SCIENCE:

A WEEKLY RECORD OF SCIENTIFIC PROGRESS.

JOHN MICHELS, Editor.

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SATURDAY, AUGUST 27, 1881.

THE CINCINNATI MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The thirtieth meeting of this Society was held at Cincinnati, on the 17th of August and following days, and adjourned on the 23rd.

The meeting opened with some discouraging features, due principally to the marked absence of many of the most prominent members of the Association. Among the absentees we noticed retiring President Lewis E. Morgan, of Rochester; Professor Spencer F. Baird, Professor O. C. Marsh, of Yale; Professor Asaph Hall, of Washington; Professor W. B. Rogers, of Boston; Professor Burt G. Wilder, of Cornell; Professor Simon Newcomb, of Washington; Professor George F. Barker, of Philadelphia; Professor Alexander Graham Bell, of Washington, and Professor Alexander Agassiz, of Cambridge.

It is agreeable to record that in spite of these desertions, which in most cases were unavoidable or due to sickness, the Cincinnati meeting has been in many respects most successful, showing that the "*esprit de corps*" of the great body of the Association is at a high standard and requires no fostering spirit to maintain its vitality.

The following registration shows the attendance of members at the annual meeting since 1869:

1869—Salem	244
1870—Troy	188
1871—Indianapolis	196
1872—Dubuque	164
1873—Portland	195
1874—Hartford	224
1875—Detroit	165
1876—Buffalo	215
1877—Nashville	176
1878—St. Louis	134
1879—Saratoga	256
1880—Boston	997

At the recent Cincinnati meeting the attendance of members was about 550, which compares most favorably with all previous years, excepting the last at Boston, which from various circumstances was a phenomenal year of success.

The growing popularity of the Association, or the increased interest of the masses in scientific matters, is shown by the registration of 400 new names on the roll of the Association, the majority of whom resided in Ohio, Indiana and Kentucky.

An agreeable feature of this meeting was the exhibition of scientific apparatus by those engaged in such manufactures.

Messrs. Beck, Bausch and Lomb, Bullock, Queen & Co., and Sexton for Gundlach showed exhibits, which made it evident that microscopists can command all they desire from the optician, provided the one essential of dollars and cents are within their reach, and even in this respect improvements have been made, which have greatly reduced the expenses of microscopists.

The following gentlemen acted as officers of the association on this occasion.

CINCINNATI, 1881.

President.—GEORGE J. BRUSH, of New Haven, Connecticut.

Vice President, Section A.—WILLIAM HARKNESS, of Washington, D. C.

Vice President, Section B.—E. T. COX, of San Francisco, Cal.

Chairman of Permanent Subsection of Chemistry.—G. C. CALDWELL, of Ithaca, N. Y.

Chairman of Permanent Subsection of Microscopy.—A. B. HERVEY, of Taunton, Mass.

Chairman of Permanent Subsection of Anthropology.—GARRICK MALLERY, of Washington, D. C.

Chairman of Permanent Subsection of Entomology.—JOHN G. MORRIS, of Baltimore, Md.

Permanent Secretary.—F. W. PUTNAM, of Cambridge, Mass.

General Secretary.—C. V. RILEY, of Washington, D. C.

Secretary of Section A.—E. T. TAPPAN, of Gambier, O.

Secretary of Section B.—CHARLES S. MINOT, of Boston, Mass.

Secretary of Permanent Subsection of Chemistry.—ALFRED SPRINGER, Cincinnati, O.

Secretary of Permanent Subsection of Microscopy.—W. H. SEAMAN, of Washington, D. C.

Secretary of Permanent Subsection of Anthropology.—J. G. HENDERSON, of Winchester, Ill.

Secretary of Permanent Subsection of Entomology.—B. PICKMAN MANN, of Cambridge, Mass.

Treasurer.—WILLIAM S. VAUX, of Philadelphia, Pa.

Nearly two hundred papers, described in the following list, were entered to be read.

TITLES OF PAPERS.

