YORKSHIRE PHILOSOPHICAL SOCIETY.

ANNUAL REPORT

FOR

MCMVII.

ANNUAL REPORT

OF THE COUNCIL

OF THE

YORKSHIRE

PHILOSOPHICAL SOCIETY

FOR

MCMVII.

PRESENTED TO THE ANNUAL MEETING,

FEBRUARY 10th, 1908.

YORK:
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1908.

TRUSTEES

OF

THE YORKSHIRE MUSEUM,

APPOINTED BY ROYAL GRANT,

TEMPEST ANDERSON, M.D.

GEORGE A. AUDEN, M.D.

LORD DERAMORE.

CHAS. E. ELMHIRST.

SIR GEORGE GIBB, LL.B.

EDWIN GRAY, LL.M.

T. S. NOBLE.

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OF THE

Yorkshire Philosophical Society.

HIS MAJESTY THE KING.

HER MAJESTY THE QUEEN.

H.R.H. THE PRINCE OF WALES.

H.R.H. THE PRINCESS OF WALES.

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* For one year in place of G. YELD.

CURATORS:

Archæology	T. Boynton, F.S.A. C. Wakefield. Rev. J. Solloway, D.D.
Geology	Rev. W. Johnson, B.A., B.Sc.
Mineralogy	W. H. Hudleston, M.A., F.R.S.
Comparative Anatomy	T. Anderson, M.D., D.Sc.
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Botany	H. J. Wilkinson.
Observatory	T. S. Noble. Dennis Taylor.
Meteorology	The Rev. W. Johnson, B.A.
Numismatics	C. Wakefield.
Entomology	S. Walker.
Library	H. M. Platnauer, B.Sc.

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PHOTOGRAPHIC SECTION:

Dr. Tempest Anderson (*President*).
J. N. Kitching (*Vice-President*).
H. Dennis Taylor and M. Spence (*Secretaries*).

KEEPER OF THE MUSEUM:

Oxley Grabham, M.A., M.B.O.U.

REPORT OF THE COUNCIL

OF THE

YORKSHIRE PHILOSOPHICAL SOCIETY,

10TH FEBRUARY, 1908.

AFTER the exceptional events of 1906 arising from the visit of the British Association, the year 1907 has seemed one of comparative quiet in the annals of our Society, but though devoid of excitement it has been by no means a year of idleness. Much attention has, as usual been devoted to the preservation of the Ruins in the Museum Gardens. The ivy has been removed from the Roman Wall connecting the Multangular Tower and St. Leonard's Hospital. Two of the windows in the Hospital have been glazed with a view to stop the action of sand scour, and further experiments with lime-wash have been carried out in the Ambulatory in the hopes of preserving the stone pillars and groined roof from the disintegrating action of the atmosphere and the acids and smoke inseparable from the busy life of the city. This action will be supplemented during the coming year by experiments with barium hydrate.

The attention of your Council was called by Mr. Edward S. Prior, of Chichester, to the collections of 12th and 13th century sculpture in the lower room of the Hospitium, which he pronounced to be unrivalled in England, but which for lack of space are very inadequately exhibited in the dim light of the Hospitium. During the last year a Sub-Committee has been appointed to consider how these treasures can be re-arranged and grouped so as to show the connection of the fragments and to exhibit in a more satisfactory manner these specimens

of the sculptor's art produced in the York workshops of long past centuries.

In October last, your Council received the first official intimation from the Town Clerk of York that it was proposed to hold an Historic Pageant in our ancient city in July, 1909, and that the Museum Gardens were suggested as the most appropriate site for the exhibition. The announcement was received with somewhat mixed feelings, and the matter was discussed from various points of view.

Your Council recognised that they were the duly authorised representatives of the Members of the Society and the natural guardians of their rights and liberties. A Sub-Committee was appointed who met the Pageant Committee and Mr. Louis N. Parker who had so successfully directed the pageants at Warwick, Sherborne, Bury St. Edmunds, Claremont, and elsewhere. The picturesque ruins of St. Mary's Abbey were described by Mr. Parker as a perfect setting for the arena of an historic pageant, and he asserted that it was the only site in and around York which would satisfy his requirements, and went so far as to declare that if the Museum Gardens could not be obtained he must decline to conduct any pageant in York, but would accept an invitation already received from Colchester.

The Pageant Committee laid great stress on the educational advantages of the Pageant, and pointed out that opportunity would be provided for the school children of York to attend at nominal charges. The question of damage to the turf by the performance and the erection of stands was fully considered, and the cost of restoration provided for as well as a substantial rent and a share in the profits produced. It was felt that to refuse the use of the Gardens would be an ungracious action to the City, and your Council decided to recommend to the members of the Society that they should take a patriotic view as distinguished from a selfish one, and this recommendation was adopted at a Special General Meeting on the 29th Nov. last. Your Council trust that the Pageant may prove a complete success, that our members may cordially co-operate not only by taking part in representing the historic characters portrayed, but in cheerfully submitting to any temporary

interference with their accustomed free use of the Gardens whilst the rehearsals and performances are in progress.

The financial statement comprised in our report shews that our expenditure has exceeded our income by the sum of £25 17s. 5d. (since reduced by the payment of arrears of subscriptions) owing to a substantial outlay on the Zoological collection.

The additions to our Fish and Bird collections have been considerable and of great interest.

The best thanks of the members are due to our energetic Keeper of the Museum, Mr. Oxley Grabham, who has added largely to the interest of the Gardens in supplying living specimens to our collection for the instruction not only of the children of our members, but also of adults. The three squirrels reared almost from birth by a domestic cat have been a source of endless interest, whilst the pigeons, finches, magpies, and pea-fowl have many admirers.

During the past year the Society has lost by death one of its oldest and most distinguished supporters, Mr. John Francis Walker. He was our senior Vice-President, and constantly presided at our meetings, was for many years Curator of Geology and the Laboratory, and enriched our collection with many specimens of brachiopods, on which he was a well recognized leading authoriity. It is hoped that his portrait will shortly be added to our gallery in the council chamber.

The Lectures and afternoon papers have been maintained at their previous high level, thanks to the untiring energy of our President and Lecture Secretary, Dr. Tempest Anderson, and included one from himself on "The Volcanoes of Central America," which he visited during the winter of 1906. A full list of the lectures is given at the end of the report.

On July 25th, Dr. Anderson entertained the whole of the members of the Philosophical Society at a most enjoyable Garden Party in the Grounds.

In September last the Institute of Journalists held their meeting at Scarborough, and a large number of them visited the Museum and Grounds of your Society where they were entertained by the Lord Mayor and Sheriff, and afterwards divided into parties and conducted round the antiquities by

members of your Council. The Journalists expressed themselves as delighted with their visit and fully appreciated the attention shewn to them.

Your Council recommends the election of Mr. George Yeld as a Vice-President in the place of Mr. J. F. Walker, and of Messrs. W. Johnson, C. K. Hitchcock, C. Wakefield, and H. J. Wilkinson, as new Members of Council for the next three years in the place of those retiring by rotation, and of Mr. H. C. Shann for one year in the place of Mr. G. Yeld. They have also appointed Dr. Solloway joint Curator of Archæology with Mr. Boynton and Mr. Wakefield, and the Rev. W. Johnson, Curator of Geology, in the place of the late Mr. J. F. Walker.

The Council has decided, in view of the size of our Coin Collection and the importance of the subject, to constitute Numismatics a separate department of the Museum and no longer to treat it as simply a branch of Archæology. They have appointed Mr. C. Wakefield Curator of the newly made department. His wide knowledge of the subject and his past services render him peculiarly fit for this position.

The Society has lost 7 Members, 2 Lady Subscribers, by death; 25 Members, 4 Lady Subscribers, and 1 Associate by resignation; 25 Members, 6 Lady Subscribers, have joined the Society during the year.

The evening Lectures delivered in the Museum were as follows:—

Thursday, January 24th.—"The Pedagogues in Greece," (with Lantern Illustrations). By C. C. Lempriere, Esq.

Thursday, February 7th.—"In the Land of the Vendetta," (with Lantern Illustrations). By the Rev. T. T. Norgate, F.R.G.S.

Thursday, February 21st.—"St. William's College,' (with Lantern Illustrations). By Geo. Benson, Esq.

Thursday, March 7th.—"Westminster Abbey," (with Lantern Illustrations). By the Rev. Jocelyn Perkins.

Thursday, March 21st.—"A Cruise in the Mediterranean," (with Lantern Illustrations). By the Rev. F. M. Blakiston,

Thursday, April 4th.—The Members of the Photographic Society gave a Lantern Night.

Thursday, October 10th.—"Reading from Shakspere." By the Rev. Canon Fleming, B.D.

Thursday, October 24th.—"Among Giants and Swamps," (with Lantern Illustrations). By Sir Alfred E. Pease, Bart.

Thursday, November 7th,—"Geology and Photography, especially in the South East of England," (with Lantern Illustrations). By W. Whitaker, F.R.S.

Thursday, November 21st.—"The Tower of London" (with Lantern Illustrations). By the Rev. Jocelyn Perkins, M.A., T.R.Hist.S.

Thursday, November 28th.—"Algeria: Past and Present," (with Lantern Illustrations). By Mrs. Aubrey Le Blond.

Thursday, December 5th.—"An Exploration of the Nun Kun Mountain Group and its Glaciers in Suru Kashmir," (with Lantern Illustrations). By William Hunter Workman, M.A., M.D., F.R.G.S.

Thursday, December 19th.—"The Volcanoes of Central America," (with Lantern Illustrations). By Tempest Anderson, M.D., B.Sc.

Archæology.—The Curators report that the chief additions to the Antiquarian Department have consisted of a donation by Dr. Tempest Anderson (1) of a very fine and representative series of the current gold, silver and copper coinages of the United States of America, Mexico, Venezuela, Guatemala and Panama, made by him during his recent visit to Central America. (2) A XXVIth Dynasty painted and inscribed Egyptian Coffin, together with a few boards of a XIIth Dynasty sarcophagus, pottery, beads, alabaster jars, scarabs, etc., presented by Professor Flinders Petrie on behalf of the British School of Archæology in Egypt. (3) A collection of Egyptian scarabs, beads, ear-rings, figures of gods, etc., presented by Miss Crawhall, of Scarborough.

They have pleasure in reporting also that the whole of the Tradesmen's Halfpenny Tokens of the XVIIth and XVIIIth centuries have now been examined and arranged; the authorities followed have been Atkin's almost classic work for the latter, while Boyne's has been used for the former. A ticket or label has been placed beneath each specimen denoting the county, city or town, and the index number of the above authorities, together with a note of explanation occasionally. It may, perhaps, be here remarked that this is the first time in the history of the Society that these tokens have been collected together and arranged.

ENTOMOLOGY.—The Hon. Curator reports:—The cabinets containing the several collections of British Insects in the Council Room, have undergone careful inspection during the past year, and (with some few exceptions) have been maintained in good condition. It is intended shortly to replace the old and worn Exotic lepidoptera in the cases above the British Bird Room with fresh specimens.

BOTANY.—An attempt has been made to make the Botanical Gardens of interest to the Members of the Society. Over two hundred plants, illustrative of the Natural Orders—Ranunculaceæ, Cruciferæ, Leguminosæ, Rosaceæ—have been put into the garden.

GEOLOGY.—The collections are in good order, and a considerable amount of work has been done in the Tertiary Room by Mr. Watson, in the way of re-papering the shelves and re-labelling the specimens. Several more specimens have been lent to Mr. H. Woods, M.A., F.G.S., of the Sedgwick Museum, Cambridge.

ORNITHOLOGY.—Many additions have been made to this Department in the way of stuffed specimens, skins, and eggs; and two interesting cases, one representing a trained Peregrine Falcon with the hood, bell, and jesses on, and the other a famous old English fighting cock which won many a main in bygone days, and still wears the old steel spurs in which he fought, have been arranged by the Keeper of the Museum.

ZOOLOGY.—The collections are in good order, the chief additions being a very fine series of stuffed specimens of Yorkshire Freshwater Fish, amongst which may be specially mentioned a magnificent Barbel of close upon 10lbs. in weight, caught in the river Swale; several interesting sea-fish have been procured, and some further skins and stuffed specimens of British mammals.

LIBRARY.—The Hon. Librarian reports that the Department in his charge is in good order. Some useful books have been purchased and several learned societies have continued to

present valuable publications, but no additions have been made requiring special notice. The want of space is becoming acute, and it is almost impossible to find room for fresh accessions.

MINERALOGY.—Few specimens have been added during the past year, but the fine collection is in excellent condition.

METEOROLOGY.—*Statistics of Station* :—Longitude, 1° 5' W. ; Latitude. 53° 57' N. ; height above mean sea level, 56 feet.

Temperature in 1907 ranged between 19°F. and 76°F., the average mean temperature for the year being 47·2° as compared with 48·2° in 1906. The lowest temperature was recorded on January 25th, when the absolute minimum thermometer read 19°F., whilst the highest reading was taken on two occasions, May 12th and July 16th, a coincidence which explains the falling off in temperature of our summer. The highest reading, 76°F., is 16°F. behind the high record of the previous year. The general public believe the summer to have been cold and wet, and the season generally unfavourable to health. The absence of sunlight in months usually the hottest not only helped to establish this belief, but gave rise to gloomy predictions regarding the general health of the people, which have been only too well verified.

A *Mean Pressure* of 29·923 inches at normal temperature and mean sea level has been recorded as against 29.934 inches for 1906, October being lowest with 29·632 inches, December next with 29·720 inches, January being highest with 30·261 inches, followed by September with 30·128 inches.

The extreme range of pressure was 2·470 inches as compared with 2·147 inches in 1906, and 2·117 inches in 1905; the highest reading being taken on January 23rd at 9 a.m., and the lowest on December 13th at 9 p.m.

Rain or Snow (0·005 inches or more) fell on 211 days, 12 more than in 1906, and 40 more than in 1905, the fall for the whole year being however only 25·60 inches, *i.e.*, 1·1 inches above the average 24·5 for the last 65 years. The combination of cold and wet days in the summer gave rise to the feeling of continuous winter.

The wettest months of the year were October, June and May, with totals of rainfall amounting to 4·63, 3·63, and 3·38 inches respectively, whilst September, January, and February produced 0·80, 0·84, 1·03 inches respectively.

