#### INDEX.

Minerals and Scottish Localities are grouped under the headings "Minerals" and.
"Scotland."

Ægirine, Occurrence in Scotland, 273. Bennie, James, Obituary Notice of, 187. Agate, Colouring matter of, 220. Age of the Earth, 240, 275. Alkalies, Percentage of, in sands and Binny Sandstone, Edifices in Edinburgh built of, 146, 160. Bones, mammalian, Discovery of, at sandstones, 34. Hailes Quarry, 27. Boulder Clay, Analysis of, 60. Almond River, Buried channel of, 194. Breccia, Igneous, of the Lui, near Braemar, 336. Analcite-Diabase from Gullane Hill, 326. Analcite, Origin of, 331. Analyses :-Breccias (Crush-Breccias) of Rum, 347. Clay, Boulder (Mackie), 60. Diabase (J. Macadam), 134. "Diabase-Porphyry" (Mackie), 56. Broxburn Shalefield, 143. Burdiehouse Shalefield, 160. Buried channel of the Almond, 194. Diorite (Mackie), 55. Granite (Mackie), 54, 111, 112. Levyne (Heddle, quoted), 342. Marl, Houston (J. Macadam), 134. Burntisland Shalefield, 162. CADELL, H. M., On the Geology of the Oil Shalefields of the Lothians, 116. — Note on the Buried River Channel of the Almond, 194. Metamorphic Gneisses, Schists, etc. (Mackie), 57, 111. Oil Shale (D. R. Steuart), 120 Calcite, Replacement of, by Turgite, 206. Carbonate of Lime in the Lower Car-Ozocerite? (D. R. Steuart), 147. Pseudomorph—? Saussurite after Labradorite (R. S. Houston), 261.
Pyrites (R. S. Houston), 211. boniferous, Chemical origin of, 3 n. Carboniferous Formation, Sections of, 2, 61, 270, 272, 352, 353, 355, 357, 378, 377, 378. Quartz-Porphyry (Mackie), 56. Rhyolite? (Mackie), 56. Shalefields of, 116. Sand — River, (Mackie), 60. Sea, Blown Cheviot Hills, Contact Metamorphism by the Granite of the, 18. Sandstones (Mackie), 58, 59. Evidence for Glacier-dammed Lakes among the, 226.
Clay, Boulder, Analysis of, 60.
Shell-bearing, in Jutland, 86. Serpentine (Mackie), 56. Anderson, Ernest M., The Dynamics of Faulting, 387.
Andesitic Lavas of Lorne, Association of - in Kintyre, 76. Tuffs with, 87. Coal Measures, Occurrence at Port Seton, Anticlines in the Lothians Shalefield, 124, 125, 126, 137, 147, 152, 155. Coal Mining in the Musselburgh Coalfield, Ardmucknish, Argyll, Spherulite Dykes 379. Cobalt, Traces of, in the Sandstones of Argyll, Duke of, Obituary Notice of, 176. Arthur's Seat, Turgite of, 1, 206. the Moray Firth Area, 256. Colouring Matter of Agate, 220. — of Rocks, 203, 204, 206. Copper, Traces of, in the Sandstones of Ash-Necks of the Lothians and Fife, 148, 162. the Moray Firth Area, 256.
CRAIG, E. H. CUNNINGHAM, on the Igneous Breccia of the Lui near Braemar, 336. CRAMPTON, C. B., The Limestones of of True Coal Measures at Port Seton, Aberlady, Dunbar, and St Monans, East Lothian, 351. 374. Balmaha-Aberfoyle District, Lower Old Red Sandstone of, 315. Crush-breccias of Rum, 347. Crustacea, Scottish Carboniferous, 372.

Banded Structure in Igneous Rocks of Skye and Rum, 346, 347.

Basalt, Spherulitic, of Ardmucknish, 363.

CURRIE, JAMES, On New Localities for Levyne in the Færces and Skye, 341.

- The Stassfurt Salt Industry, 403.

Dalmeny Shalefield, 159. Dykes, Spherulitic, of Ardmucknish, Argyll, 363. Dynamics of Faulting, 387.

Earth, Age of the, 240, 275.

Edinburgh, Exposures of Rock in, 2, 267. Enstatite, Effects of Metamorphic Action

on, 22. Erratics, in Boulder Clay, Edinburgh, 9.

- in Eastern Moray, 91.

in Kintyre, 77.

Uplift of, above present level of parent rock, 97.

Færöes, Localities for Levyne in, 341.

Faulting, Dynamics of, 387. Faults in the Lothian Shalefield, 124, 143, 152, 153, 159.