1. Magnetic survey of Missouri.—*Francis E. Nipher.*
2. On the effect of prolonged stress upon the strain in timber.—*R. H. Thurston.*
3. Numerical elements of the orbits of the seven Electrical Vortices, to whose motions atmospheric storms are principally due, with the processes by which they have been derived, and examples given of the application of the formula by which their positions on the surface of the earth can be computed for any given time.—*Thomas Bassnett.*
4. Universal Energy of light.—*Pliny Earl Chase.*
5. A new system of interest, discounts, etc.—*James W. Robinson.*
6. The constitution of the "Atom" of science.—*Mrs. A. B. Blackwell.*
7. Cañons, as I have seen them, with some thoughts as to their origin.—*Wm. Bross.*
8. The unification of geological nomenclature.—*Richard Owen.*
9. Recent discoveries, measurements, and temperature observations made in Mammoth Cave, Ky.—*H. C. Hovey.*
10. A remarkable case of retention of heat by the Earth.—*H. C. Hovey.*
11. Coal dust as an element of danger of mining; shown by the late explosion in the Albion Mines, in Nova Scotia.—*H. C. Hovey.*
12. The successful administration of nitrous-oxide for dental and surgical operations.—*C. P. Howland.*
13. An Iso-picraminic acid.—*Charles W. Dabney, Jr.*
14. Development of Sugar in Maize and Sorghums.—*Peter Collier.*
15. A revision of the anatomy of the ethmoid bone in the mammalia.—*Harrison Allen.*
16. The life unit in plants.—*Byron D. Halsted.*
17. On Bopyrus manhattensis from the gill-cavity of Palæmonetes vulgaris Stimpson.—*Carl F. Gissler.*
18. The uncivilized mind in the presence of higher phases of civilization.—*Otis T. Mason.*
19. The stone images and idols of the mound-builders.—*Wm. McAdams.*
20. Some remarkable relics from mounds in Illinois.—*Wm. McAdams.*
21. Stone implement showing glacier marks.—*Wm. McAdams.*
22. The occurrence of Cretaceous fossils near mouth of Illinois river.—*Wm. McAdams.*
23. Mound-builders' skeleton.—*Watson C. Holbrook.*
24. Stone implements in the drift.—*Watson C. Holbrook.*
25. Prehistoric hieroglyphics.—*Watson C. Holbrook.*
26. A contribution to Croll's theory of secular climatal changes.—*W. J. McGee.*
27. Influence of forests upon streams.—*David D. Thompson.*
28. Alchemy, the cradle of Chemistry. Illustrated by lantern views.—*H. Carrington Bolton.*
29. The great primordial force.—*H. R. Rogers.*
30. "Mixed" or "New Process" sugars. With methods and results of analysis.—*H. W. Wiley.*
31. Amylose. Its nature and method of manufacture. Its optical properties.—*H. W. Wiley.*
32. Relation of reducing power as measured by Fehling's solution to the rotatory power of commercial glucose and grape sugar.—Second paper.—*H. W. Wiley.*
33. On a new material suitable for stop-cocks and stoppers for reagent bottles,—*H. W. Wiley.*
34. The stereoscope, and vision by optic divergence.—*W. Le Conte Stevens.*
35. The nitrogenous constituents of grasses.—*Clifford Richardson.*
36. Mineralogical Notes.—*Benjamin Silliman.*
37. On the influence of the structure of the nerve-fibres upon the production and conduction of nerve-force.—*H. D. Schmidt.*
38. The recurrence of faunas in the Devonian Rocks of New York.—*H. S. Williams.*
39. Note on some Fish remains from the Upper Devonian of New York.—*H. S. Williams.*
40. Note on specimens of Ptilophyton and associated fossils collected by Dr. H. S. Williams, in the Chemung Shales of Ithaca, N. Y.—*J. W. Dawson.*
41. Compcsition and quality of American Wines.—*Henry B. Parsons.*