The cumulative totals for the wettest week since 1841 are now October 183·41 inches, August 178·87 inches, and July 166·07 inches. The heaviest rainfall occurred on June 29th, —·94 inch, the last week of June again taking the record fall.

The prominent features of our observations are the very wet periods:—April—June, October—December, the phenomenally fine September and the general low temperature throughout the year. Our experiences of these periods prevent our accepting the statement that the earth is gradually losing its supplies of water.

Observations of the winds show that again on no day during the year 1907 did the wind blow with the force of a "gale," while the chief air-currents were S. (195) days, W. (176), S.W. (66), N. (71), N.W. (77), E. (57), 14 days being "calm" as against 5 in 1906.

Days of "clear sky" numbered 42 as in 1906, "overcast" were 120 as against 113 in 1906, and there were 16 thunderstorms. Snow fell on 17 days.

The worst feature of the year to the meteorologist is the falling off of bright sunshine, the hours recorded being 1265·3 as against 1384·3, a reduction from 31 % to 29 %.

The Observatory.—The permanent features of this building and the instruments seem to be in very good state of repair. The Equatorial is in perfect adjustment from an optical point of view, but there is a want of proper mechanical balance, the free end of the Declination axes being heavier than the telescope end, so that if the hand leaves it in order to reach the right ascension clamp, the Declination axis is apt to swing round on the hour axis.

The Photographic Section.—The membership of this Section has increased during 1907. A considerable departure has been made from its former procedure of holding meetings

regularly once a month during the Winter session. Instead the dates of meetings are fixed from time to time as the occasion arises and members are found willing to introduce suitably interesting subjects to fill up the evening. In this way several very successful evening meetings have been held. The exhibition of lantern slides, illustrating the work in Natural History and other photographic work undertaken by members of the Section, before the general Society in the Spring, was, as usual, very well attended and highly appreciated. Members and Associates of the Yorkshire Philosophical Society, anxious to join the Photographic Section, should apply to one of the Hon. Secretaries,

Mr. H. Dennis Taylor, Stancliffe, The Mount, or Mr. Malcolm Spence, Almery Garth, Marygate.

METEOROLOGICAL STATION, YORK.—THE MUSEUM.

Longitude 1° 5′ W., Latitude 55° 57′ N. Height above Mean Sea Level 56 ft. Gravity Correction + ·024 in.

1907.	Mean Pressure at 32° Fahrenheit.		Air Temperature.										Humidity.									Earth Temp.	
	At M. S. Level	At Station Level.	9 a.m.	9 p.m.	Mean.	Means of Min.	Means of Max.	Min. & Max. Combined.	Absolute Min. and Max. Min.	Absolute Min. and Max. Day.	Absolute Min. and Max. Max.	Absolute Min. and Max. Day.	Deprn. of Wet Bulb. 9. am.	Deprn. of Wet Bulb. 9 p.m.	Deprn. of Wet Bulb. Mean.	Tension of Vapour. 9 a.m.	Tension of Vapour. 9 p.m.	Tension of Vapour. Mean.	Percentage. 9 a.m.	Percentage. 9 p.m.	Percentage. Mean.	At 1 ft.	At 4 ft.
	ins.	ins.	°	°	°	°	°	°	°		°		°	°	°	in.	in.	in.	%	%	%	°	°
Jan.	30·261	30·200	37·2	38·6	37·9	33·6	43·4	38·5	19·0	25th	50·4	6th	1·1	1·3	1·2	·200	·209	·205	90	90	90	37·8	41·7
Feb.	29·954	29·894	35·5	36·8	36·2	32·1	43·7	37·9	21·0	3rd	57·0	27th	1·2	1·2	1·2	·185	·195	·190	89	90	90	36·1	39·5
Mar.	30·092	30·032	41·1	42·4	41·8	34·7	52·4	43·6	27·0	12th	67·8	31st	2·3	2·3	2·3	·210	·223	·217	82	83	83	39·6	40·5
April	29·770	29·711	46·2	44·2	45·2	38·8	53·7	46·3	28·5	19th	66·0	1st	2·7	1·9	2·3	·253	·248	·251	82	85	84	45·6	44·1
May	·858	·800	51·2	49·2	50·2	43·5	58·3	50·9	34·0	22nd	76·0	12th	3·0	2·2	2·6	·302	·296	·299	80	85	83	49·9	47·6
June	29·770	·713	55·9	53·4	54·7	48·4	63·0	55·7	41·2	4th	74·4	9th	3·9	2·3	3·1	·341	·345	·343	76	85	81	53·9	50·9
July	30·014	·957	58·2	55·1	56·7	49·0	65·2	57·1	38·2	1st	76·0	16th	3·6	1·9	2·8	·380	·380	·380	78	87	83	55·9	53·2
Aug.	29·911	29·854	59·5	56·2	57·9	50·2	65·8	58·0	43·0	28, 30	73·0	4th	3·6	1·8	2·7	·398	·399	·399	78	88	83	57·9	55·6
Sept.	30·128	30·070	54·8	54·4	54·6	46·0	65·9	56·0	33·0	4th	73·8	18th	2·0	1·6	1·8	·373	·378	·376	88	90	89	55·9	55·1
Oct.	29·632	29·575	48·2	49·0	48·6	42·3	56·4	49·4	31·0	25th	64·8	6th	0·7	1·2	1·0	·320	·317	·319	96	92	94	51·8	53·4
Nov.	·967	·907	42·0	43·3	42·7	38·0	48·9	45·5	26·0	26th	57·0	2nd	1·1	0·7	0·9	·243	·265	·254	91	95	93	46·1	49·5
Dec.	29·720	29·661	39·0	39·6	39·3	35·4	44·1	39·8	25·0	24th	53·0	8th	0·8	1·1	1·0	·222	·221	·222	94	91	93	40·4	44·3
Year	29·923	29·865	47·4	46·9	47·2	41·0	55·1	48·1	19·0	Jan. 25th	76·0	May 12th July 16th	2·2	1·6	1·9	·286	·290	·288	85·3	88·4	86·9	47·6	48·0

STATION, YORK.—THE MUSEUM.

Heights above Ground :—Barometer, 3 feet ; Thermometers, 4 feet ; Rain-gauge, 1 foot.

1907.	Amount of Cloud.			Rainfall.			Weather, No. of Days of									Wind, No. of Observations of								
	9 a.m.	9 p.m.	Mean	Total.	Max.	Day.	Rain.	Snow.	Hail.	Thunder Storm	Clear Sky.	Over-cast.	Fog.	Gale.	Strong (Wind 4·7)	N.	N.E.	E.	S.E.	S.	S.W	W.	N W	Calm.
				ins.	ins.																			
Jan.	5·6	5·9	5·8	0·84	·25	1st	15	6	0	0	4	10	3	0	4	3	0	4	2	11	10	26	6	0
Feb.	5·1	4·8	5·0	1·03	·27	12th	17	5	1	1	8	8	6	0	4	5	0	0	1	12	2	18	13	5
Mar.	4·8	3·5	4·2	1·22	·47	19th	15	2	0	0	8	5	7	0	8	1	1	1	3	17	8	21	9	1
April	5·8	7·4	6·6	1·27	·25	3rd	16	0	0	2	1	11	3	0	0	9	3	16	7	5	2	12	6	0
May	7·5	7·6	7·6	3·38	·78	31st	23	0	0	1	1	16	0	0	3	10	7	3	4	13	3	9	12	1
June	7·3	7·8	7·6	3·63	·94	29th	22	0	0	4	0	13	0	0	3	2	3	0	0	23	8	19	5	0
July	6·8	6·8	6·8	1·55	·40	10th	16	0	1	3	2	9	0	0	1	8	7	7	1	10	8	16	2	3
Aug.	7·0	7·1	7·1	1·85	·83	14th	15	0	0	2	0	9	0	0	1	1	0	0	0	17	10	27	7	0
Sept.	4·7	4·6	4·7	0·80	·39	4th	6	0	0	0	7	6	6	0	0	5	3	2	12	19	3	9	5	2
Oct.	6·8	6·1	6·5	4·63	·65	16th	26	0	0	2	3	12	6	0	1	9	3	4	5	30	3	1	6	1
Nov.	6·0	6·6	6·3	2·63	·70	26th	19	1	0	1	5	12	7	0	3	14	0	6	5	20	1	9	5	0
Dec.	7·1	6·2	6·7	2·77	·51	7th	21	3	0	0	3	9	8	0	3	4	1	14	6	18	8	9	1	1
Year	6·2	6·2	6·2	25·60	·94	June 29	211	17	2	16	42	120	46	0	31	71	28	57	46	195	66	176	77	14

RIVER HEIGHT RECORDS REGISTERED BY THE AUTOMATIC RECORDER AT THE GUILDHALL, YORK, 1907.

Date.	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.	
	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.
		ft. in.		ft. in.		ft. in.		ft. in.		ft. in.		ft. in.
1	12 p.m.	0 5	noon	0 3	9 p.m.	0 4	noon	S.L.	noon	above 0 2	12 p.m.	6 5
2	,,	8 9	1 a.m.	0 3	noon	0 4	,,	S.L.	12 p.m.	1 2	4 a.m.	6 7
3	6 a.m.	9 0	noon	S.L.	,,	0 2	,,	S.L.	9 p.m.	2 4	1 a.m.	4 6
4	1 a.m.	7 2	12 p.m.	0 1	1 a.m.	0 2	,,	S.L.	7 a.m.	2 8	,,	2 8
5	,,	2 6	noon	0 1	4 p.m.	0 3	,,	0 2	2 p.m.	0 9	12 p.m.	2 9
6	7 p.m.	6 3	,,	0 1	noon	0 3	10 a.m.	0 2	1 a.m.	0 6	9 a.m.	6 3
7	12 p.m.	2 1	,,	S.L.	,,	0 3	1 a.m.	S.L.	6 p.m.	0 1	1 a.m.	5 8
8	3 p.m.	1 6	,,	S.L.	12 p.m.	1 5	,,	0 3	noon	S.L.	,,	2 6
9	12 p.m.	1 2	,,	S.L.	,,	0 10	,,	0 3	,,	S.L.	,,	1 6
10	,,	1 3	,,	S.L.	,,	0 6	,,	0 5	12 p.m.	S.L.	12 p.m.	1 6
11	noon	1 3	12 p.m.	0 6	4 p.m.	2 6	noon	0 4	,,	0 10	5 p.m.	2 5
12	9 p.m.	0 9	noon	0 6	1 a.m.	2 2	,,	0 5	,,	0 6	12 p.m.	3 1
13	noon	0 8	12 p.m.	1 5	,,	1 0	,,	0 3	noon	S·L.	6 a.m.	4 4
14	6 p.m.	0 5	2 p.m.	1 10	,,	1 0	12 p.m.	S.L.	,,	S·L.	1 a.m.	2 10
15	noon	0 5	12 p.m.	4 3	12 p.m.	1 6	1 a.m.	S.L.	12 p.m.	0 9	,,	1 6
16	,,	0 4	1 p.m.	6 11	9 a.m.	3 6	noon	below 0 2	noon	1 4	noon	0 8
17	,,	0 4	12 p.m.	7 6	7 p.m.	7 8	,,	0 2	1 a.m.	0 6	,,	0 5
18	,,	0 4	3 a.m.	7 9	12 p.m.	3 10	,,	0 2	,,	0 4	5 p.m.	0 2
19	,,	0 3	7 a.m.	2 9	,,	1 8	,,	0 2	,,	S.L.	12 p.m.	0 6
20	,,	0 2	10 p.m.	8 9	7 p.m.	5 1	6 p.m.	0 7	,,	S.L.	noon	0 6
21	,,	0 1	12 p.m.	4 2	12 p.m.	2 4	1 a.m.	0 5	noon	S.L.	10 a.m.	2 4
22	,,	below 0 1	,,	1 3	noon	1 0	noon	0 3	,,	S.L.	12 p.m.	0 3
23	,,	0 2	11 a.m.	0 6	1 a.m.	1 7	,,	0 2	,,	S.L.	,,	0 6
24	,,	0 2	12 p.m.	0 2	,,	0 8	1 a.m.	0 2	12 p.m.	1 0	noon	1 2
25	,,	0 3	,,	1 0	12 p.m.	0 9	,,	above 0 10	noon	1 10	10 p.m.	3 2
26	,,	0 4	3 p.m.	1 10	noon	0 9	,,	0 3	12 p.m.	0 6	9 p.m.	0 11
27	,,	0 4	12 p.m.	0 11	,,	0 7	noon	S.L.	noon	S.L.	12 p.m.	1 1
28	,,	0 2	,,	0 6	,,	0 6	,,	S.L.	,,	0 6	6 a.m.	1 3
29	4 p.m.	above 2 5			1 a.m.	0 6	,,	below 0 2	,,	0 9	11 p.m.	0 7
30	7 p.m.	0 5			noon	0 3	,,	0 2	1 a.m.	0 8	12 p.m.	0 10
31	12 p.m.	0 4			,,	0 2			12 p.m.	2 2		

