

**ART. IV.—*New Classification of Meteorites, with an Enumeration of Meteoric Species*; by CHARLES UPHAM SHEPARD.**

THE arrangement here proposed differs so widely from the two formerly put forth by me, as to be really new. The changes introduced will, I trust, appear as flowing naturally from the recent progress of the study. The localities by which the system is illustrated are such as are represented in my collection, now deposited in Amherst College. A number of localities found on my previous lists as well as upon those of others, are omitted,

either because a degree of doubt hangs over their meteoric origin, or for the reason that they have suffered artificial alteration, or been too largely exposed to terrestrial decomposition.

# CLASSIFICATION OF METEORITES.

<p><b>CLASS I.</b> <b>LITHOLITES.</b> Stoney. (Λίθος, a stone.)</p>	<p>Sub-Class I. <b>EUCRITIC.</b> <i>Crystalline: earthy individuals distinct.</i> (Ευκρίτος, distinct.)</p>	<p>Ord. 1st. <i>Feldspathic.</i> Contains one or more species of feldspar. Ord. 2nd. <i>Augitic.</i> Contains augite.</p>
	<p>Sub-Class II. <b>DYSCRITIC.</b> <i>Earthy individuals indistinct.</i> (Δυσκρίτος, indistinct.)</p>	<p>Ord. 1st. <i>Psammitic.</i> (Ψάμμος, sand.) Has the structure of sandstone. Ord. 2nd. <i>Hoicardic.</i> Compactly massive. Ord. 3rd. <i>Oolitic.</i> With oolitic grains. Ord. 4th. <i>Porphyritic.</i> Sub-porphyrilic. Ord. 5th. <i>Basaltic.</i> Trappean.</p>
	<p>Sub-Class III. <b>ANTHRACIC.</b> <i>Black.</i> (Ανθραξ, coal.)</p>	<p>Ord. 1st. <i>Alalene.</i> (Αλάς, soft.) Friable. Ord. 2nd. <i>Anatalene.</i> (α, privative and ατάτος, firm.) Firm.</p>
<p><b>CLASS II.</b> <b>LITHOSIDERITES,</b> Stone and iron, mixed. (Λίθος &amp; Σίδηρος, iron.)</p>	<p>Sub Class I. <b>PLEIOLITHIC.</b> <i>More than half stoney.</i> (Πλειων, more.)</p>	<p>Ord. 1st. <i>Stigmatic.</i> (Στίγμα, a spot.) Iron in round spots.</p>
	<p>Sub-Class II. <b>MEIOLITHIC.</b> <i>Less than half stoney.</i> (Μειων, less.)</p>	<p>Ord. 1st. <i>Mignumic.</i> (Μίγνυμι, to mix.) Stone and iron much mixed.</p>
<p><b>CLASS III.</b> <b>SIDERITES.</b> Chiefly iron.</p>	<p>Sub-Class I. <b>PSATHARIC.</b> <i>Brittle.</i> (Ψαθαρός, brittle.)</p>	<p>Ord. 1st. <i>Chalyptic.</i> (Χάλυψ, steel.) Steel-like.</p>
	<p>Sub-Class II. <b>APSATHARIC.</b> <i>Tough.</i> (Αψαθαρός, tough.)</p>	<p>Ord. 1st. <i>Agrammic.</i> Without lines when etched. Ord. 2nd. <i>Sporagrammic.</i> With scattered lines. Ord. 3rd. <i>Microgrammic.</i> Lines very small. Ord. 4th. <i>Eugrammic.</i> Lines distinct. Ord. 5th. <i>Megagrammic.</i> Lines coarse. [and] Ord. 6th. <i>Tæniastic.</i> (Ταινία, a ribbon.) Banded. Ord. 7th. <i>Nephelic.</i> (Νέφην, a cloud.) Clouded.</p>