Felsite, Spherulitic, of Glen Feshie, 114. Flora of Inland Salt Regions of Germany, 403.

Gas in Salt at Stassfurt, 407.

in Shalefields of the Lothians, 147. Glacier-dammed Lakes of the Cheviots,

Glen Feshie, Spherulitic Felsite of, 114. Gœthite, Occurrence at Ratho, 209.

GOODCHILD, J. G., Hæmatite on Arthur's Seat (Abstract), 1. [See also p. 206.]

— Some Recent Exposures of

Rock in Edinburgh, 2.

- John Henderson, 165.

Obituary Notice of the Duke

of Argyll, 176.

The Geognosy of Scottish Tourmalines, 182.

The Scottish Ores of Iron, 200.

On some Pseudomorphs after

a Lime-Soda Felspar, 260.

— Further Remarks on some Recent Exposures of Rock in Edinburgh, 266.

The Nepheline Ægirine Pegmatite of Cnoc na Sroine, 273.

On unconformities and Palæontological Breaks in Relation to Geological Time, 275.

Granites, Analyses of, 54, 91, 111, 112. Granite Veins, Chemical Composition of, compared with that of probable original

magma, 107.

— Differences in chemical composition between the central and marginal zones, 98.

Movement of potash to periphery and of soda to centre, 108. Greenockite, New Locality for, 208.

Hailes Quarry, Discovery of Mammalian Bones at, 27.

HARKER, A., The Tertiary Crust Movements of the Inner Hebrides, 344.

Hebrides, Inner, Tertiary Crust Movements of, 344.

Henderson, John, Obituary Notice of, 165.

HEPBURN, DAVID, Obituary Note on James

Simpson, 32.

On the Association of Human Remains with those of the Red Deer and the Ox in Hailes Quarry, Midlothian, 197.

and James Simpson, On Mammalian Bones found during excavations at Hailes Quarry, near Edinburgh, 27.

Hermand Sandstone, Edifices in Edin-

burgh built of, 129.

Hinxman, L., Note on Specimens of Spherulitic Felsite from Glen Feshie, 114.

HORNE, JOHN, Obituary Notice of Mr Bennie, 187.

Obituary Notice of Mr J. W. Kirkby, 231. Houston Marls, Description and Analysis

of, 132, 134. Human Remains associated at Hailes with those of Red Deer and Ox, 197.

Course of, in Aberdeenshire and Ice. Kincardineshire, 222.

- in Cheviots, 226

- in Moray Firth Basin, 91.

Iron Oxides as colouring material in Rocks, 204.

Scottish Ores of, 200.

JESSEN, A., On the Shell-bearing Clay in Kintyre, 76.

Joly, Prof., Criticism of his views as to the determination of the Age of the Earth from the Saltness of the Sea, 240. Jutland, Shell-bearing Clay in, 86.

KENDALL, PERCY F., and H. B. MUFF, On the Evidence for Glacier - dammed Lakes in the Cheviot Hills, 226.

Kerr, —, Note on Agate Specimens from Monzie, 237. Kintyre, Shell-bearing Clay in, 76.

KIRKBY, JAS. W., Note on the Ostracoda

from the Scotsman office section, 15.

On Lower Carboniferous Strata and Fossils at Randerstone, near

Crail, Fife, 61. Kirkby, Jas. W., Obituary Notice of,

KYNASTON, HERBERT, Notes on Contact Metamorphism round the Cheviot Granite, 18.

On some Tuffs associated with the Andesitic Lavas of Lorne, 87.

Lakes, Glacier dammed, in the Cheviots, 226

Lead, Traces of, in the Sandstones of the Moray Firth area, 256.

Levyne, Minerals associated with, 342.

— in the Færöes and Skye, Localities for, 341.

Lime, Percentage of, in Sands and Sandstones, 42. Limestones of Aberlady, Dunbar, and St Monans, 374. Limonite, Formation of, 205. Lorne, Tuffs associated with Andesitic Lavas of, 87. Lothians, Oil Shalefields of, 116. Lui, Igneous Breccia of the, 336. MACKIE, W., Seventy Chemical Analyses of Rocks (chiefly from the Moray Firth), with Deductions, 33. Some Notes on the Distribution of Erratics over Eastern Moray, On Differences in Chemical Composition between the Central and Marginal Zones of Granite Veins, with further Evidence of Exchanges between such Veins and the Contact Rocks, 98.