RIVER HEIGHT RECORDS.—*Continued.*

Date.	JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.
		ft. in.		ft. in.		ft. in.		ft. in.		ft. in.		ft. in.
1	12 p.m.	0 8	noon	below 0 2	noon	0 9	noon	below 0 4	5 p.m.	9 3	1 a.m.	2 8
2	noon	0 7	,,	0 2	,,	water off.	,,	0 4	1 a.m.	8 9	6 p.m.	1 3
3	12 p.m.	0 10	,,	0 2	,,	,,	,,	0 4	,,	3 10	12 p.m.	1 6
4	,,	0 6	,,	0 2	,,	,,	,,	0 4	,,	1 6	1 p.m.	2 2
5	noon	0 8	,,	0 2	,,	,,	,,	0 4	,,	1 3	11 p.m.	6 6
6	,,	1 2	,,	0 2	,,	,,	,,	0 4	,,	0 10	10 p.m.	2 8
7	,,	0 8	,,	0 2	6 a.m.	below 0 7	,,	0 4	6 p.m.	0 8	11 p.m.	1 4
8	12 p.m.	0 5	12 p.m.	S.L.	noon	0 4	,,	0 6	noon	0 7	12 p.m.	7 6
9	3 p.m.	1 5	1 a.m.	S.L.	,,	0 3	,,	0 5	,,	0 7	,,	9 10
10	7 a.m.	0 5	,,	above 0 6	,,	0 4	,,	0 5	,,	0 8	3 a.m.	9 11
11	noon	0 5	noon	0 3	,,	0 4	,,	0 3	1 a.m.	0 8	1 a.m.	9 3
12	1 a.m.	0 5	1 a.m.	0 3	,,	0 4	5 p.m.	S.L.	12 p.m.	0 5	,,	8 1
13	noon	0 1	6 p.m.	0 10	,,	0 4	12 p.m.	above 2 5	,,	3 9	,,	6 2
14	12 p.m.	0 5	noon	0 10	,,	0 5	5 a.m.	2 6	4 a.m.	3 11	10 p.m.	4 11
15	,,	0 3	,,	1 0	,,	0 5	5 p.m.	S.L.	1 a.m.	1 6	12 p.m.	3 9
16	noon	0 1	,,	1 0	,,	0 6	10 p.m.	0 8	5 a.m.	1 0	,,	2 10
17	,,	S.L.	,,	1 0	,,	0 6	12 p.m.	4 3	noon	0 7	noon	2 9
18	,,	S.L.	,,	0 11	,,	0 5	10 a.m.	7 6	12 p.m.	1 0	,,	2 10
19	,,	S.L.	,,	0 10	,,	0 5	1 a.m.	5 2	,,	0 9	,,	2 10
20	,,	S.L.	,,	1 0	,,	0 6	,,	0 11	6 p.m.	0 6	12 p.m.	5 9
21	,,	S.L.	,,	1 1	,,	0 6	4 p.m.	3 9	12 p.m.	0 9	4 p.m.	8 6
22	,,	S.L.	,,	1 2	,,	0 5	12 p.m.	0 8	9 p.m.	0 7	12 p.m.	4 5
23	,,	S.L.	,,	1 2	,,	0 5	3 p.m.	0 9	12 p.m.	3 2	,,	2 10
24	,,	S.L.	,,	1 2	,,	0 5	,,	1 2	4 a.m.	3 3	noon	2 10
25	,,	S.L.	,,	1 2	,,	0 5	12 p.m.	0 7	1 a.m.	1 5	,,	2 10
26	,,	S.L.	,,	1 1	,,	0 4	,,	1 5	12 p.m.	1 3	,,	2 10
27	,,	S.L.	1 a.m.	0 11	,,	0 5	,,	1 0	12 p.m.	3 8	,,	2 10
28	,,	S.L.	noon	0 9	,,	0 4	,,	1 0	7 p.m.	5 0	9 a.m.	1 8
29	,,	S.L.	,,	0 9	,,	0 4	1 p.m.	S.L.	1 a.m.	4 10	noon	1 3
30	,,	below 0 2	,,	0 9	,,	0 5	12 p.m.	0 8	,,	5 0	9 a.m.	0 10
31	,,	0 2	,,	0 9			,,	7 6			,,	0 9

OUSE FLOODS FROM RETURNS TO THE CITY SURVEYOR.

COMPARATIVE TABLE, 1907.

Date.	Nidd at Pateley Bridge.		Ure at Middleham Bridge.		Swale at Richmond.	
	Hour.	Height.	Hour.	Height.	Hour.	Height.
		ft. in.		ft, in.		ft. in.
Jan. 2	5-30 p.m.	2 6	7 a.m.	11 0	9 a.m.	3 0
,, 5			4 p.m.	4 6		
,, 6					4 a.m.	3 0
Feb. 15			4 p.m.	6 0	7 p.m.	2 6
,, 17			1 p.m.	10 0	1 p.m.	3 0
,, 19					7-15 p.m.	4 6
Mar. 10					6 p.m.	2 9
,, 16			4 p.m.	10 0	2 p.m.	4 0
,, 17					1 p.m.	2 0
May 3			5 p.m.	5 0	7 p.m.	2 0
,, 31					7-30 p.m.	2 0
June 5			4 p.m.	5 0	6 p.m.	2 0
,, 12			2 p.m.	6 0		
,, 20					7 p.m.	3 0
,, 25			6 a.m.	6 0		
Oct. 17			4 p.m.	9 0	5 p.m.	5 6
,, 31			4 p.m.	9 0	7 p.m.	4 0
Nov. 27			4 p.m.	5 0	12 p.m.	3 0
,, 28					9 a.m.	2 0
,, 28			8 a.m.	3 0		
Dec. 4					11 p.m.	3 0
,, 5					9 a.m.	2 0
,, 8					12 p.m.	4 0
,, 9			9 a.m.	8 9	9 a.m.	3 0
,, 10			4 p.m.	5 0	4 p.m.	2 0
,, 20			8 a.m.	7 0		

YORK—THE MUSEUM.

Barometer at 32° and M.S.L.

1907.	Highest Barometer.		Lowest Barometer.	
January	31·065	23rd, 9 a.m.	28·977	2nd, 9 a.m.
February	30·574	2nd, 9 a.m.	28·689	20th, 9 a.m.
March	30·504	11th, 9 p.m.	29·141	16th, 9 p.m.
April	30·281	24th, 9 p.m.	29·185	7th, 9 a.m.
May	30·283	29th, 9 a.m.	29·083	2nd, 9 p.m.
June	30·131	17th, 9 a.m.	29·459	3rd, 9 a.m.
July	30·479	15th, 9 p.m.	29·514	4th, 9 a.m.
August	30·282	21st, 9 p.m.	29·508	15th, 9 a.m.
September	30·527	22nd, 9 a.m.	29·415	2nd, 9 p.m.
October	30·057	5th, 9 a.m.	29·131	15th, 9 a.m.
November	30·481	30th, 9 a.m.	29·149	26th, 9 p.m.
December	30·376	24th, 9 a.m.	28·595	13th, 9 p.m.
Year	31·065	Jan. 23rd, 9 a.m.	28·595	Dec. 13th, 9 p.m.

YORK (BOOTHAM)—SUNSHINE VALUES.

Month.	Total Hours.	Percentages.	
	1907.	1907.	1906.
January	50·3	21	13
February	79·6	29	26
March	156·3	43	31
April	137·1	33	43
May	111·9	23	20
June	138·0	27	37
July	141·9	28	42
August	148·2	33	40
September	155·8	42	42
October	78·7	24	24
November	52·4	21	13
December	15·1	7	20
Year	1265·3	29	31

THE TREASURER'S ACCOUNT IN CONNECTION WITH THE FUND FOUNDED BY THE LATE WM. REED, ESQ., FOR SPECIFIC PURPOSES.

Dr. INCOME.

	£	s.	d.
Interest on £600 York Corporation 3 °/₀ Redeemable Stock, less Income Tax	17	2	0
Interest on £50 placed on Deposit at York City and County Bank	1	5	0
	£18	7	0

EXPENDITURE. **Cr.**

	£	s.	d.
Books and Binding	18	7	0
	£18	7	0

BALANCE SHEET.

	£	s.	d.
Amount of Fund on 31st December, 1907	687	19	2
	£687	19	2

	£	s.	d.
Amount invested in York Corporation 3 °/₀ Redeemable Stock	600	0	0
Amount placed on Deposit at York City and County Bank	50	0	0
Cash at Bankers in General Account	37	19	2
	£687	19	2

7th February, 1908. Examined and found correct,

PHILIP L. NEWMAN.

EDWIN GRAY, *Hon. Treasurer.*

THE TREASURER IN ACCOUNT WITH THE YORKSHIRE

Previous Year.	Dr. INCOME.	£	s.	d.	£	s.	d.
	Subscriptions:						
	Town Members	627	0	0			
	Country Members	11	0	0			
	Temporary Members...	1	0	0			
	Lady Subscribers	63	10	0			
	Associates	16	0	0			
	Arrears received	29	0	0			
818	Keys of Gates...	61	18	6			
					809	8	6
	Rents:						
	Major Allenby, St. Mary's Lodge	65	0	0			
	Mr. Hill, Marygate Baths	40	0	0			
	York Amateur Rowing Club	5	0	0			
	York and District Field Naturalists' Society, less £2 paid to Attendant	1	0	0			
	York Waterworks Co., for Shed	5	0	0			
	Do. for Light	0	1	0			
	Corporation of York—Lease of Exhibition Land ...	2	0	0			
	Yorkshire School for the Blind, for Light	0	1	0			
	National Telephone Co., for Wayleave	1	0	0			
	Post Office, for Wayleave	0	1	0			
	York University Extension Society	2	2	0			
	York & District Teachers' Association	0	1	6			
121	York Architectural Society...	1	0	0			
					122	6	6
	Whitsuntide Admission Fees	12	19	3			
	Less: Attendants and Police 5 0 0						
7	Wood for Barricades and Joiners for fixing 2 2 6						
		7	2	6			
					5	16	9
6	*Meteorological Department:*						
	Grant from Corporation of York				5	0	0
6	Sale of Catalogues and Plans				5	0	0
3	Sale of Photographs				3	0	0
7	Bank Interest				3	3	0
215	Gate Money				230	14	11
	Hire of Tent				4	4	0
26	Interest on £918 8s. 9d. India 3% Stock, less Income Tax				26	3	8
					1214	17	4
	Excess of Expenditure over Income				25	17	5
202					£1240	14	9
	Balance in hands of the Treasurer, 31st December, 1907				93	12	0
119					£93	12	0

Examined and found correct,

PHILIP L. NEWMAN.

7th Feb., 1908.

EDWIN GRAY,

Hon. Treasurer.

PHILOSOPHICAL SOCIETY FOR YEAR ENDING 31ST DEC., 1907.

Previous Year.	EXPENDITURE.	£ s. d.	£ s. d.	Cr. £ s. d.
1	Crown Rent			1 0 0
19	Corporation Rent			19 2 6
	Rates and Taxes:			
	Property Tax and City Rates		43 0 10	
	Waterworks Company's Rate		8 17 2	
	Gardeners' Licenses		2 5 0	
58	Receipt and Cheque Books Stamping ...		1 17 4	
				56 0 4
	Insurance:			
	Fire Premium		7 5 0	
8	Employer's Liability Premium		1 19 6	
				9 4 6
	Salaries and Wages:			
	Mr. Grabham		150 0 0	
	Mr. Fielden		60 0 0	
	Miss Baines		41 12 0	
	Mr. Guy		30 0 0	
	Attendants at Museum and Hospitium, viz.:			
	Attendant at Museum	80 12 0		
	Female Attendant at Museum	31 4 0		
144	Female Attendant at Hospitium... ...	32 10 0		
			144 6 0	
158	Gardeners, including temporary hands and extra duty at gates		154 7 6	
				580 5 6
198	*Yorkshire Insurance Company, Annuity ...			198 14 10
	General Additions, Repairs, and Expenses:			
180	Museum and Hospitium		30 3 8	
58	Estate		25 17 8	
51	Gardens		51 9 4	
				107 10 8
14	Library—Books and Binding			5 11 8
42	Lectures			41 13 4
9	Printing and Stationery			9 6 6
11	Printing Communications to Members, and Postage of same			12 5 6
8	Printing Reports and Postage thereof			31 19 7
	Gas, Coal, and Coke:			
	Museum		24 11 8	
	Gardens		18 15 4	
59	Estate		21 7 10	
				64 14 10
35	Antiquarian Department			15 0 2
	Zoological Department			60 5 8
16	Meteorological Department			16 9 10
1	Preparation of Photographs for sale			1 1 6
9	Sundry Postages			9 10 3
1	Sundries, including Carriage of Parcels ...			0 17 7
				£1240 14 9
	Balance in hands of the Treasurer, 31st December, 1906			119 9 5
	Excess of Expenditure over Income, 1907			25 17 5
				£93 12 0

* Annuity of £201 8s. 0d. payable until October, 1914, inclusive, created to repay an advance of £3500 made by the Yorkshire Insurance Co.

Principal repaid	2281 1 1
„ outstanding	1218 18 11
	£3500 0 0

NEW MEMBERS ELECTED, 1907.

Allen, W. A., 3, Grosvenor Terrace.
Beharrell, J. G., 1, Queen Anne's Road.
Bentley, Mrs., Fulford Grange.
Brode, Rev. T. Ainsworth, 5, The Crescent.
Brown, Arthur, 44, Monkgate.
Brown, J. G., 2, Carlton Terrace.
Creighton, Thos., 25, Priory Street.
Dick, Thos., 21, Railway Street.
Gofton, Ernest, 10, Grosvenor Terrace.
Grainger, Thos., 60, Petergate.
Hawkswell, Ralph, 19, Stonegate.
Hetherton, John, Clifford Street.
Howell, Mrs. S. A., 42, Stonegate.
Macdonald, Peter, Acomb.
Mackenzie, F. S., Club Chambers.
Mildred, Mrs. C. E., 6, Queen Anne's Road.
Newman, Rev. F. S., 16, Grosvenor Terrace.
Pearce, John, Lendal.
Pressly, D. L., Bootham.
Rutherford, J., 8, Grosvenor Terrace.
Sedgwick, J. Robinson, 11, South Parade.
Underwood, W., 70, Petergate.
Wilkinson, K. E. T., 60, Marygate.
Wright, J. H., 36, Market Street.

NEW LADY SUBSCRIBERS.

Brown, Mrs. G., 21, Avenue Terrace.
Keyworth, Miss, 6, Clifton.
McNaught, Mrs., 19½, Blake Street.
Pearson, Mrs., 57, Bootham.
Rawling, Miss, Swinegate.
Taylor, Mrs. M., 90, Minster Yard.

TEMPORARY MEMBER.

de Bunsen, Lothar, 2, Minster Court.

DEATHS, 1907.

Members.

Bentley, Wm., Fulford Grange.
Crawhall, Geo., Burton Croft.
Hardcastle, Hy., Clifton Green.
Rowntree, J. S., The Mount.
Walker, John Fras., Bootham.
Whytehead, T. B., Acomb.
Wright, Saml., Fairmount House.

Lady Subscribers.

Luden, Mrs., Clifton.
Vause, Miss, The Esplanade.

RESIGNATIONS.

25 Members.
4 Lady Subscribers.
1 Associate.

DONATIONS TO MUSEUM AND LIBRARY.

LIBRARY.