## CLASS I. LITHOLITES.

## SUB-CLASS I. EUCRITIC.

ORDER 1st. *Feldspathic.*

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|---|--|
| 1. Stannern, Moravia, May 22, 1908.           | 6. Bialistock, Poland, Oct. 17, 1827.        |
| 2. Juvenas, France, June 15, 1821.            | 7. Nobleboro, Maine, U. S. A., Aug. 7, 1823. |
| 3. Jonzac, France, June 13, 1819.             |  |
| 4. Mäding, Bavaria, Dec. 13, 1803.            | 8. Manegon, July 26, 1843.                   |
| 5. Petersburg, Tenn., U. S. A., Aug. 5, 1856. | 9. Luotolaka, Finland, Dec. 13, 1813.        |

ORDER 2d. *Augitic.*

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|--|-------------------------------------|
| 1. Chassigny, France, Oct. 3, 1815.                    | 3. Ensieheim, France, Nov. 7, 1492. |
| 2. Bishopville, S. Carolina, U. S. A., March 26, 1818. | 4. Shalka, India, Nov. 30, 1850.    |

## SUB-CLASS. II. DYSCRITIC.

ORDER 1st. *Psammitic.*

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|--|--|
| 1. Erxleben, Prussia, April 15, 1815.            | 4. Simbirsk, Russia.                       |
| 2. Bethlehem, New York, U. S. A., Aug. 11, 1859. | 5. Pillistfer, Russia, Aug. 8, 1862.       |
| 3. Kleinwenden, Prussia, Sept. 16, 1843.         | 6. Klein Menow, Mecklenburg, Oct. 7, 1861. |

ORDER 2nd. *Howardic.*

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|---|--|
| 1. Paulograd, Russia, May 19, 1826.           | 21. Kuleschofka, Russia, Mar. 12-13, 1811.     |
| 2. Zaborzika, Russia, April 10, 1818.         |  |
| 3. Mauerkirchen, Austria, Nov. 20, 1768.      | 22. Lissa, Bohemia, Sept. 3, 1808.             |
| 4. Oesel, Baltic Sea, May 13, 1855.           | 23. Bachmut, Russia, Sept. 15, 1814.           |
| 5. Charkow, Russia, Oct. 13, 1787.            | 24. St. Denis, Belgium, June 7, 1855.          |
| 6. Linum, Prussia, Sept. 5, 1854.             | 25. Apt, France, Oct. 8, 1803.                 |
| 7. Castine, Maine, U. S. A., May 20, 1848.    | 26. Linn, Iowa, U. S. A., Feb. 25, 1847.       |
| 8. Alboreto, Italy, July, 1766.               | 27. Politz, Russian Germany, Oct. 13, 1819.    |
| 9. Futtehpur, India, Nov. 30, 1822.           | 28. Nashville, Tenn., U. S. A., May, 9, 1827.  |
| 10. Kakova, Hungary, May 19, 1838.            | 29. Forsyth, Georgia, U. S. A., May, 8, 1829.  |
| 11. Aumières, France, June 4, 1842.           | 30. Deal, New Jersey, U. S. A., Aug. 14, 1829. |
| 12. Utrecht, Holland, June 2, 1843.           | 31. Tirlemont, Belgium, Dec. 7, 1863.          |
| 13. Lucé, France, Sept. 13, 1768.             | 32. High Possil, Scotland, April 5, 1804.      |
| 14. Milena, Croatia, April 26, 1842.          |  |
| 15. Slobodka, Russia, Aug. 10, 1818.          | 33. Moradabad, India, Feb. 1808.               |
| 16. New Concord, Ohio, U. S. A., May 1, 1860. | 34. Durla, India, Feb. 18, 1815.               |
| 17. Girgenti, Sicily, Feb. 10, 1853.          | 35. Yorkshire, Eng., Dec. 13, 1795.            |
| 18. Uden, Holland, June 12, 1840.             |  |
| 19. Buschof, Russia, June 2, 1863.            | 36. Darmstadt, Hessia, 1815.                   |
| 20. Angers, France, June 3, 1822.             |  |