42. On Dibromiodacrylic and Chlorbromiodacrylic Acids.—*C. F. Mabery* and *Rachel Lloyd.*
43. On Chlortribrompropionic Acid.—*C. F. Mabery* and *H. C. Weber.*
44. Alhazen's Problem: its history and bibliography, together with various solutions of it.—*Marcus Baker.*
45. Is the law of repetition the Dynamic Law underlying the Science of Chemistry?—*Miss Virginia K. Bowers.*
46. A study of blood during a protracted fast.—*Lester Curtis.*
47. A contribution to the study of Bacterial Organisms, and commonly found on exposed mucus surfaces, and in the alimentary canal of healthy individuals.—*Geo. M. Sternberg.*
48. Suggestions for improvement in the manufacture of glass, and new methods for the construction of large telescopic lenses.—*G. W. Holley.*
49. On the electrical resistance and co-efficient of expansion of incandescent platinum.—*E. L. Nichols.*
50. On recent deep-sea soundings in the Gulf of Mexico and Caribbean Sea, by the U. S. Coast Survey.—*J. E. Hilgard.*
51. Symmetrical method of Elimination in Simple Equations, by the use of some of the principles of Determinants.—*Jas. D. Warner.*
52. A Musical Local-telegraph alphabet.—*William Boyd.*
53. An Improved Sonometer.—*W. Le Conte Stevens.*
54. A new and improved freezing Microtome.—*Thomas Taylor.*
55. A new and Improved Freezing apparatus for use in Surgical and Dental Practice, being a substitute for the ether spray.—*Thomas Taylor.*
56. Bacteria and Micrococci, and their relations to plant culture.—*Thomas Taylor.*
57. Electricity, Magnetism, Gravitation. Their phenomena considered as the manifestation of one force.—*S. S. Parsons.*
58. The Berea Grit of Ohio.—*Edward Orton.*
59. The Gold-bearing drift of Indiana.—*Geo. Sutton.*
60. On the amount of Glacial erosion in Ohio, Indiana and Illinois, with some deductions therefrom.—*E. W. Claypole.*
61. On the Discovery of an Archemediform Tenestellid in the Upper Silurian Rocks of Ohio.—*E. W. Claypole.*
62. Life-history of the Buckeye Stem-borer. *Sericoris instrutana* Clem.—*E. W. Claypole.*
63. Some needed reforms in the use of Botanical Terms.—*Charles R. Ridler.*
64. Digital differentiation.—*A. J. Howe.*
65 The excavation of the Grand Cañon of the Colorado River.—*C. E. Dutton.*
66. On the cause of the Arid climates of the Far West.—*C. E. Dutton.*
67. Evolution and its place in Geology.—*Edward S. Edmunds.*
68. A Short study of the Features of the Region of Lower Great Lakes, during the Great River Age; or notes on the Origin of the Great Lakes of North America.—*J. W. Spencer.*
69. On the inhabitants of N. E. Siberia, commonly called Chukchis and Namollo.—*W. H. Dall.*
70. A Lawgiver of the Stone Age.—*Horatio Hale.*
71. *Ilex cassine*, the Black Drink of the Southern Indians.—*John G. Henderson.*
72. Was the antelope hunted by the Indians on the prairies of Illinois?—*John G. Henderson.*
73. Agriculture and Agricultural Implements of the Ancient Inhabitants of the Mississippi Valley.—*John G. Henderson.*
74. Houses of the Ancient Inhabitants of the Mississippi Valley.—*John G. Henderson.*
75. Comparative Differences in the Iroquis Group of Dialects.—*Mrs. Erminnie A. Smith.*
76. Typical thin sections of the rocks of the cupriferous series in Minnesota.—*N. H. Winchell.*
77. The limited biological importance of synthetic achievements in Organic Chemistry.—*Albert B. Prescott.*
78. On a mesal cusp of the deciduous mandibular canine of the domestic cat, Felis domestica.—*Burt G. Wilder.*