Books presented.	Donors.
The Quarterly Journal of the Geological Society of London, Vol. lxiii., 1907.	The Society.
Transactions of the Royal Society of Edinburgh, Vol. xli., Part 3. Vol. xlv., Parts and Proceedings, Vol. xxvi., No. 6; Vol. xxvii., Nos. 1, 2, 3, 4, 5.	The Society.
Catalogue of the Madreporarian Corals, Vol. iv. Catalogue of the Lepidoptera Phalænæ, Vol. vi., and Illustrations of British Blood Sucking Flies.	The Trustees of the British Museum.
Transactions of the Zoological Society of London, Vol. xviii., Part 1. Proceedings for 1907.	The Society.
Report of the British Association for the Advancement of Science, York, 1906.	The Association.
Transactions of the Linnean Society, Zoology and Botany for 1907 and Journal; Botany, Vol. xxxviii., Nos. 263 & 264; Zoology, Vol. xxx,, Nos. 195 and 196.	Dr. Tempest Anderson.
Annual Report of the Smithsonian Institution for 1905, and Annual Report of the Board of Regents, 1905 and 1906.	The Institution.

Annual Reports of the Bureau of American Ethnology, 1902-3 and 1903-4, and Bulletin, No. 30; Part 1 Handbook of American Indians.	The Bureau.
Records of the Geological Survey of India, Vol. xxxiv., Parts 3, 4; Vol. xxxv., Parts 1, 2, 3, 4.	The Survey.
Memoirs of the Geological Survey of Great Britain for 1907.	The Survey.
The History of the Geological Society of London, 1907.	H. B. Woodward.
The Journal of the Palæontographical Society, 1890, 1892, 1895, 1896.	Sir Charles Strickland.
Proceedings of the Royal Institution of Great Britain, Vol. xviii, Part 3.	The Institution.
An Account of the Crustacea of Norway, Vol. v., Parts 17, 18, 19, 20, by G. O. Sars.	The Author.
Memoirs and Proceedings of the Manchester Literary and Philosophical Society, Vol. li., Nos. 1, 2, 3.	The Society.
Transactions of the Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne, Vol. i., Part 3.	The Society.
Transactions of the Edinburgh Geological Society, Vol. ix. Part 1.	The Society.
Bulletin of the American Geographical Society, Vol. xxxviii., No. 12; Vol. xxxix., Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.	The Society.
Memoirs of the Russian Geological Society, Nos. 16, 21, 23, 24, 25, 26, 27, 29, 31, 33; Bulletin, Vol. xxiv., Nos. 1 to 10; Vol. xxv., Nos. 1 to 9.	The Society.
Proceedings of the Russian Mineralogical Society for 1906.	The Society.

Memoirs of the Russian Naturalists' Society, Vol. xix., No. 2.	The Society.
The Journal of the Manchester Geographical Society, Vol. xxii., Nos. 7 to 12; Vol. xxiii., Parts 1, 2.	The Society.
Transactions of the Leicester Literary and Philosophical Society, Vol. xi., Part 1.	The Society.
Proceedings and Transactions of the Croydon Natural History & Scientific Society for 1906-7.	The Society.
British Association Handbooks for 1874—90, 91, 92, 95, 96.	W. Whitaker, B.A.
Bulletin of the Geological Institute of Mexico, No. 24.	The Institute.
Records of the Geological Survey of New South Wales, Vol. viii., Part 3, and Annual Report for the Department of Mines for 1906.	The Survey.
The Third and Final Report of the Geological Survey of Natal and Zululand, by Wm. Anderson.	The Author.
Proceedings of the Geologists' Association for 1907.	The Association.
Journal of the Northants Natural History Society, Vol. xiii., Nos. 105, 106, 107, 108.	The Society.
Transactions of the Natural History Society of Glasgow, Vol. vii., Part 3.	The Society.
Verhandlungen der Naturforschenden Gesellschaft in Basel, Vol. xix., Nos. 1, 2.	The Society.
Annals of the National Museum of Montevideo, Vols. vi. and vii.	The Museum.
Boletin del Instituto Geologico De Mexico, No. 22, 1906.	The Institute.

Annals of the New York Academy of Sciences, Vol. xvii., Part 2.	The Academy
Transactions of the Perthshire Society of Natural Science, Vol. iv., Part 4.	The Society.
Transactions of the Academy of Science of St. Louis, Vol. xv., No. 6; Vol. xvi., Nos. 1 to 7.	The Academy.
Transactions of the University of Rennes, Vol. v.; Part 2, Botany; Vol. v., *Zoology*.	The University.
Transactions of the Wisconsin Academy of Sciences, Arts and Letters, Vol. xvi., Part 1.	The Academy.
Report of the University Geological Survey of Kansas, Mineral Resources of Kansas, 1902-1903.	The University.
Inventaire Général des Richesses D'Art de la France, Vol. iv.	The Society.
Proceedings of the Liverpool Geological Association, New Series, No. 2.	The Association.
Report and Proceedings of the Belfast Natural History and Philosophical Society for 1905-6.	The Society.
Bergen Museums Aarbog for 1906 and 1907, and Aarsberetning for 1906.	The Museum.
Bolletin del Cuerpo de Ingenieros de Minas del Peru, 10 Parts.	The Engineers.
Annalen des K.K. Naturforschenden Hofmuseums für 1906.	The Society.
The Sceatta and Styca Coinage of the Early Archbishops of York, by Major A. B. Creeke.	The Author.
Memoirs of the Department of Agriculture in India, Vol. i., No. 5; Vol. ii., Parts 1-10. The Agricultural Journal, Vol. ii., Parts 2 and 3, and Bulletin, No. 4.	The Institution.

Catalogue of the Best Works on Natural History, by William Wood.	Mr. Harold Copperthwaite.
Det Kongelige Norske Videnskabers Selskabs Skifter 1906.	The Society.
Proceedings of the Bath Natural History and Antiquarian Field Club, Vol. xi., No. 2.	The Club.
Mitteilungen des Vereins für Erdkunde Leipsic, 1906.	The Society.
Bulletin of the University of Kansas, Vol. vii., No. 5.	The University.
Publication of the Royal Hungarian Minister of Agriculture—the International Convention for the Protection of Birds, by Otto Herman.	The Author.
Meteorological Observations at Tacubaya for 1904.	The Society.
Proceedings of the Bristol Naturalists' Society, Vol. i., Part 3.	The Society.
Bulletin of the University of Montana, Nos. 36, 39, 40, and The Coal and Lignite Deposits of Montana.	The University.
The University of Toronto Studies, 15 Parts.	The University.
Meterological Observations at Stations of the 2nd Order for the year 1902; 2nd Annual Report of the Meteorological Committee for the year 1907 and Weekly Weather Reports for 1907.	The Meteorological Society.
Transactions of the Hull Field Naturalists' Club; Guide to the Wilberforce Museum, Hull, and Quarterly Records of Additions, No. 20; Notes on a Collection of Roman Antiquities, and Hull Museum Publications, No. 44.	Mr. T. Sheppard, F.G.S.

Descriptive Account of the Antiquities of the Y.P.S., 1852.	Miss Ward.
The 73rd Annual Report of Bootham School Natural History Society.	The School.
The Ornamented Samian Ware (Terra Sigillata) found at Lancaster, by Thomas May, F.S.A.	The Author.
The Publications of the Manchester Museum, Owen's College, Nos. 61 and 62.	The Museum.
Bulletin of the New York Public Library for 1907.	The Library.
Bulletin of the Lloyd Library for 1907.	The Library.
Annual Report of the Medical Officer of Health of York for 1906.	Dr. E. M. Smith.
Calendar of the University of Leeds for 1907-8.	The University.
Calendar of the Armstrong College, Newcastle-upon-Tyne, for 1907-8.	The College.

GEOLOGICAL DEPARTMENT.

NIL.

ANTIQUITIES.

Two Models of Clog Almanacks.	Mr. M. B. Cotsworth
Parts of an Old Coal Bucket and Spade from Kendall Green, Barnsley.	Mr. C. E. Elmhirst.
An Ancient Horse Shoe from Terrington	The Rev. Mackay.
Green Glass from York Minster, found after the fire of 1829.	Mr. Aymer Vallance.
A York Halfpenny, 1667, and Stone Bolias from Pampas, S. America,	Capt. E. Walker.
A Valuable Collection of Egyptian Relics, Old Jewellery and Fans.	Miss Crawhall.
A Crinoline and Parachute.	Mr. O. Grabham, M.A.

A 26th Dynasty painted and inscribed Egyptian Coffin, together with a few boards of a 12th Dynasty Sarcophagus; also some Pottery, Alabaster Jars, Scarabs, Beads, Gods, Soul Houses, Etc.	Mr. Flinders Petrie, on behalf of the British School of Archæology in Egypt.
Two Roman Vases, found in York Castle.	Miss Fisher.
An Ancient Key, found at 17, Stonegate, and 41 Coins, Types of the Coinage of Mexico, Panama, and the United States of America.	Dr. Tempest Anderson.
Four 19th Century Tokens.	Mr. J. Backhouse.
Fragments of 16th and 17th Century Pottery, dredged from the Nidd.	Mr. S. H. Smith.
Three Old Insurance Co.'s Shields.	Dr. C. K. Hitchcock.
Stone Spear Head and Photograph of Sacred Stone from Brazil.	Mr. Newton.

ZOOLOGY AND COMPARATIVE ANATOMY.

Seven Birds' Skins from Los Angeles Valley, California.	Col. Ditmas.
Mounted Purple Heron (the first Yorkshire specimen), Four Live Bramble Finches.	Mr. W. H. St. Quintin.
A Collection of British Bird Eggs, and Bird Skins from Jamaica.	Mr. J. Backhouse.
Two Choughs (mounted) from Ireland.	Col. I. B. Emmerson
Smear Dab, and Lumpsucker Fishes from Bridlington, and Two Iron Grey Moles.	Mr. F. B. Norcliffe.
Stuffed Brünnich's Guillemot and Two of Lord Lilford's Plates of the same, framed; a pair of Stuffed House Sparrows.	Mr.O.Grabham,M.A.

A pair of Pouters and pair of Jacobin Pigeons.	Mr. Barton.
Three Live Ring Doves.	Mr. W. Glaisby.
A White Rabbit, variety of the true wild breed.	Mr. S. H. Smith.
Snake Skin.	Mr.H.Copperthwaite
Live Mule Bird (female), cross between Canary and Goldfinch.	Mrs. White.
Leisler's or Hairy Armed Bat.	Mr. A. Whitaker.
Pictures of Blink Bonny, framed.	Mr. A. F. Meyrick.

BOTANY.

Donations to the Herbarium.

Specimen of Vicia orobus, *D.C.*, from Westmoreland, contributed by Joseph A. Martindale.

Also specimens of Helianthemum polifolium, *Mill.*, and Hippocrepis comosa, *Linn.*, from Torquay, contributed by F. H. Weekes, Esq.

A sketch of the Flora of British India, by Sir Joseph D. Hooker, G.C.S.I. (under revision).

SELBY ABBEY AND ITS BUILDERS.

Paper read by E. Ridsdale Tate.

April 8th, 1907.

A great and, we may almost say heart-rending, calamity had just befallen the beautiful and neighbouring Abbey at Selby, a gem of Norman and Mediæval craftsmanship, ruthlessly destroyed by fire caused during the erection of a New Organ. The story is too vivid in our minds, and any repetition is therefore unnecessary.

We are here to-day to consider for awhile the various details in connection with the building of the Monastery and the growth of the town around it.

Many of us no doubt were anxious to see the devastation wrought by the great conflagration, and those who were not familiar with the town would be struck by the flatness of the surrounding country. From either the north or south bank of the river Ouse, Selby Abbey, with its massive square Norman tower and long line of Nave and Choir, is a conspicuous object on the low lying landscape. But as the traveller draws nearer the town, he perceives that he is in sight of a place where the quaint, antique, and modern are mingled together—old and timeworn, here and there picturesque, and sometimes ugly. The somewhat low tower of the Abbey Church, a rather massive structure as we now see it, is hardly more conspicuous than one or two modern Church spires, a tall chimney emitting a volume of black smoke; the tall signal masts at the bridges, and the high buildings of the 20th century flour mills. Like many another Yorkshire town, Selby is a blending of the old and new; a place where echoes of the past sound in unison with the present.

About all our great churches there is a strange sense of dominant power—it is as if each stood in the midst of its own particular town or city, like some guardian angel. Selby Abbey, in particular, gives one this impression, for wherever one goes in Selby, whether along the narrow quaintily built alleys and streets

at the side of the church, or by the river side where various craft are being loaded or unloaded, or even to the Railway Station where there is usually a certain amount of bustle and commotion, there is the feeling that behind you stands the Abbey, the principal feature of all the ancient and modern influences which have combined to make the town.

No records, on which reliance can be placed, carrying back the history of Selby to a date previous to the Norman Conquest are known to be in existence, and it would appear from this that Selby like many other places sprang up around its Monastery. It is only incidentally mentioned in the "Great Survey"—Domesday Book—although many of the villages around are fully recorded. The incidental notices state that the Abbot at Selby holds so many carucates of land, and so many ploughs, fisheries and meadows—this merely shows there was an Abbey in existence at that time.

The ecclesiastical founder of the Abbey was a secular monk from the Monastery of Auxerre, in France, known as Benedict, the anchorite. He attracted the favourable notice of the Abbot, who gave him the choice of two honourable courses, either to take the badge of military service or to become a regular monk. Benedict is recorded to have said—"There are plenty of soldiers who fight more to serve their passions than the right; but in the service of God virtue and honour are rewarded." He became a regular monk, and gained promotion in his monastery for purity of life and character. Benedict at length was honoured by a vision of St. Germain, in which the Saint commanded him to leave his own country and go to a land that he would show him. The Saint's protection was promised, and, in addition, the gift of the finger preserved on the altar. At first, Benedict neglected the offer, but on a re-appearance of the vision, who this time threatened punishment, he at once applied to the head of the Monastery for leave to depart on his mission; but as this was refused, he secretly stole away and took the finger with him. Benedict made his way to the coast and, no doubt guided by St. Germain, had a prosperous voyage to the shores of England.

Although Selby, situated on the banks of the Ouse, near the City of York, had been pointed out by the Saint to Benedict as his future abode, Benedict appears to have lost his bearings and wandered about a great deal in the South of England before he found his way North. Having arrived at Lynn, in Norfolk, he

found a vessel bound for York, which had been waiting for 15 days for a favourable wind, but as soon as Benedict joined the vessel the wind sprang up, and we may assume that it was not long before the River Ouse was reached. On approaching Selby Benedict at once recognised the place as pointed out to him by St. Germanus in his dream, and along with his companions and sailors disembarked. Benedict explored the country on all sides and found it a pleasant spot. He then built a cottage, and devoted himself to religious duties.