— On the Saltness of the Sea in relation to the Geological Age of the Earth, 240. Traces of the Heavy Metals in the Sandstone of the Moray Firth Basin, Magnesium Salts of Stassfurt, Export to Scotland, 411. Mammalian Remains from Hailes Quarry, 27, 197. MARTIN, ROBERT, Coal Mining in the Musselburgh Coal-Field, 379. Metamorphism, 18, 19. Midcalder Shalefield, 140. MILNE, JOHN, On Old Red Sandstone in Aberdeen and Neighbourhood, 221. Minerals: Ægirine, 273. Agate, 220, 224, 237, 327. Analcite, 328. Apatite, 330.
Barytes, 93, 237, 320.
"Bitumen," 154.
Feldspar, 260, 273, 331. Galena, 157. Garnet, 40, 100. Gœthite, 209. Greenockite, 208. Hæmatite, 207. Hornblende, 94. Hypersthene, 93. Jasper, 237. Labradorite, 260. Levyne, 342. Limonite, 206, 207. Marcasite, 211. Millerite, 211. Mispickel, 212. Nepheline, 273. Orthoclase, 273. Ozocerite, 147. Petroleum, 147. Pyrites, 211, 234. Pyrrhotite, 214.

Rubinglimmer, 208.

Rutile, 93, 94. Sphene, 35, 36, 92, 94. Turgite, 206. Vivianite, 27, 212. Moray, Erratics of, 91.

MUFF, H. B., and PERCY F. KENDALL,
On the Evidence for Glacier-dammed Lakes in the Cheviot Hills, 226. Nepheline, Occasional Origin of Analcite, 331. Nepheline-Ægirine Pegmatite, Occurrence in Sutherland, 273.
Nickel, Traces of, in the Sandstones of the Moray Firth Basin, 256. Obituary Notices-Duke of Argyll, 176. James Bennie, 187. John Henderson, 165. J. W. Kirkby, 231. Jas. Simpson, 32. Oil Shale, Physical characters of, 118.

— Ultimate composition of, 120. Oil Shalefields of the Lothians, 116. Old Red Sandstone in Aberdeen, 221 - of Balmaha and Aberfoyle, 315. Ostracoda, Edinburgh, 15. Fife, 61. — Kintyre, 77. Ox, Bones of, at Hailes Quarry, 197. PEACH, B. N., The Higher Crustacea of the Carboniferous Rocks of Scotland (Abstract), 372. Pegmatite, A suggested definition of, 183. Petroleum, Natural, in the Lothians, 147. Philpstown Shalefield, 151. Port Seton, Fossils of, 354, 355, 356, 358. - Occurrence of Coal Measures at, 351. Potash, Movement of, to the margin of Granite Veins, 108. occurrence in Germany, 403. Pseudomorphs, 260, 327, 328. Pumpherston Shalefield, 137. Pyrites, as colouring matter of Clay, 203. - from Stanley, Renfrewshire, Analysis of, 211. Randerstone, Fossiliferous Strata of, 61. Red Deer, Bones of, at Hailes Quarry, 197. Rubinglimmer, suggested identification with Turgite, 208.

Rum, Crush-Breccias of, 347.

Salt Industry of Stassfurt, 403.

of, 350.

Salt, Rock, 407, 409.

-, Gneisses of, 346. -, Order of Intrusion of Igneous Rocks Saltness of the Sea in relation to the Geological age of the Earth, 240. Sandstones of the Moray Firth Basin, Traces of the Heavy Metals in, 256. Scotland: Geology, Mineralogy, a Petrology of-Aberdeenshire (Aberdeen), 221. — (Braemar), 337. Argyllshire (Ardmucknish), 363. (Kintyre), 76. (Lorne) 87. Ayrshire (Dreghorn), 260. Banffshire (Portsoy), 98. Berwickshire (Cove), 206. Edinburghshire (Edinburgh), 2, 15, 27, 197, 206, 207, 208. —— (Musselburgh), 379. Pentlands), 220. — (Ratho), 209. Fifeshire (Beith), 211. (Elie), 206. (Kirkcaldy), 206. (Randerstone), 61.
(St Monans), 374.
Haddingtonshire (Aberlady), 206, (Dunbar), 206, 374. (Garleton Hills), 206. (Gullane Hill), 326. (North Berwick), 207. — (Port Seton), 351. Inverness-shire (Glen Feshie), 114. (Skye), 342. (Strathdearn), 10. Linlithgowshire, 194. Lothians, 116. Morayshire, 91, 256. (Rothes), 98. (Aberfoyle and Balmaha), 315. Perthshire (Monzie), 237. Renfrewshire (Gourock), 208. — (Stanley), 211. Stirlingshire (Falkirk), 212. — (Sauchie), 214. Sutherlandshire (Cnoc na Sroine), ea, Saltness of, in relation to the Geological Age of the Earth, 240. — Triassic, composition of, 406. Shalefields of the Lothians, 116. Shell-bearing Clay in Jutland, 86. SIMPSON, JAMES, and DAVID HEPBURN, on Mammalian Bones found during