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|---|--|
| 37. Nerft, Russia, April 12, 1864.              | 50. Charwallas, India, June 12, 1834.          |
| 38. Mncerata, Italy, May 8, 1846.               | 51. Berlanguillas, Spain, July 8, 1811.        |
| 39. Dhurmsala, India, July 14, 1860.            | 52. Goruckpore, India, May 12, 1861.           |
| 40. Wessely, Moravia, Sept. 9, 1831.            | 53. Macao, Brazil, Nov. 11, 1836.              |
| 41. Sules, France, March 8, 1798.               | 54. Eichstadt, Bavaria, Feb. 19, 1785.         |
| 42. Puvars, France, Oct. 21, 1844.              | 55. Agen, France, Sept. 5, 1814.               |
| 43. Heredia, Costa Rica, Apr. 1, 1857.          | 56. Château-Renard, France, June 12, 1841.     |
| 44. Vouillé, France, May 13, 1831.              | 57. Doroninsk, Russia, Apr. 10, 1805.          |
| 45. Toulouse, France, April 10, 1812.           | 58. Killeter, Ireland, April 29, 1844.         |
| 46. Constantinople, Turkey, June, 1805.         | 59. Shytal, India, Aug. 11, 1803.              |
| 47. Grüneberg, Silesia, Prussia, Mar. 22, 1841. | 60. Lixna, Russia, July 12, 1820.              |
| 48. Charsonville, France, Nov. 23, 1810.        | 61. Honolulu, Sandwich Isl'ds, Sept. 14, 1825. |
| 49. Aigle (L'Aigle), France, April 26, 1803.    | 62. Alessandria, Piedmont, Feb. 2, 1860.       |

ORDER 3rd. *Oolitic.*

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|---|---|
| 1. Gutersloh, Prussia, April 17, 1851.          | 9. Pegu, India, Dec. 27, 1857.                |
| 2. Nanjemoy, Maryland, U. S. A., Feb. 10, 1825. | 10. Cereseto, Piedmont, July 17, 1840.        |
| 3. Benares, India, Dec. 13, 1798.               | 11. Esnaude, France, Aug. 1837.               |
| 4. Pulaski, Missouri, U. S. A., Feb. 13, 1839.  | 12. Poltawa, Russia, anterior to 1838.        |
| 5. Nellore, India, Jan. 23, 1852.               | 13. Zebrauk, Bohemia, Oct. 14, 1824.          |
| 6. Ausson, France, Dec. 9, 1858.                | 14. Ohabu, Transylvania, Oct. 10-11, 1857.    |
| 7. Timochin, Russia, March 13-25, 1807.         | 15. Cassignano, Parma, Italy, April 19, 1808. |
| 8. Trenzano, Italy, Nov. 12, 1856.              |   |

ORDER 4th. *Porphyritic.*

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|---|---|
| 1. Assam, India. Found 1840?                    | 10. Parnallee, India, Feb. 28, 1857.            |
| 2. Mézo-Madaras, Transylvania, Sept. 4, 1852.   | 11. Nulles, Spain, Nov. 5, 1851.                |
| 3. Chandakapoor, India, June 6, 1838.           | 12. Abkurpore, India, April 18, 1838.           |
| 4. Weston, Conn., U. S. A., Dec. 14, 1807.      | 13. Cabarrus, N. Car., U. S. A., Oct. 31, 1849. |
| 5. Agra, India, March 28, 1860.                 | 14. Okniny, Russia, Dec. 27, 1833.              |
| 6. Siena, Tuscany, Italy, June 16, 1794.        | 15. Tabor, Bohemia, July 3, 1753.               |
| 7. Harrison, Kentucky, U. S. A., Mar. 26, 1859. | 16. Blansko, Moravia, Nov. 25, 1833.            |
| 8. Richmond, Virginia, U. S. A., June 14, 1829. | 17. Serez, Turkey, June, 1818.                  |
| 9. Limerick, Ireland, Sept. 10, 1813.           | 18. Luponnas, France, Sept. 7, 1753.            |
|   | 19. Barbotan, France, July 24, 1790.            |
|   | 20. Tipperary, Ireland, Aug. 1810.              |
|   | 21. Bremevörde, Hannover, May 13, 1855.         |