Eventually he was able to enlist the powerful support of Hugh, the Norman Governor of York, who promised his support, counsel and protection. Hugh also promised to build a church, and workmen were sent from York to do so. The governor found buildings had been already erected on land belonging to the king, so that Benedict had to accompany Hugh to William the Conqueror to obtain the grants mentioned in the Charter of Foundation.

The foundation of the Monastery at Selby by William the Conqueror in 1069—three years after the Conquest—is an incident worthy of note, because it is the only Abbey founded by William in the North of England. He, along with his Queen, Maud, stayed there, and their fourth son, afterwards Henry I., was born at Selby.

The Royal Charter is published in "Dugdale's Monasticon," being copied from the original in 1620. The document is undated, as is frequently the case with early charters prior to the reign of Henry III. (1216). It is in Latin, and the following is an extract —in English—from this interesting document.*

It begins :—

> "In the name of the Holy and indivisible Trinity, Father, Son, and Holy Ghost. Amen. William, the bravest and most powerful of all Kings, by whom at this time royal sceptres are swayed under heaven, governing the great realm of England, which, by permission and will of God, first by signs and wonders, and after, by great power and war overcoming the English, to Holy Church, as well as to his earls and barons, and all his ministers, greeting. By the Providence of God's divine pity, and by my own goodness, inspired by the mercy of God, I have granted leave to Benedict, a most pious abbot, who has devoutly requested it, to build in Selby a Monastery in honour of our Lord Jesus Christ, and of his most blessed mother the Virgin Mary, and of St. Germain, Bishop of Auxerre. In which foundation I have comprised, and of my royal munificence have set apart and given from my own table, Selby itself," &c., &c.

*Morrell's "History of Selby," p. 33.

Here follow a number of grants of land, not only in the surrounding district, but in the counties of Lincoln, Leicestershire, and Northamptoushire. Then it goes on to say—

> "And in my gift, I have granted him to hold along with these, all things from whatever source, as well, in lands and possessions, as in other offerings, which, by the promptings of the Holy Spirit, may be presented by pious benefactors, and whatever may be acquired in any way, by right, by solicitation, or by purchase; under the royal favour, quietly and freely, exempt from all taxation, trouble, and annoyance, as becomes the alms of a King and an Abbey of his founding, in endless and perpetual peace."
>
> It then goes on to say—"it is to have its own court with sac, sol, tol and team, and all customs of a higher order that the Church of St. Peter at York has—and for the evidence or testimony and confirming of this charitable gift, for the salvation of my soul and those of my ancestors and successors, this charter was given and confirmed in London in the presence of these, namely, Odo, Bishop of Bayeux; Remigius, Bishop of York; Edward of Salisbury," and several Norman Barons and of the King's whole court.

The manor of Selby and the Church belonged to the Archbishop of York, but was included in the grant by William to Benedict, the first abbot of the newly founded Monastery.

For long years after the Conquest great numbers of Saxons supported themselves in secluded forests, occasionally wandering out in search of plunder, or to molest the hated invaders—the Normans. It is recorded that a large band of these men, headed by one Syva, infested the neighbourhood of Selby, and attracted to the Church, with the intention of plunder, an attempt was made to lift the door off its hinges to make a forcible entry, but the hand of the leader stuck to the wall of the sacred building, and there it defied all the attempts of his companions to remove it. In the morning he was found by the monks—red handed—and after confessing his guilt and promising amendment by an oath, he was allowed to go.

The son of Viscount Hugh was cured of fits by the touch of the "Finger," and it is said that many other great miracles were performed at this time, but the monk, who records all this interesting legend, quaintily says "that of the many and great miracles wrought at this time, *the memory of but few has been preserved.*"

Benedict was ordained by Thomas, Archbishop of York, 1070—1100, who owed his own elevation to the Northern See to the Conqueror. During his episcopate York Minster was rebuilt—the Norman Minster, of which only fragments of the Crypt remain.

The first abbot—Benedict—is said to have erected an oratory or chapel of wood, and later on added domestic offices to it, also

of wood. This oratory appears to have been the first church iu Selby of any sort. Subsequently it is again mentioned in the record of a great flood, as the Chapel of the Town, and as being near the course of the river. Another record says "that it was in the same place where to this time the Chapel of the Town remains standing." The site is on the south side of Water Lane.

But this was after the Norman portion of the Abbey had been built. Somewhat later, and during the reign of King Stephen, we find another mention of the Chapel, from which it may be inferred that the original wooden building was then standing, for St. Germain is reputed to have interfered in its behalf to save it from the flames, while the surrounding houses were being consumed by a fire which destroyed a portion of the town.

The subsequent history of the Church is soon told. From the registers of Archbishop Giffard (1265—1279) we learn that "the Church of St. Germanus in the town, is a chapel; the rite of Baptism was administered in it till children were carried to the Monastery. The chapel and its altar are not dedicated, because the dead are interred in the burial ground of the Abbey"; it henceforth continued as a chapel of ease, served from the Monastery, the Church of which became the Church of the town, the Nave being used as the Parish Church.

In 16th year of James I., the whole Church was by letters patent made parochial, and the burden of keeping it in repair was thrown upon the parish.

The Abbey Church, with its adjacent Monastic buildings, were begun by Hugh de Lacy, the second Abbot—1097—on a new site and higher ground, and somewhat further from the river than the old Oratory. The period during which he was Abbot—1097—1123—26 years—was one of great architectural activity, in which most of the great Benedictine Monasteries were founded and their buildings erected, so that Hugh de Lacy would not lack examples. Nothing of his Abbey but the Church now remains, and this fortunately nearly complete, as sufficient remains of the foundations of its original terminations have been found which show the form and extent of the whole Church as planned by him.

A plan of the Abbey Church, *Fig.* 1., shows the semi-circular apsidal terminations of the Norman Choir. The Church was originally cruciform, having Nave, North and South Transepts, Choir and side Chapels. Two western towers were originally intended, but only carried up to the roof level, and part of the

central tower still remains, the upper storey of which fell in 1690, causing great destruction to the South Aisle of Choir as well as completely demolishing the South Transept.

The accompanying plan of the central part of town, *Fig.* 2, shows the positions of the various ancient buildings referred to in these notes.*

In the centre is the Abbey with some remains of the Monastic buildings indicated by dotted lines. The great Gatehouse of the Abbey, demolished about the year 1792; there were probably other gateways, say, for instance, in Ousegate and Micklegate.

In the Market Place we have the old Gothic Market Cross; a quaint old building in Micklegate. The Soke Mill, probably the Abbey flour mill; the Abbot's Staithe, of which some of the massive masonry still remains; an ancient warehouse of some considerable extent close by, and formerly belonging to the Monastery. Then there is the quaint old wooden bridge, which makes a very picturesque subject for the artist. On the south side of the town, at the end of James Street, are the remains of the great Tithe Barn and Granary belonging to the Abbey, of which only a fragment now remains. A large portion was demolished when a new street was formed a few years ago. But we are digressing from our story of the Builders of the Monastery.

Hugh de Lacy, previously mentioned, was the most distinguished of the Abbots of Selby. His character, as lovingly portrayed by his biographers, presents a beautiful picture of Monastic life under its bests aspects—that of active labour. His name should ever be venerated by the townspeople of Selby, since it was by his energy and pious zeal that the noble Church of the Abbey was built.

There are few pictures more tempting to describe (excluding, of course, our own venerable city) than the town of Selby as it appeared during the time the Monastery was being reared by Abbot Hugh and his fellow-labourers.

In the whirl and uproar of our own day it is very difficult to imagine the spectacle which in those days caught the eye, gazing on a secluded Abbey and the adjacent grange. In black tunics and leathern girdles—the emblems of chastity—might be seen carters yoking their bullocks to the team; or driving them to the

*Plans of central part of Town and Abbey Church by C. C. Hodges. Yorks. Arch. Journal. Vol. xii.

field, or shepherds watching their flocks, or wheelwrights, carpenters, and masons, all plying their trades. Then as the bell of the Monastery sounding the hours of prayer, summoning the brotherhood to join in the spirit, if not in person, in the sacred offices of the Church.

Around the Monastic workshops might be seen the belt of cultivated land, and further beyond, perhaps, workmen toiling in the making of a road or draining the marshes, or herds grazing in the fields, or perhaps the harvest being reaped—all this under the shelter of ecclesiastical privileges which were in those days regarded with respect.

Abbot Hugh, in his great zeal for the Abbey at Selby, did not overlook the religious wants of the surrounding villages. He was a devout architect. He devoted himself to the building of the Abbey Church and other buildings with the greatest ardour. "laying out not only his own property, but the offerings of the faithful, prudently and to the best advantage; since it was for the glory of God's House and not his own, which would have been sacrilege and robbery." Every day, clothed in a workman's dress, he was accustomed to carry to the wall mortar, stones, and whatever was necessary like the rest of the labourers, at the close of the week receiving his wages like them, which he distributed to the poor on the Sunday. He ruled over the Monastery for nearly 26 years, during the reigns of William Rufus and Henry I. He resigned his office through failing health, and, after visiting various Monasteries, returned to his beloved Selby, where he settled at a farm in the neighbourhood. He was allowed to end his days in the house he loved so well and which he had helped to rear, and was laid to rest in the Chapter House.

Many grants were made by the Crown to the Abbey, but these grants were not always of a voluntary nature. It very frequently happened then as now, privileges had to be paid for, and in the time of King John we find the Abbot of St. Mary's, at York paid £100 for a similar privilege—a big sum in those days.

Herbertus—1123—1127—the third Abbot, had not the business capacity of his predecessor. He lacked the qualities necessary to administer the affairs of a large Monastery, and the secular matters were much neglected. His special qualifications were those of a retired monk, and he was told by the Pope's Legate to retire into private life.

Then followed Duranus—1127—1137, who hailed from St. Mary's at York. He was a man of handsome presence and of considerable ability, but over the rest we must draw a veil. He was compelled to retire by Archbishop Thurstan.

The Abbey remained without a head for two years, as the rival claims of two monks could not be settled, until at last Thurstan sent Walter from Pontefract—1139—1143. He devoted himself to the affairs of the Monastery, and after ruling six years, was laid to rest in the Chapter House amid demonstrations of the greatest respect.

Now we come to Helias Pagnel or Paynell—1143—1153. He was the third son of Ralph Pagnell, the first Norman Baron of Drax, Leeds, &c., and founder of the Priory of the Holy Trinity in York. He was promoted from being Prior of this Monastery to that of Selby, his father being a great benefactor to Selby, as also to York.

There are many interesting incidents in connection with the lives of these great Abbots which I would have liked to mention, but the time allotted to me is all too short to attempt even a brief notice; so that I will just give a list of them before passing on to the description of the Abbey Church.

Germanus, 1153—1160, from Tynemouth.

Gilbert, 1160—1184.

Interval of five years.

Roger de London, 1189—1195.

Richard, 1195—1214, Prior of Selby, who presided over the Abbey when King John paid his visit in 1212, during the troublous days.

Geoffrey, 1214. He was never installed.

Alexander, 1214—1221, Prior of Selby.

Richard, 1221, from St. Ives.

Richard de Kellesay, 1222—1237, sub-Prior of Selby. More Monastic misgovernment.

Hugh de Brayton, 1244—1284.

Thomas de Whalley, 1255—1262. This ecclesiastic did not observe the Monastic Rules, or visit the sick, or even attend to the temporal welfare of the Monastery.

Thomas, 1262, deposed and re-instated, 1269.

In the interval—

David de Cawood ruled, 1263—1269.

Thomas Whalley, re-instated 1269—1280.

William de Aslakeby, 1280—1293. During hs abbacy the wealth of the Monastery increased very largely, and it was at this time that many distinguished natives of Selby showed their ability in other walks of life than the cloister.

John de Wystowe, 1293, resigned 1300.

William de Aslaghby, 1300—1313. Archbishop Greenfield borrowed £20 from this Abbot towards raising 4000 florins which he had borrowed from the Lombards to pay the Pope. This Abbot also saw the end of the Order of Knights Templars.

Simon de Scardeburgh, 1313—1320, from Scarboro'. During this period the Monasteries at Selby and York had to contribute each 200 marks towards carrying on war with Scotland. This Abbot was summoned to seven Parliaments.

John de Wystowe, 1321—1335.

John de Heslyngton, 1335—1341. It is probably to these two Abbots that we must attribute the beautiful work of the Choir.

Gilfred de Gatesby, 1341—1362. The builders at this time were busy raising the Choir of York Minster and the Nave of Howden Collegiate Church. The beautiful Choir of Selby was completed at this time.

John de Shireburn, 1368—1407, a period of 39 years, the longest term of office enjoyed by an Abbot, and was contemporary with five Archbishops of York.

William Pygot, 1406—1429. His tombstone remains.

John Cave, 1429—1436. His tombstone also remains near that of his predecessor.

John Ousthorpp, 1436—1466.

The last important additions to the Abbey were made during his time. The Eastern Aisle of the North Transept, on the endowment of a Chantry by John Lathom. This chantry or chapel was dedicated to St. Catherine. John Lathom was an ecclesiastic holding high offices in the diocese of York, and Secretary to Archbishop Kemp.

The 28th Abbot was John Sharrow, 1466—1496.

It is probable that the large Perpendicular Window in the North Transept was inserted by him and also the arch at the East end of the North Nave Aisle, which probably caused the depression in the adjoining Norman arches of the Nave.

Lawrence de Selby, 1486—1504. He was buried in front of the High Altar, where his slab now remains.

Robert Deeping, 1504—1518, from Croyland.

He appears to have added to the Monastery, as the arch of one of the rooms in the Minister's House bore the arms of the Abbey of Croyland. This house stood at the west end of the Abbey and near the Abbey Gateway. Another room was pointed out as being the birthplace of Henry II.

The next two Abbots only held office four years each.

Thomas Rawlinson, 1518—1522.

John Barwic, 1522—1526.

*The latter was buried in front of the High Altar, and his slab remains.

Robert Selby, 1526—1540.

The arrival at the Abbey of Norroy King at Arms, on his heraldic visitation of the Northern Counties in 1530, must have raised some feelings of mistrust in the minds of his brethren. The ceremony of recording the armorial bearings of an institution on the point of annihilation must have appeared as the very mockery of woe.