excavations at Hailes Quarry, near Edinburgh, 27. Simpson, James, Obituary Note on, 32. Soda, Movement of, towards the centre of granite veins, 108. Spherulitic Structure, List of Observed Occurrences, 115. - in Basalt Dykes of Ardmucknish, 363. in Felsite of Glen Feshie, 114. Stassfurt, Salt Industry of, 403. STRACHAN, J., Notes on some Agates from the Pentlands (Hillend), 220. Strathdearn, Geology of, 10. -, Glaciation of, 13. TAIT, D., and E. B. BAILEY, On the Occurrence of True Coal Measures at Port Seton, East Lothian, 351. Tertiary Crust Movements of the Inner Hebrides, 344. TOIT, ALEX. L. DU, The Lower Old Red Sandstone Rocks of the Balmaha-Aberfoyle Region, 315. Torridonian period, Climate of, 42, 53. - Sandstones, Source of the material of, 41. Tourmalines, Scottish, Geognosy of, 182. Triassic Sea, Composition of, 406. Tuffs associated with Andesitic Lavas of Lorne, 87. Turgite, Formation of, 205. -, Occurrence in Scotland, 206. Unconformabilities in relation to Geological Time, 275. Vivianite, Occurrence at Hailes Quarry, Wallace, Thomas, Additional Notes on the Geology of Strathdearn and adjoining district of the Aviemore Rail-

way, 10.
West Calder Shalefield, 128, 136.
Young, B. Robert, An Analcite Diabase and other Rocks from Gullane Hill, 326.

Zonal forms of Fossils, Lists of, 288, 291, 293, 294, 296, 302, 303, 306, 308, 310, 311, 312.

# **TRANSACTIONS**

OF THE

# Edinburgh Geological Society.

VOL. VIII. PART III.



## EDINBURGH:

PRINTED FOR THE SOCIETY BY

TURNBULL & SPEARS, THISTLE STREET.

LONDON: SIMPKIN, MARSHALL, HAMILTON, KENT & CO., Ltd.

1905.

#### LIST OF OFFICE-BEARERS

OF THE

## EDINBURGH GEOLOGICAL SOCIETY

FOR SESSION 1905-06.

BEING THE SEVENTY-SECOND.

President.
James Currie, M.A., F.R.S.E.

Tice-Presidents.

Robert Kellock.

Wm. Mackie, M.A., M.D.

John A. Johnston.

Monorary Secretary. - DAVID GLOAG.

Zibracian. - David Tair, H.M. Geol. Survey.

Treasurer .- A. CAMPBELL, 62 Marchmont Road.

#### Conneil.

D. R. STEWART, F.I.C.

J. G. GOODCHILD, F.G.S., F.Z.S.

C. T. CLOUGH, M.A., F.G.S.

Andrew Lre, M.A.

B. N. PEACH, LL.D., F.R.S.

H. M. CADELL, B.Sc., F.R.S.E.

ROBERT CAMPBELL, M.A., B.Sc.

JAMES BISSET, M.A., F.R.S.E.

J. A. GRAHAM MILLER, W.S.

Anditors.—T. K. FARQUHARSON and R. C. MILLAR, C.A.

## CONTENTS.

---:0:---

	T A A 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PAGE						
XXX1.	J. G. GOODCHILD on Unconformities and Paleontological Breaks in relation to Geological Time,	275						
XXXII.	ALEX. L. Du Toir, The Lower Old Red Sandstone Rocks of the Balmaha-Aberfoyle Region,	315						
XXXIII.	ROBERT B. YOUNG, An Analcite Diabase and other Rocks from Gullane Hill,	326						
XXXIV.	E. H. CUNNINGHAM CRAIG on the Igneous Breccia of the Lui near Braemar,	336						
XXXV.	James Currie on New Localities for Levyne in the Færces and in Skye,	341						
XXXVI.	ALFRED HARKER, The Tertiary Crust-Movements in the Inner Hebrides,	344						
XXXVII.	E. B. Bailey on the Occurrence of True Coal Measures at Port Seton, East Lothian,	351						
XXXVIII.	E. B. Bailley on the Occurrence of Two Spherulitic ("Variolitic") Basalt Dykes in Ardmuchnish, Argyll, ,	363						
XXXIX.	B. N. Peach, Abstract of Opening Address, The Higher Crustacea of the Carboniferous Rocks of Scotland, .	372						
XL.	C. B. CRAMPTON, The Limestones of Aberlady, Dunbar, and St Monans,	374						
XLI.	ROBERT MARTIN, Coal-Mining in the Musselburgh Coal-Field, .	379						
XLII.	ERNEST M. ANDERSON, The Dynamics of Faulting,	387						
XLIII.	JAMES CURRIE, The Stassfurt Salt Industry,	403						
Volume Indices and Titles								

