Scouts. On Saturday, October 6, 1979 Al Kolodziejczak, Carl Milazzo, Rowland Rupp, and myself, went to Scouthaven near Arcade to give a talk and telescope demonstration. We took Rowland's RV-6 and

Al's 8" Celestron.

The first thing we did when we got there was to sit down to fried chicken followed by rice pudding. After gorging ourselves, we went to the meeting building where we sat in on a program of skits and group singing.

Following their regular meeting, we gave a short talk about telescopes, after which, Al and Rowland went outside to set up their equipment, while Carl and I fielded questions. Miraculously, the sky which had been overcast and stormy all week, cleared for about an hour enabling some good viewing although the moon was full.

After some more questions (I was hit with several of the black-hole variety) and some discussion, our program ended and the sky clouded over. We were then treated to coffee and donuts to warm us up for the long drive home.

Our group has promised to continue assisting the Boy Scouts with presentations and astronomy merit badge counseling.

ANSWERS TO THE QUIZ

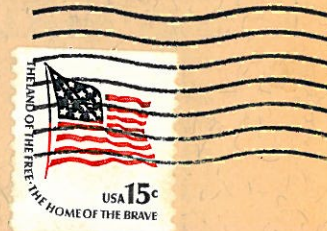
#1- SEVEN - The semi-major axis, eccentricity, inclination between the planes of the orbit and the ecliptic, Longitude of the ascending node, longitude of perihelion, epoch, and mean motion.

#2- These are measured in the same scale as the apparent magnitudes of stars. The magnitude of the planet is very viable, depending upon its distance from both the Sun and the Earth and upon its phase.

#3- Mercury and Venus. None of the others pass between the Sun and Earth. The Moon is a satellite, NOT a planet.

The Buffalo Astronomical Assn., Inc.
c/o Darwin Christy, Editor- The Spectrum
216 Kohler Street
Tonawanda, New York 14150

FIRST CLASS

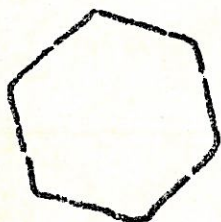


Mr. & Mrs. Rowland Rupp
132 Burroughs Dr.
Snyder, N.Y. 14226

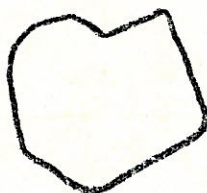
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OUTLINE OF THE LUNAR WALLED PLAIN PTOLIMAEUS ACCORDING TO VARIOUS AUTHORITIES.

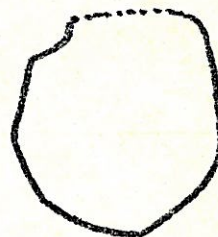
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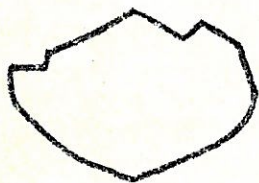
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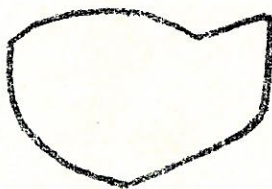
Beer and Maedler (1834)



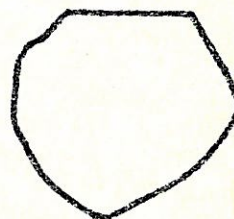
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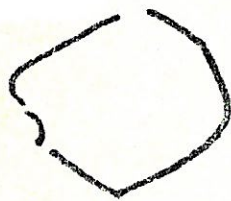
Maedler (1837)



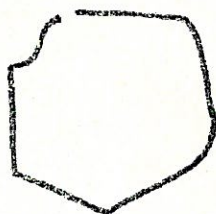
Neison (1876)



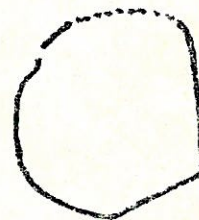
Schmidt (1878)



Elger (1895)



Goodacre (1931)



Wilkins (1958)