Turning back to the period of Abbot Heslyngton's rule as a particularly interesting one in the history of the building of the Abbey, it may be well for one moment to consider the cycle through which our greater churches passed. The Choir was the first portion required for divine service, and it was the first to be erected, and so long as it continued of the original fabric, was successively beautified and enriched until it was found too small or mean for the tastes of the more luxurious times. Meanwhile the Transepts and Nave were often rebuilt in the style prevailing at the time. When these had been completed, the Choir and Norman work, probably very massive and crude, with its apses, would look altogether out of harmony with the rest of the fabric which was of a higher order of architecture, and so it had to be rebuilt. Doubtless the old Choir was far inferior to the rest of the Church, and it is fortunate that the decision to rebuild the Choir at this period was arrived at.

The beautiful Decorated style was just at its perfection. The Nave of York Minster and part of the West Front had just been

*Morrell's History of Selby. "List of Abbots."

completed, and perhaps the master mason at Selby was fortunate enough in securing the services of the skilful workmen who had been employed in York. But we must not forget our own beautiful Abbey of St. Mary, and I would like to draw your attention for one moment to the striking similarity of design between the Nave of St. Mary's and the Choir of Selby. *(See illustration.)* *Fig.* 3. *Plate II.*

The Abbey of Selby had existed for nearly 500 years when the great Dissolution of the Monasteries was ordained by Henry VIII., and in 1540 Selby and York became prey to the King's avaricious craving for money, Selby Abbey yielding £818 19s. 0½d.

Turning to the features of the Abbey Church, which is the only existing portion of the Monastery, there is every reason in assuming the foundations of the whole Church were laid down by Hugh, the 2nd Abbot, and that the general conception of the Nave, Transepts, and original Choir were due to his architect. The Church consisted of a Nave of eight bays with aisles, a West Front with two engaged towers, a North Porch, North and South Transepts without aisles but with apsidal chapels, a Choir of apparently three bays with aisles terminating with an apse. The whole Church was undoubtedly intended to have stone vaults. The internal length of the Norman Church was 220 ft.; length of Transepts, 111 ft.; full width across Nave and Aisles, 59 ft.; and the height from floor of Nave to top of wall, 51 ft.

The first two bays of Nave, South wall of Nave, Choir, Apses, Transepts, are the work of Abbot Hugh. Two additions at two periods were made by his successor. The last four bays are Transitional period, as well as the North Porch.

Of the upper part of Nave of Church, the Triforium on north side is of 12th century work; the six bays of the Triforium on south side and whole of the Clerestory are of Early English work.

The Nave presents a very interesting picture of the growth of architecture from the Norman to the Decorated styles. *Plate III.*

The Choir (or more properly the Presbytery) as we now see it, was built in the 14th century, and the building of it extended over a considerable period. It is divided into seven bays, with aisles on each side and a Sacristy on the south side. The 14th century builders, in order to avoid disturbing the Norman Presbytery before it was absolutely necessary, appear to have commenced with the first four pillars from the present east end, and then

commenced two more on the south side, starting from the apse and working east. The Sacristy is also of this period, and bears a striking resemblance, as also does the Aisle wall, to our Abbey of St. Mary. Afterwards the remaining portion of the South Aisle and two piers eastward were completed. Then followed the beautiful East window and buttresses, the remaining portion of the Choir westward, the rebuilding of the East Arcade of the North Transept. These works then took the place of Abbot Hugh's Norman Presbytery and its side chapel. The remaining additions were the Lathom Chapel and the Great Window in the North Transept, both in the Perpendicular style. *Plate IV.* The upper stage of the tower was re-erected in 1702, to replace the one which fell in 1690. The cost of material and labour must have been abnormally low at this time. This catastrophe completely destroyed the South Transept, which was never rebuilt. Two bays of the South Aisle were also ruined, but these were rebuilt in the style of the period, and remained an eyesore until this part of the Church was restored with praiseworthy skill by Mr. Ocdrid Scott in 1890.

The exterior conveys the idea of a very lengthy building, and it is remarkable for the simplicity and boldness of its detail.

In the centre of the west front is a beautiful Transitional Norman doorway, the arch being highly enriched with a variety of zig-zag moulded work.

Before the restoration, by the late Sir Gilbert Scott, about 1871-73, the embattled parapet was continued right across the front, but the central portion was then removed and the present gable erected, and is a 19th century creation.

The North Porch is a fine piece of Transitional Norman work.

The Aisle windows of the Choir, of Geometrical design, are very similar to those of St. Mary's Abbey, York. The windows of the Clerestory have flowing tracery approaching the flamboyant. A curious feature on the traceried parapets is the "seated figures"; these also occur on the open traceried parapet of the Choir Clerestory passage, inside the Church. The beautiful open traceried spirelets.

The East window is a magnificent example of flowing tracery. The seven lights are filled with ancient stained glass. Fortunately this was very little damaged by the recent fire.

Of the original Norman Central Tower, only a fragment remains at the north-west corner.

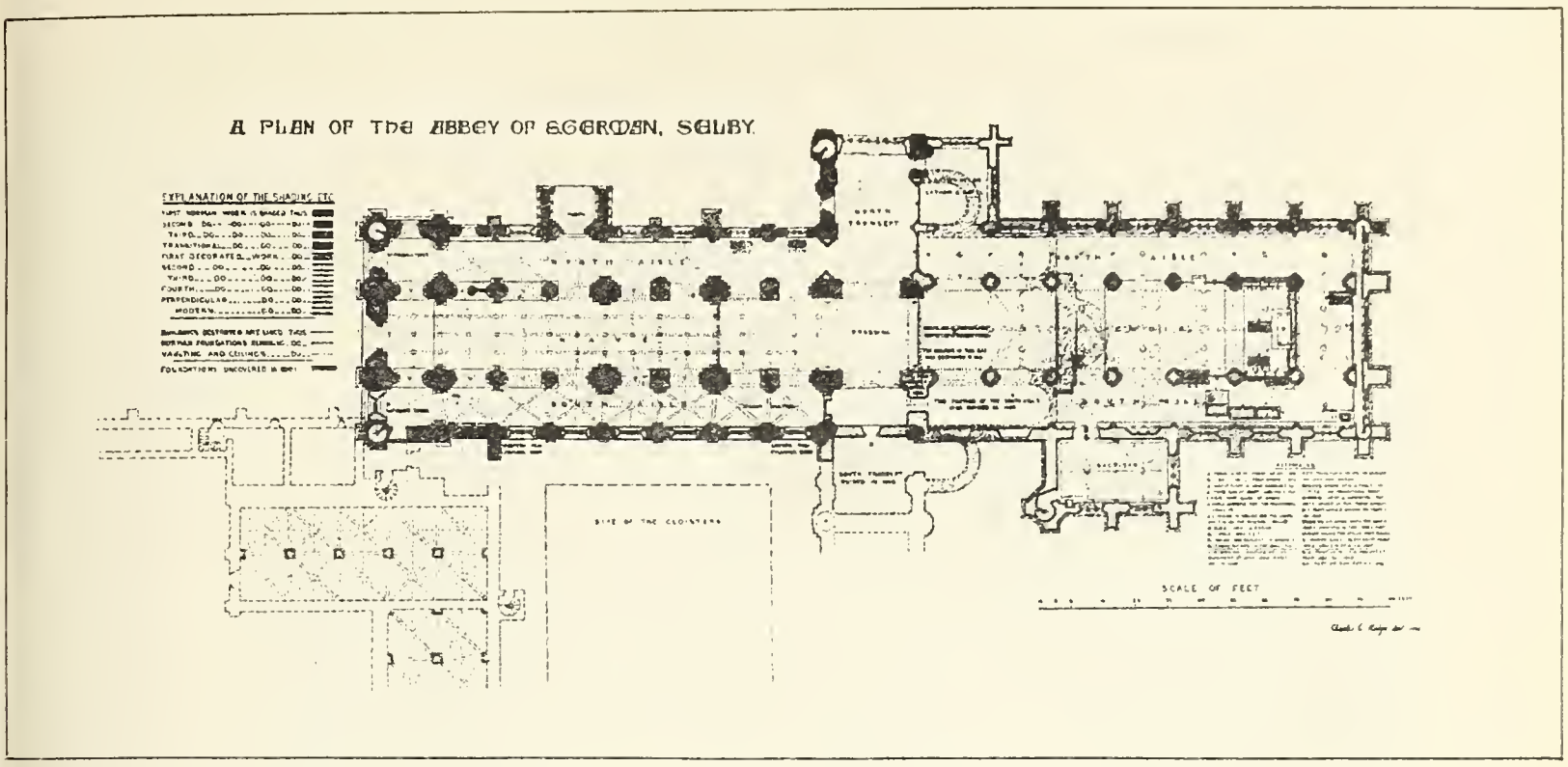
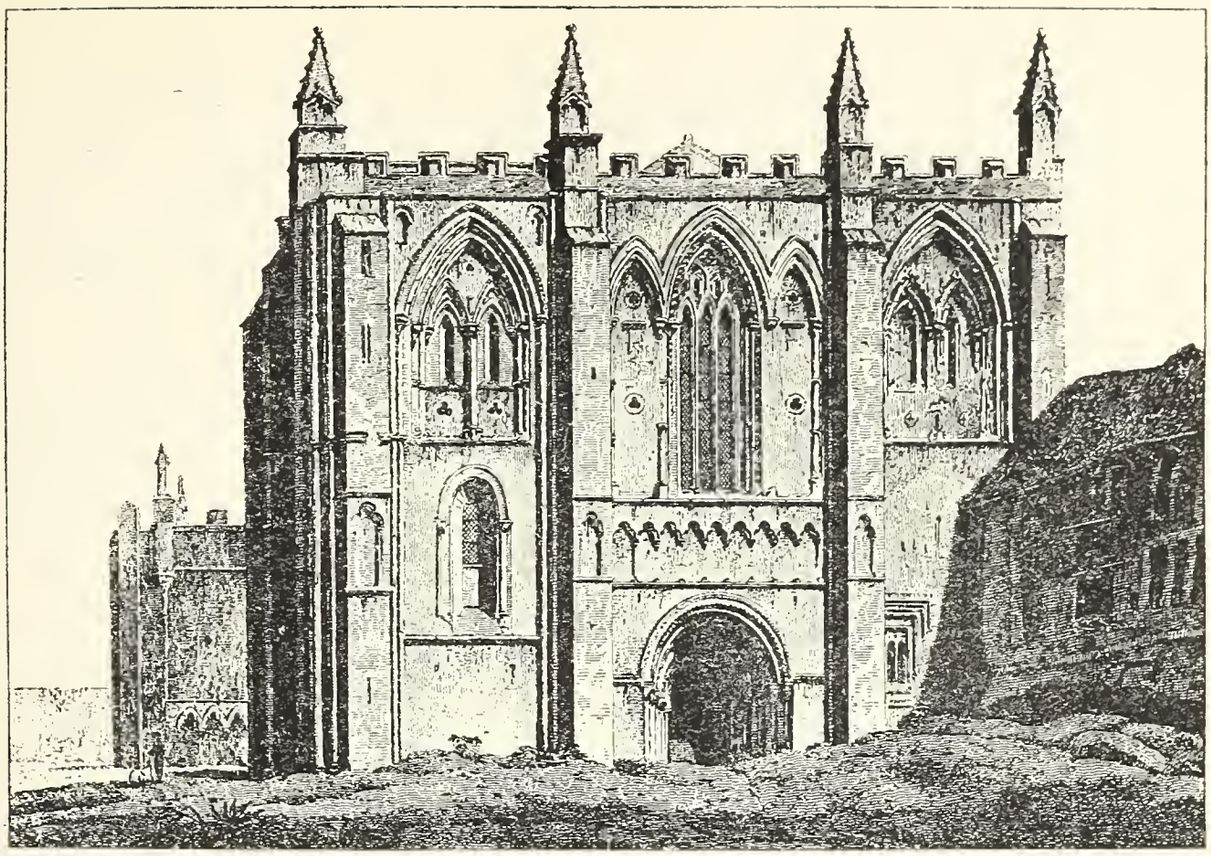


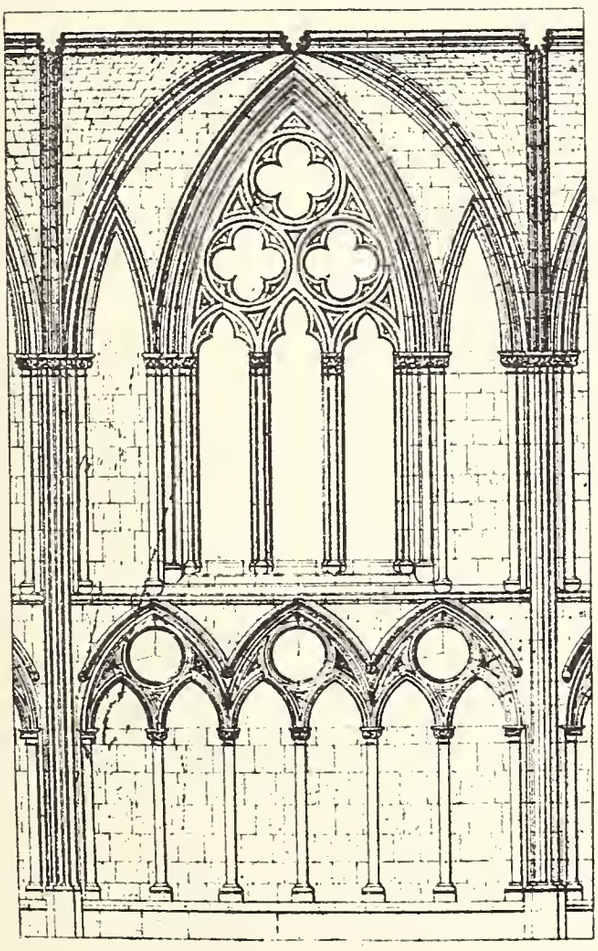
Fig. 1.

Fig 2.

From Plans by Mr. C. C. Hodges,
in *Yorks. Arch. Jour.*, vol. xii.