<sup>\*\*\*</sup> The authors alone are responsible for the facts and opinions contained in their respective papers.

### PUBLICATIONS

OF THE

## Edinburgh Geological Society.

		_				
	Transactions.				ľo ellows.	To the Public.
Volume	I. Part I. (2 Plates)		_		0	2 6
, 0212110	", II. (6 Plates),					Print.
,,	,, III. (9 Plates), .		•	. 3	0	5 0
,,	Complete,				Out of	Print.
Volume	II. Part I. (9 Plates), .			. 3	Ó	5 0
	TY /1 TO1-4-1	•	•	. 2		3 0
)) ))	,, III. (1 Plate), . ,, III. (4 Plates), .	•	•	. 4	ŏ	5 0
"	Complete,	•	•		•	12. 0
	• " '	•	•		-	Print.
	III. Part I. (4 Plates),	•	•		Out of	<i>Frm</i> . 5. 0
	,, II. (6 Plates), .	•	•	. 4		Print.
"	,, III. (7 Plates), Complete,	•	2	•	Out of	Print.
***	· · · · · · · · · · · · · · · · · · ·	•	•	•	•	•
Volume	IV. Part I. (4 Plates), .	•	•	• .	Out of	Print.
,,	" II. (2 Plates),		. •		0	5 0
>>	,, III. (1 Plate),	•	•	. 4	0	5 0
33-	Complete,	•	•	•		Print.
Volume	V. Part I. (2 Plates), .		٠.	. 4	0	5 0
,,	,, II. (4 Plates), .		•	. 4	0	5 0
,,	,, III. (11 Plates), .		•	. 5	0	6 0
. **	,, IV. (1 Plate), .		٠.	. 3	0	4 0
**	Completè,			. 12	0	16 O
Volume	VI. Part I. (1 Plate), .			. 2	0	3 0
,,,	,, II. (3 Plates), .	•		. 2		3 0
,,	,, III. (4 Plates), .	•		. 2	6	3 6
,,	,, IV. (3 Plates), .			. 1	6	2 0
,,	,, V. (4 Plates), .			. 2	6	36
,,	Complete,			. 10	.0	13 0
Volume	VII. Part I. (2 Plates), .			. 2	. 0	3 0
"	,, II. (1 Plate), .	:		. ī	6	2 0
,,	,, III. (16 Plates), .			$\overline{7}$	, Õ	9 0
,,	,, IV. (11 Plates), .		•	. 6	0	8 0
,,	Complete,	. •		. 14	.0	18 0
Volume	VIII. Part I. (3 Plates), .			. 5	0	7 0
	, II. (2 Plates), .	•	•	. 3		5 0
33	Special Part (62 Illustration	s).	•	. 4	-	6 0
133	Part III. (5 Plates), .	~,,		$\frac{1}{4}$		őŏ
"	Complete,	:		. 15		22 0
	of Members,			. 0	7	0 6
Lon	s of the Society,	•	•	. 0		0 6
TINA	s or one poetery,	<b>:</b>	. •	. 0	Ð	0 0

Orders for the Society's Publications, and all printed matter intended for the Library, should be addressed to the Honorary Librarian, Mr David Tair, India Buildings. All communications for the Secretary should be addressed to the Society's Library, India Buildings.

The Edinburgh Geological Society was founded in 1834; but it did not publish Transactions till 1868. Fellows pay an Entrance Fee of 10s. 6d., and an Annual Subscription of 12s. 6d.; or a single payment may be made for Life of £6:16:6. Life Members and Fellows who have paid Annual Subscriptions to the amount of Two Guineas may receive the Society's Diploma on payment of a fee of 7s. 6d. Candidates for election must be nominated by two Ordinary Fellows.

The Society is supported solely by the Annual Subscriptions of its Ordinary Fellows, and derives no pecuniary aid from Government.