79. Remarks on the Classification and Distribution of Producti.—*S. H. Trowbridge.*
80. Note on a comparison of Newcomb's Tables of Uranus and Neptune, with those of the same planets by Le Verrier.—*D. P. Todd.*
81. The Saroscope : Register of eclipses traced from Eden's prime, 3939 B. C.—*A. W. Brown.*
82. Pentachloramyl formate.—*Alfred Springer.*
83. On the features of Equivalence to Chemical Elements, shown by electricity and heat.—*Samuel J. Wallace.*
84. On a sign of logical connection in Equations.—*Samuel J. Wallace.*
85. On an abbreviation in writing a long series of figures, and its use in calculations.—*Samuel J. Wallace.*
86. Retarded Development in Insects.—*C. V. Riley.*
87. New Insects Injurious to American Agriculture.—*C. V. Riley.*
88. The Egg-case of Hydrophilus triangularis.—*C. V. Riley.*
89. On the Oviposition of Prodoxus decipieus.—*C. V. Riley.*
90. The Cocoon of Gyrinus —*C. V. Riley.*
91. Ozark Highlands.—*G. C. Swallow.*
92.—On the disposition of color—markings of domestic animals.—*Wm. H. Brewer.*
93. On the ancient Japanese bronze belts.—*Edw. S. Morse.*
94. On changes in Mya and Lunatia since the deposition of the New England Shell-heaps.—*Edw. S. Morse.*
95. On worked shells in New England Shell-heaps.—*Edw. S. Morse.*
96. Natural and industrial history of the White Pine in Michigan.—*Wm. Hosea Ballou.*
97 Experiments to determine the comparative strength of globes and cylinders of the same diameter and thickness of sides.—*S. Marsden.*
98 On a convenient method of expressing micrometrically the relation between English and metric units of length on the same scale.—*Wm. A. Rogers* and *Geo. F. Ballou.*
99. Evidence of atomic motion within liquid molecules, as based upon the speed of chemical action.—*R. B. Warder.*
100. On a new method of applying water power of small head to effect the direct compression of air to any required high pressure.—*H. T. Eddy.*
101. A preliminary investigation of two causes of lateral deviation of spherical projectiles based on the kinetic theory of gases.—*H. T. Eddy.*
102. Phenomena of growth in plants.—*D. P. Penhallow.*
103. On the life duration of the Heterocera (moths).—*J. A. Lintner.*
104. On the action of Pilocarpin in changing the color of the human hair.—*D. W. Prentiss.*
105. On a simple method of measuring faint spectra.—*Wm. Harkness.*
106. On the methods of determining the solar parallax, with special reference to the coming transit of Venus. —*Wm. Harkness.*
107. The sources of the nitrogen of plants.—*W. O. Atwater.*
108. The chemistry of fish and invertebrates.—*W. O. Atwater.*
109. The quantitative estimation of nitrogen.—*W. O. Atwater.*
110. The quantitative estimation of Chlorine.—*W. O. Atwater.*
111. Historic Notes on Cosmic Physiology.—*T. Sterry Hunt.*
112. Upon the use of the Induction Balance as a means of determining the location of leaden bullets imbedded in the human body.—*Alexander Graham Bell.*
113. Upon a new form of electric probe.—*Alexander Graham Bell.*
114. The best method of mounting whole chick embryos.—*Charles Sedgwick Minot.*
115. Note on whether man is the highest animal.—*Charles Sedgwick Minot.*
116. Note on the segmentation of the vertebrate body.—*Charles Sedgwick Minot.*
117. The motion of roots in germinating Indian Corn—*W. J. Beal.*
118. Exhibition of some archæological specimens from Missouri.—*S. H. Trowbridge.*
119. Animal myths of the Iroquois.—*Mrs. Erminnie A Smith.*
120 A remarkable invasion of northern New York by a Pyralid Insect (*Crambus vulgivagellus*).—*J. A. Lintner.*
121. On the wave-lengths of the principal lines of the Solar Spectrum.—*T. C. Mendenhall.*
122. How does the bee extend its tongue.—*A. J. Cook.*
123. The Syrian Bees.—*A. J. Cook.*
124. Carbolic acid as a preventive of Insect Ravages.—*A. J. Cook.*
125. A. new self-registering Mirror Barometer.—*John R. Paddock.*
126. On the length of life of Butterflies.—*W. H. Edwards.*
127. On certain habits of Heliconia charitonia.—*W. H. Edwards.*
128. Notes on experimental Chemistry.—*Albert B. Prescott.*
129. Additional facts on the fertilization of Yucca.—*Thomas Meehan.*
130. On the Interpretation of of Pictographs by the application of Gesture-signs.—*W. J. Hoffman.*
131. On the great outburst in Comet *b* of 1881, observed at the Cincinnati Observatory.—*Ormond Stone.*
132. An alleged abnormal peculiarity iu the history of Argynnis myrina.—*W. H. Edwards.*
133. Some new forms of apparatus for the chemical laboratory.—*G. C. Caldwell.*
134. Time service, Carleton College Observatory.—*W. W. Payne.*
135. Note on the theory of the flight of elongated projectiles. —*H. T. Eddy.*
136. On the mechanical Principles involved in the flight of the boomerang.—*H. T. Eddy.*
137.—On a convenient form of slide case.—*Robt. Brown, Jr.*
138. A filtration evaporation balance.—*H. Carmichael.*
139. The liquifaction of glass in contact with water at 250° c. —*H. Carmichael.*
140. A new Radiometer.—*H. Carmichael.*
141. A new differential Thermometer.—*H. Carmichael.*
142. On some relations of Birds and Insects.—*S. A. Forbes.*
143. Comparison of Maya dates with those of the Christian Era.—*Cyrus Thomas.*
144. A new theory of the formation of Hail.—*Leonard Waldo.*
145. Method of determining the value of the Solar Parallax from meridian observations of Mars.—*J. R. Eastman.*
146. Numbers of cometary orbit relative to perihelion distance.—*H. A. Newton.*
147. Phonetics of the Káyowe language.—*Albert S. Gatschet.*
148. The needle telephone, a new instrument by Dr. Goodman, of Louisville, Ky.—*J. Lawrence Smith.*
149. Hiddenite, a new American gem.—*J. Lawrence Smith.*
150. Iron with anomalous chemical properties.—*J. Lawrence Smith.*
151. Determination of Phosphorus in iron.—*J. Lawrence Smith.*
152. Nodular concretions in meteoric iron, bearing on the origin of same.—*J. Lawrence Smith.*
153. An anomalous magnetic property of a specimen of iron.—*J. Lawrence Smith.*
154. Regulator of filter pumps.—*J. Lawrence Smith.*
155. Ringing Fences.—*S. W. Robinson.*
156. Niagara River. Its cañon, depth and wear.—*Wm. Hosea Ballou.*
157. On the relations of the growth, size and age of animals. *Charles S. Minot.*
158. Suggestions of co-operation in furthering the study of entomology.—*B. Pickman Mann.*
159. On Standard Time.—*E. B. Elliott.*
160. The Electrophore and electric lighting.—*E. B. Elliott.*
161. An attachment for burettes avoiding the necessit y of using glass stop-cocks.—*Fr. A. Roeder.*
162. On a new form of balances.—*Fr. A. Roeder.*
163. Natural Filtration of water for domestic use in cities. —*G. C. Swallow.*
164. Note on an experimental determination of the value of π.—*T. C. Mendenhall.*
165. Remarks upon and an exhibition of Japanese Magic mirrors.—*T. C. Mendenhall.*