From Engraving by *Byrne, 1813.*



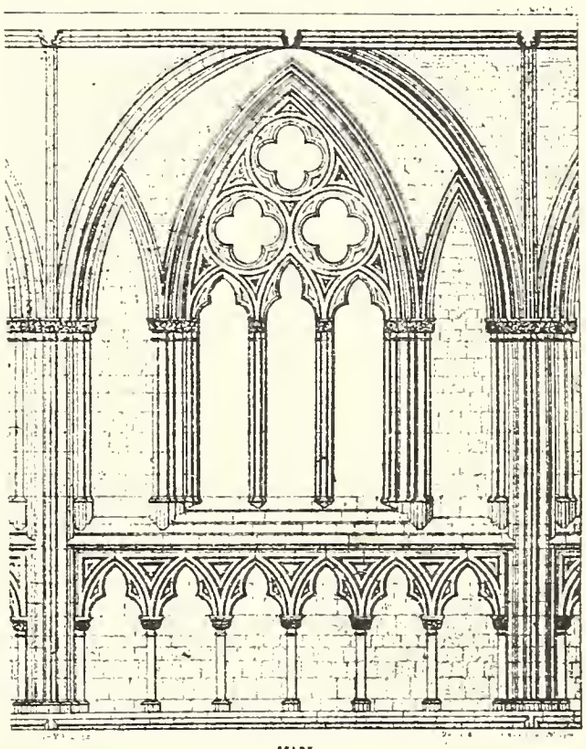
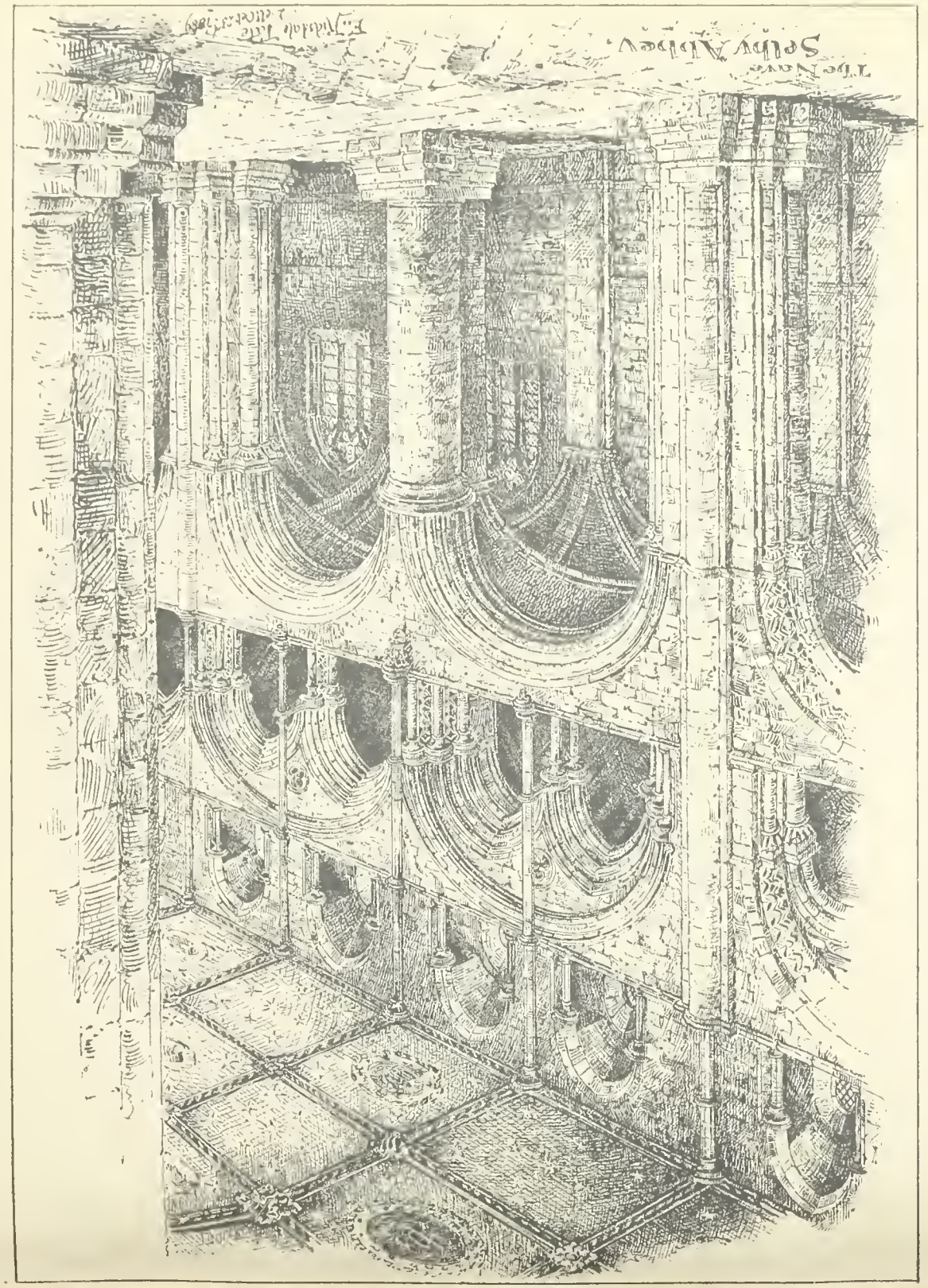
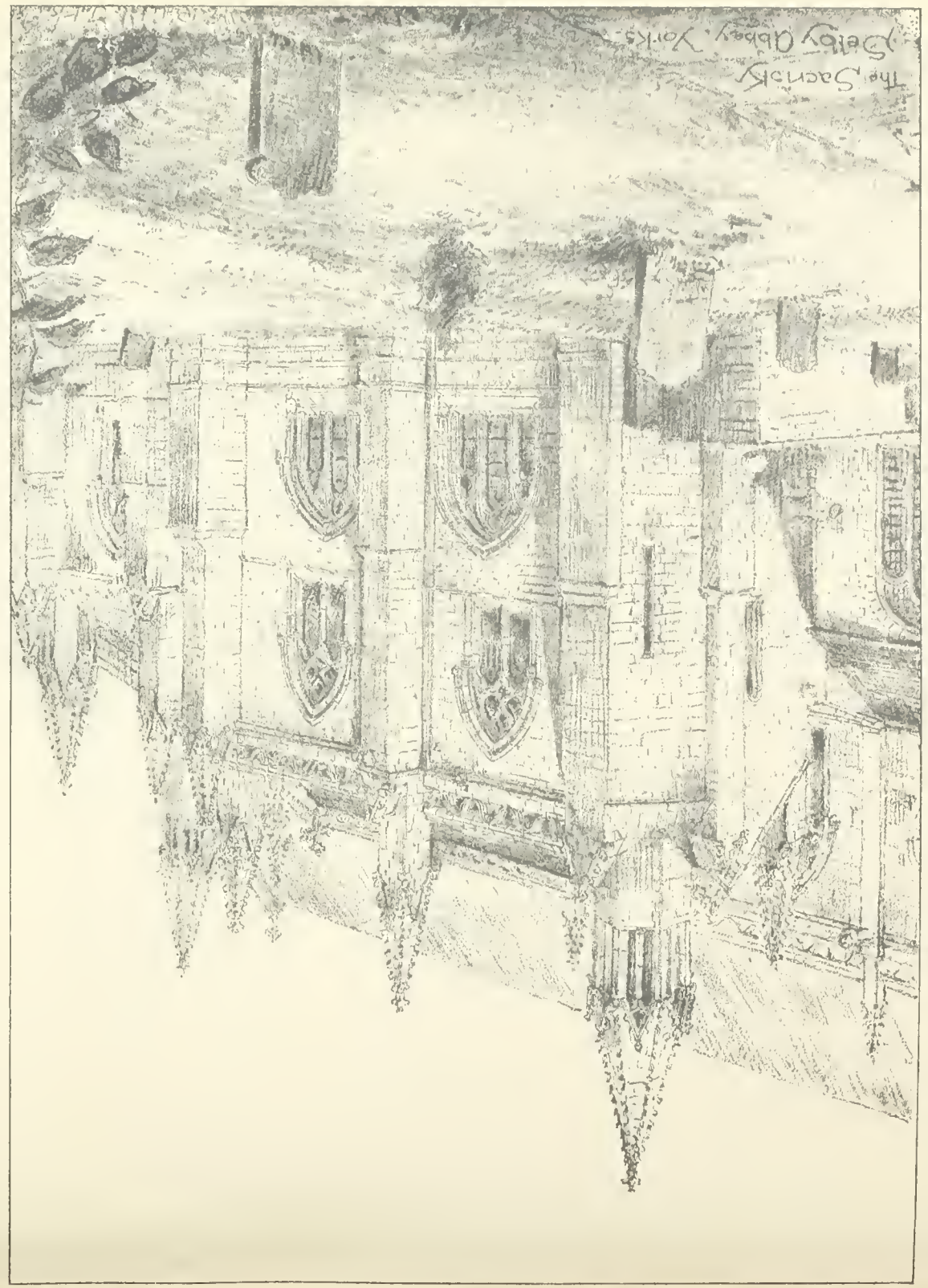
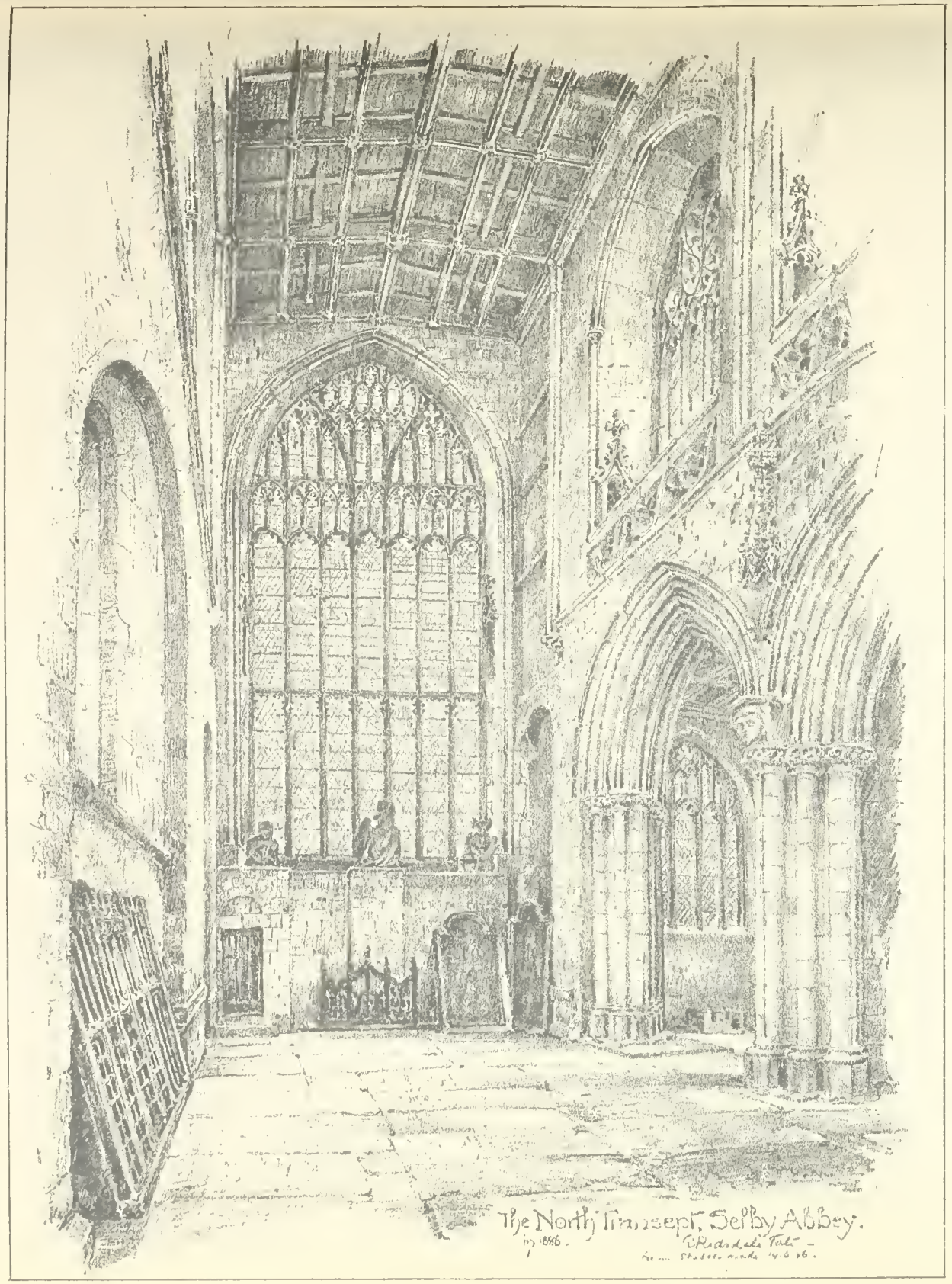


Fig. 3.

PLATE III.






The North Transept, Selby Abbey.
in 1886.
C. Rudsdale Tait.