ORDER 5th. *Basaltic.*

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|--------------------------------------|------------------------------------|
| 1. Chantonmay, France, Aug. 5, 1812. | 3. Segowlee, India, March 6, 1853. |
| 2. Renazzo, Italy, Jan. 16, 1824.    | 4. Mainz, Hessa. Found in 1852.    |

AM. JOUR. SCI.—SECOND SERIES, VOL. XLIII, No. 127.—JAN., 1887.

SUB-CLASS III. ANTHRACIC.

ORDER 1st. *Atalene*.

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|-----------------------------------|--|
| 1. Alais, France, March 15, 1806. | 3. Charleston, S. C., U. S. A., Nov. 16, 1857. |
| 2. Orgueil, France, May 14, 1864. |  |

ORDER 2d. *Anatalene*.

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|--|--|
| 1. Coll Bokkeveldt, Africa, Oct. 13, 1838. | 3. Grosnja, Caucasus, Russia, June 16, 1861. |
| 2. Kaba, Hungary, April 15, 1857.          | 4. Simonod, (Ain) France, Nov. 13, 1835.     |

CLASS II. LITHOSIDERITES.

SUB-CLASS I. PLEIOLITHIC.

ORDER 1st. *Stigmatic*.

1. Hainholz, Westphalia. Found 1856.
2. Sierra de Chaco, Atacama, S. A. Found in 1862.

SUB-CLASS II. MEIOLITHIC.

ORDER 1st. *Mignumic*.

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|--------------------------------------|---|
| 1. Atacama, S. A. Found 1827.        | 5. Taney, Missouri, U. S. A. Found in 1856. |
| 2. Rittersgrün, Saxony. Found 1801   |   |
| 3. Steinbach, Saxony. Found 1751     | 6. Newton, Ark., U. S. A. Found in 1860.    |
| 4. Krasnojarsk, Siberia. Found 1776. |   |

CLASS III. SIDERITES.

SUB-CLASS I. PSATHARIC.

ORDER 1st. *Chalyptic*.

1. Rutherford, N. Car., U. S. A. Found in 1856.
2. Niskornuk, Greenland.
3. Newstead, Roxburgshire, Scotland. Found in 1661.
4. Otaego, N. Y., U. S. A. Found in 1845.

SUB-CLASS II. APSATHARIC.

ORDER 1st. *Agrammic*.

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|--|---|
| 1. Scriba, N. York, U. S. A. Found 1814.     | 4. Botetourt, Virginia, U.S.A. Found anterior to 1845.          |
| 2. Babb's Mill, Tenn., U.S.A. Found 1842.    | 5. Oktibbeha, Miss., U. S. A. Found in an Indian mound in 1856. |
| 3. Smithland, Kentucky, U. S. A. Found 1840. | 6. Wöhler's unknown locality.                                   |
|  | 7. Tucson, Sonora. Found 1850.                                  |

ORDER 2d. *Sporagrammic*.