166. Notice of a fern indigenous to California, but heretofore considered as an introduced hot-house species.—*Mrs. Leander Stone.*
167. Scheme for aiding the Euler's transformations of coordinates.—*J. D. Warner.*
168. The temporal process of the malar bone in the ancient human crania from Madisonville.—*Frank W. Langdon.*
169. Buffalo drives on the Rock river in Wisconsin.—*—Stephen D. Peet.*
170. The Emblematical Mounds on the four lakes of Wisconsin.—*Stephen D. Peet.*
171. Fossil teeth of Mammals from the Drift of Illinois.—*Wm. McAdams.*
172. On comparison of yard and metre by means of reversible pendulum.—*C. S. Peirce.*
173. Exhibition of a curious stone relic.—*G. W. Holstein.*
174. Some Phenomena in the conjugation of the infusorium Actinophrys Sol.—*J. D. Cox.*
175. On the errors to which Self-registering clinical thermometers are liable.—*Leonard Waldo.*
176. Note on the chemical examination of maize residue from the manufacture of glucose.—*C. Gilbert Wheeler.*
177. The Temperature of North German Traps at the time of their extrusion.—*H. Carmichael.*
178. Recent existence of sword-fish, shark, and dolphin in the fresh water pond near Buffalo, N. Y.—*Wm. Zimmerman.*
179. Antiquity of Man in America.—*W. De Haas.*
180. Progress of Archæological Research.—*W. De Haas.*
181. The Mound Builders. An inquiry into their assumed southern origin.—*W. De Haas.*
182. Four years' observation with the Lysimeter, at Framington, Mass.—*E. Lewis Sturtevant.*