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|---|--------------------------------------|
| 1. Chester, S. Car., U. S. A. Found 1847. | 3. Dacotah, U. S. A. Found 1838.     |
|   | [in 1832.]                           |
| 2. Walker, Alabama, U.S.A. Found          | 4. Rasguta, New Granada. Found 1823. |

ORDER 3rd. *Microgrammic.*

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|--|---|
| 1. Santa Rosa, (Coahuila) Saltillo, Mex. Found 1850. | 5. Senegal, Africa. Found 1763.                 |
| 2. Tocavita, near Tunga, New Grenada. Found 1823.    | 6. Tucuman, Otumpa, Arg. Rep., S.A. Found 1788. |
| 3. Brannan, Bohemia. Fell July 14, 1847.             | 7. Bilburg, (Eifel) Prussia. Found 1814.        |
| 4. Salt River, Kentucky, U. S. A. Found 1850.        | 8. Bonanza, Mexico. Found 1865,                 |

ORDER 4th. *Eugrammic.*

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|---|---|
| 1. Oxtlalhuaca, Mex. Found 1784.                  | 19. Caillé, France. Found 1828.                             |
| 2. Toluca, Mexico. Found 1784.                    | 20. Nebraska, U.S. A. Found 1856.                           |
| 3. Mani (Toluca valley). Wöhler's 19 lb. mass.)   | 21. Lockport, N. York, U.S.A. Found 1818.                   |
| 4. Ruff's Mountain, S. Car., U. S. A. Found 1850. | 22. Oldham, Kentucky, U. S. A. Found 1860.                  |
| 5. Marshall, Kentucky, U. S. A. Found 1856.       | 23. Durango, Mexico. Found 1811.                            |
| 6. Schwetz, Prussia. Found 1850.                  | 24. Carthage, Tenn., U.S. A. Found 1845.                    |
| 7. Cranbourne, Australia. Found 1861.             | 25. Oregon, U. S. A. Found 1845.                            |
| 8. Robertson, Tenn., U.S.A. Found 1860.           | 26. Bahia, (Bendigo) Brazil.                                |
| 9. Seneca Falls, N. York, U. S. A. Found 1850.    | 27. Agrani, Croatia. Fell May 20, 1751.                     |
| 10. Orange River, Africa. Found 1856.             | 28. Elbogen, Bohemia. Found 1811.                           |
| 11. Oaxaca, Mexico. Found 1843.                   | 29. Lion River, Africa. Found 1853.                         |
| 12. Burlington, N. York, U. S. A. Found 1819.     | 30. Putnam, Georgia, U.S.A. Found 1839.                     |
| 13. Tula, Russia. Found 1846.                     | 31. Aeriotopos,* near Denver City, Colorado. Found in 1866. |
| 14. Wayne, Ohio, U. S. A. Found 1849.             | 32. Asheville, N. Car., U.S.A. Found in 1830.               |
| 15. Lennart, Hungary. Found 1815.                 | 33. Guilford, N. Car., U.S.A. Found in 1828.                |
| 16. Bohumilitz, Bohemia. Found 1829.              | 34. Tazewell, Tenn., U. S. A. Found in 1853.                |
| 17. Texas (Red River), U.S.A. Found 1814.         | 35. Oberrkirchen, Nassau. Found in 1863.                    |
| 18. Madoc, Canada. Found 1854.                    | 36. Dickson, Tenn., U. S. A. Fell July 30, 1835.            |

ORDER 5th. *Megagrammic.*

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|----------------------------------|--|
| 1. Arva, Hungary. Found 1814.    | 5. Cocke, (Sevier) Tenn., U. S. A. Found 1841. |
| 2. Sarepta, Russia. Found 1854.  | 6. Heywood, N. Car., U.S.A. Found 1854.        |
| 3. Zaccatén, Mexico. Found 1792. |  |
| 4. DeKalb, Tenn. Found 1845.     |  |

\* *Aerptos*, lofty and *oros*, place, from its being found over 8,000 feet above the sea.

ORDER 6th. *Tæniastic.*

1. Cape of Good Hope, Africa. Found 1801.

ORDER 7th. *Nephelic.*

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|--|---|
| 1. Black Mountain, S. Car., U. S. A. Found 1835. | 4. Union, Georgia, U. S. A. Found 1853.   |
| 2. Seeläagen, Prussia. Found 1847.               | 5. Pittsburg, Penn., U. S. A. Found 1850. |
| 3. Nelson, Kentucky, U. S. A. Found 1856.        | 6. Tabarz, Thuringia. Found 1854.         |

## APPENDIX TO SUB-CLASS II. Markings not ascertained.

1. Savisavik, Greenland. Found 1850 †  
 2. Benton, Texas, U. S. A. Found 1856.  
 3. Brazos, Texas, U. S. A. Found 1856.

Total number of localities in the collection, 211.

## METEORIC MINERALS.\*

1. CHAMASITE, (*Reichenbach*.)  $\text{Fe}$ , or variable mixtures of  $\text{Fe}$  and  $\text{Ni}$  up to 23 p. c. of the latter.
2. TÄNITE, (*Reichenbach*.)  $\text{Fe}^x \text{Ni}^x$ . ( $\text{Fe}^4 \text{Ni}^3$ . †)†
3. OKTIDBEHITE, (*Shepard*.)  $\text{Fe Ni}$ .
4. SOHRIDERSITE, (*Haidinger*.)  $\text{Fe}^x \text{Ni}^x \text{P}^x$  ( $\text{Fe}^4 \text{Ni}^2 \text{P}$ . †)†
5. RHADITE, (*Reichenbach*.)  $\text{Fe}^x \text{Ni}^x \text{P}^x$ .
6. CHALYPITE, (*Shepard*.)  $\text{Fe}^x \text{C}^x$ . Forchhammer obtained as a leading constituent of the Niakornak Iron a hard, brittle, cast-iron like compound of iron and carbon in proportions of from 7.23 to 11.06 p. c. of carbon, which would indicate the formula of  $\text{Fe}^2 \text{C}$  for this species.
7. FERROSILICITE, (*Shepard*.)  $\text{Fe}^6 \text{Si}$  (Si being 22).
8. TROILITE, (*Reichenbach*.)  $\text{Fe}^7 \text{S}^9$  (or  $\text{Fe}$  62.07, S 37.93).
9. GRAPHITOID, (*Shepard*.)  $\text{Fe}^x \text{C}^x$  (nearly pure C).
10. KADAITÉ, (*Shepard*.)  $\text{C}^x \text{H}^x \text{O}^x$  (meteoric petroleum).
11. CHROMITE.  $\text{Fe Cr}$  (with traces of Mg).
12. QUARTZ.  $\text{Si}$ .
13. OLIVINE.  $\text{Fe}^2 \text{Si} + 9 \text{Mg}^2 \text{Si}$  ( $= \text{Si}$  41.3, Mg 47, Fe 10).
14. AUGITE or ENSTATITE.  $\text{Mg Si}$  ( $= \text{Si}$  59.71, Mg 40.29).
15. PIDDINGTONITE, (*Haidinger*.)  $\text{R Si} + \text{R}^2 \text{Si}^2$  ( $= \text{Si}$  57.66, Fe 20.65, Mg 19, Ca 1.5).
16. SHEPARDITE, (*Rose*.)  $\text{Mg}^2 \text{Si}^2$  ( $= \text{Si}$  68.91, Mg 31.02).
17. ANORTHITE.  $\text{R Al Si}^2$  (R being mostly Ca, with a little Mg, Na and R. Taking R as wholly Ca, composition would be Si 45.8, Al 25.00 and Ca 18.00.)
18. LABRADORITE.  $\text{R Al Si}^2$ . (R chiefly Ca Na and K. Composition nearly Si 59.09, Al 20.39, Ca 16.62.)

\* Only those species are enumerated which are supposed to have existed in meteorites anterior to their arrival within our atmosphere.

† I have observed in a single instance among the iron and nickel *matte* of the produce of the dipyrrite mine at Gup, Penn., thin laminae of an alloy of Fe and Ni precisely resembling the Tænite of meteoric iron, which consisted of Fe 56.11 and Ni 43.89.

‡ An artificial compound having this composition was produced by Deville.

Amherst College, Sept. 29, 1866.