The next annual meeting of the Association will take place at the City of Montreal under the Presidency of Dr. J. W. Dawson, Principal of McGill College. The election of Dr. Dawson will be a welcome announcement in all scientific circles, and the meeting for 1882 will doubtless be one of the most memorable in the annals of the Association.

We commence this week with the publication of a series of the papers read at the Cincinnati meeting or abstracts prepared by the authors. Those who have not forwarded their communications are requested to do so as soon as convenient. We shall be willing to prepare suitable illustrations, if a request for the same is made at once, to afford time for their preparation.

REPORT ON THE GEOLOGY AND RESOURCES OF THE BLACK HILLS OF DAKOTA. By HENRY NEWTON, E. M., and WALTER P. JENNEY, E. M., Washington, D. C., 1880.

The report on the Black Hills issued six years after the death of its leading observers, to whose name at least it may prove an appropriate monument, comprises the geology, palæontology, mineral resources, lithology and related subjects of interest of that boss of rocks whose circular uplift commands the outstretched plains of central Dakota.

To the *fames sacra auri* may at least be attributed one important service in this connection, as it was a transient disturbance with the Indian settlers, caused by the appearance of gold hunters on their domain, that immediately led to the survey.

The Black Hills had been assigned to the Sioux, and this unauthorized irruption raised the question how far the United States Government might permit a violation of their contract with the Indians, and how much benefit in mineral wealth would accrue to the new explorers and settlers if their incursions were tolerated. To answer more especially this latter question, and to make substantial contributions to general knowledge, the United States Government instituted a survey of this interesting and unknown country, and to Messrs. Jenney, and Newton, was intrusted its management and direction, under the auspices of the Department of the Interior.

After six months spent in this wild and inhospitable region, members of the survey returned, richly provided with means for a more deliberate examination of its character, and scientific aspects in the laboratories and cabinets of the east.

A delay—one of the innumerable hitches incident to congressional apathy or pre-occupancy—in the appropriation of monies for the printing of their report, invited Mr. Newton to revisit the hills in the spring of 1877 to complete his observations, mend or extend his theories, and here he contracted typhoid fever, of which he died—a loss to science, to society and education.

The work begun under his vigorous and intelligent supervision naturally halted, and although many of its various parts were long since completed, it is only now that in a compiled form they appear in print.

Mr. Gilbert edited the work and undertook the difficult and thankless task of deciphering, compacting and evolving from the *disjecta membra* of Mr. Newton's notes, the part devoted to the discussion of the geology, physical and stratigraphical of these hills. It is not difficult to detect the mind and pen of the author of the "Geology of the Henry Mountains," and whether or not the essay would form an exact reproduction of Mr. Newton's views, it is itself a valuable monograph, instructive and suggestive.

The Black Hills cover an area of 850 square miles, rising from the level and uninhabited wastes about them to an altitude at their highest point of nearly 8000 feet, thickly covered with dense and primeval forests of pine, whose condensed shadows from afar hides all else, and for long marches distinguishes these highlands to the approaching traveller.

The Black Hills, briefly, are an uplift of conformable strata, displaying their consecutive beds in symmetrical succession, from a central axis or elevation, disintegrated and channelled, sculptured and modified by subærial and aqueous erasion. The simplicity and perfection of their stratigraphical structure render them comparatively easy of exposition, and make them a capital example of primary sedimentation, possibly to become classic in future illustrations of geological principles.

The formations, as they are crossed from the centre of the group outward to the circumference, and similarly disposed on every side—*i. e.*, sloping inward to the centre—are the archæan, Potsdam sandstone, carboniferous, shales and limestone, red beds—Trias, Jura—cretaceous and then beyond, upon the plains Tertiary. The central area is a diversified region abounding in park-like expanses, wild and rugged chasms, peaks, isolated pyramids, picturesque gorges, table-lands and a net-work of enfilading streams pouring outward east and west to swell the waters of the Cheyenne and Belle Fourche rivers. This is the archæan area or axis, upon whose flanks repose the higher strata, and in whose gulches and stream beds were found the traces of gold which first brought these hills to scientific notice. This axis lies generally north and south, is slightly arcuate, with its convexity pointing eastward, and is composed of schists, quartzites, gneiss rock, granite, trachytic intrusions and associated metamorphic slates. The granite and quartzites form salient ridges, and the trachyte sharp peaks in the landscape. Next out-cropping underneath the carboniferous is the Potsdam, unconformably bedded upon the upturned edges of archæan slates, carrying characteristic fossils and made up of basal conglomerate, sandstone locally altered around trachytic cones to quartzite, and calcareous beds. This rock has undergone extensive removal along with