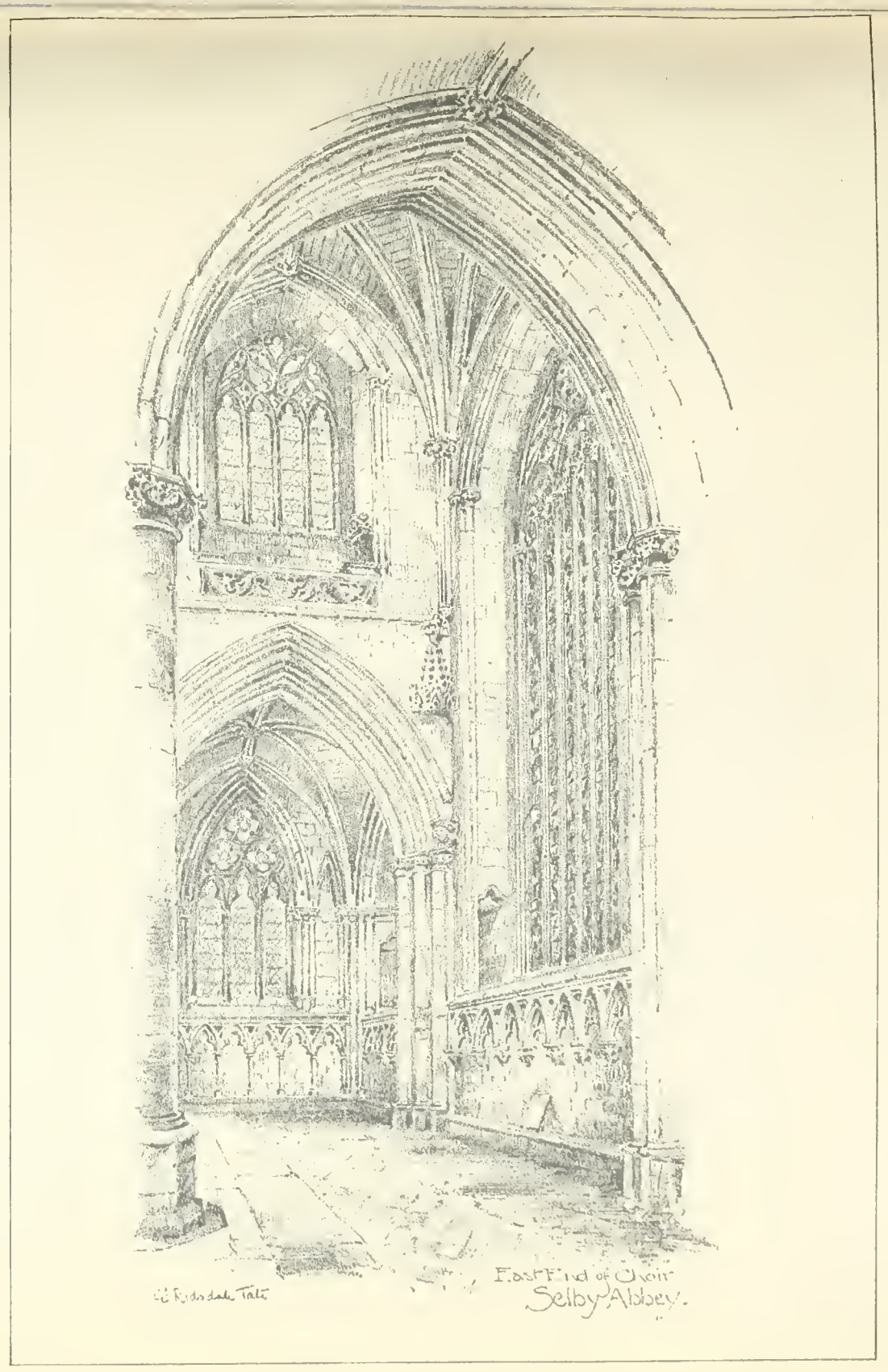
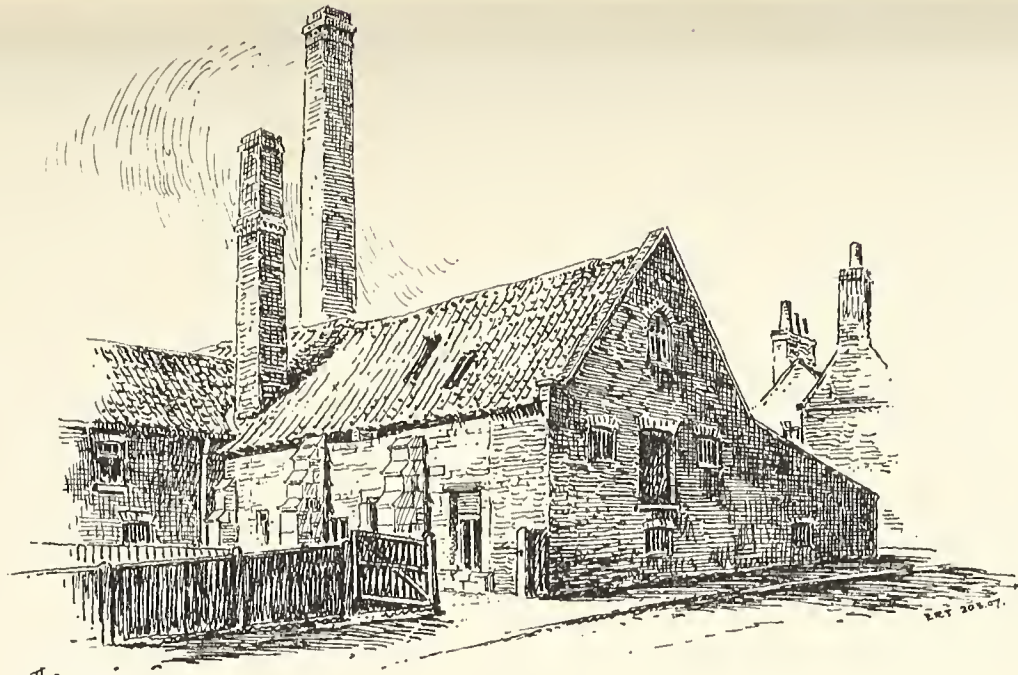

C. Rudsdale Tait
East End of Choir
Selby Abbey.

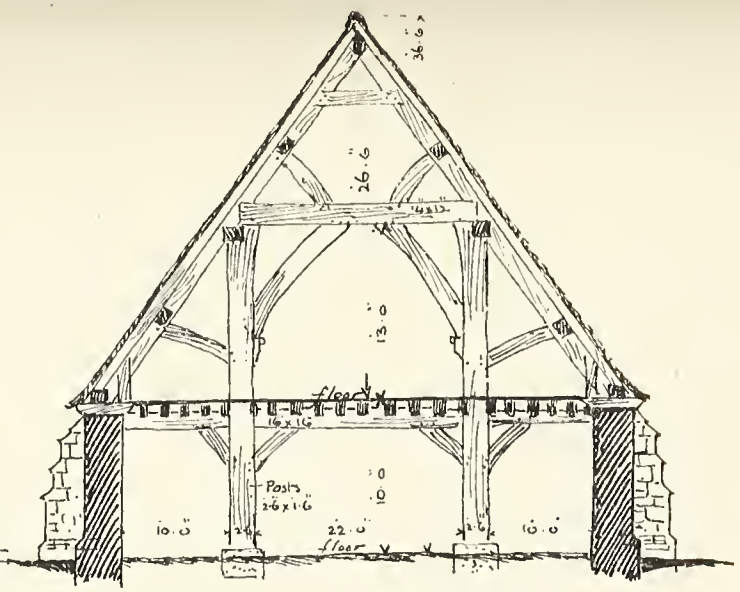
PLATE IV.


CHURCH
MONKS DORMITORY
KITCHEN
SCRIPTORIUM
CHAPTER HOUSE
OUSEGATE
REFECTORY
MARKET PLACE
Selby Abbey
Previous to Dissolution
A suggestion partly based on existing remains.
E.R. TATE 1907
GATEHOUSE
GUESTEN HALL
MASTER
GRANARY & BREWHOUSE
LAUNDRY
ORCHARD
ABBOTS HOUSE

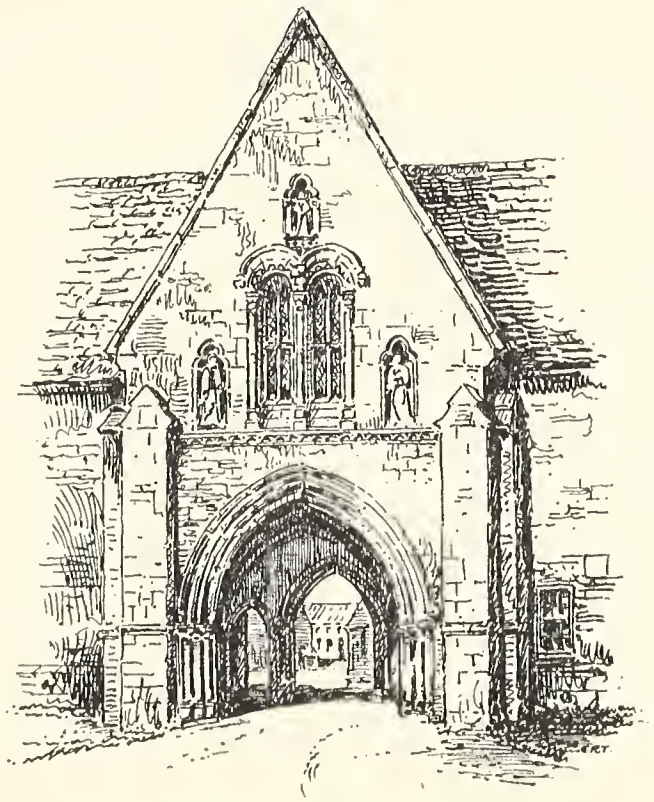
PLATE V.



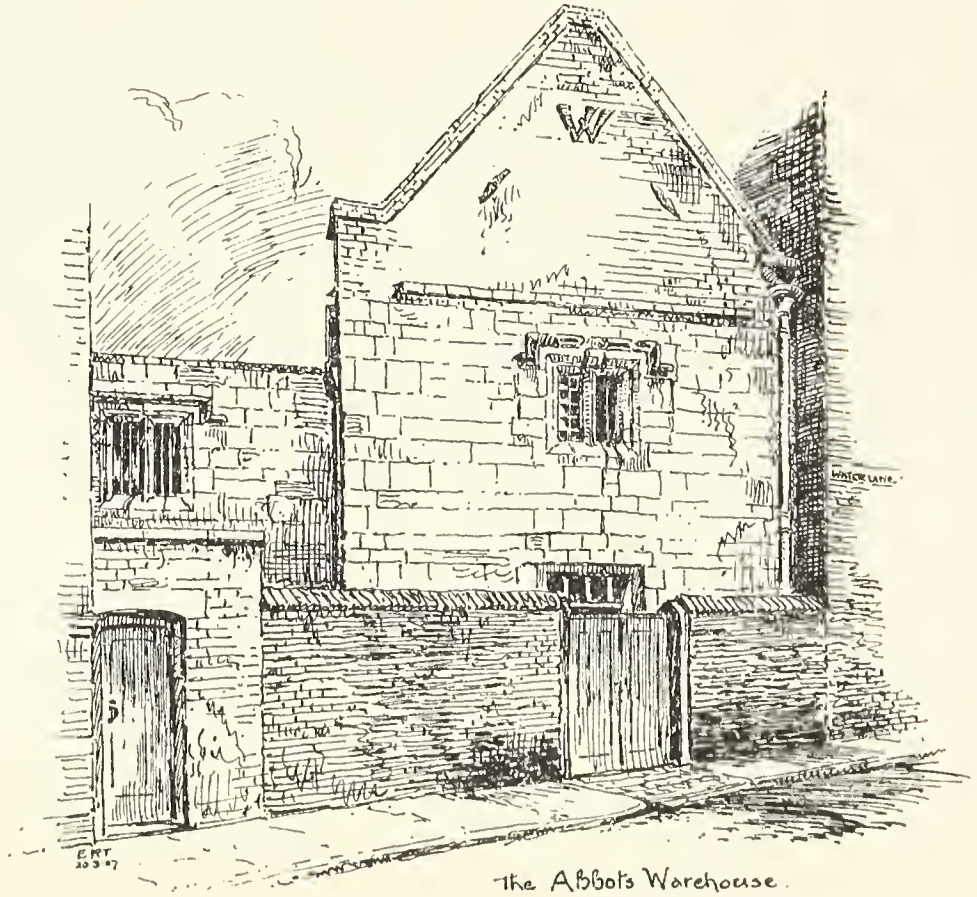
The Abbey Tithe-Barn. Selby. 1907.



Section thro' Barn
shewing Timber framing.



The Great Gateway
Selby Abbey - in 1783, demolished 1792.
Copied from a drawing in the Bodleian Library.



The Abbot's Warehouse.
Water Lane, Selby. 1907.

PLATE VI.

Two doorways in the south wall of Nave mark the position of the Cloisters. Traces of the foundations of the Chapter House and South Transepts and a portion of the Cloister were discovered a few years ago.

The beautiful painted Roof over the Nave was completely destroyed by the fire.

Around the Sanctuary still remains the beautiful carved and traceried Stone Screen of 14th century work.

The Sedilia of 15th century work is very fine, the pinnacles have been somewhat damaged by the fire, although they were a restoration.

The Font, standing on a raised platform at the west end of Nave, is probably Transitional work. Circular and very plain, the richly carved Perpendicular cover has been fortunately preserved, which I think is about the only piece of woodwork.

Of the Monastic buildings nothing now remains above ground.

On *Plate V.* is a view of the Monastery as it very probably appeared at the time of the dissolution. It is, of course, in a great many points merely a suggestion, although based on the usual plan of a Benedictine Monastery.

The illustrations give but a small idea of the many points of beauty and interest, better still would be a visit to the grand old Abbey itself, to revel in the old time charms it presents to the lover of antiquity. And ere we part, shall we not

. . . . "turn once again,
Vowing that beauty shall ne'er be forgot."

THE KING'S MANOR, YORK.

Plate I.

By A. B. Norwood, M.A.

THE King's Manor is the name given to the irregular pile of building now occupied by the Yorkshire School for the Blind, and the Manor School for boys.

A considerable portion of the edifice stands upon the site, and indeed, in some details, actually forms part of what was originally the residence of the Lord Abbot of St. Mary's.

The story of the founding of St. Mary's Abbey is connected with two of the most famous monasteries of Saxon times—Whitby and Lastingham.

In 1074, the ancient Abbey of Whitby was refounded, Stephen, a monk of Whitby, being created Prior. In 1078, however, having incurred the displeasure of his patron, Earl William de Percy, Stephen had to abandon the Priory, and found his way to Lastingham, the place for ever famous as the old home of SS. Cedd and Chadd. An appeal to the King from Stephen for help resulted in the old monastery, or what was left of it, being given to him. The work of restoration at once began, and Stephen was consecrated Abbot of Lastingham by Thomas Bayeux, Archbishop of York. But his former patron, Earl Percy, still pursued him with relentless enmity, and in 1087 he was driven from Lastingham.

Stephen now found a friend in Alan of Bretagne, Earl of Richmond, into whose hands the Church of St. Olave in York, together with a large number of Manors, had passed for services rendered to the Norman Conqueror at the siege of York. Earl Alan gave to Stephen and his monks this Church dedicated to St. Olave, with four acres of land adjoining to build offices thereon. When, however, Stephen came to take possession of his new grant, he found it claimed by Archbishop Thomas, who only relinquished his pretension on receiving from the King a grant of the Church of St. Stephen.

Now that this difficulty was settled, the work of erecting the various buildings necessary for a Religious Foundation

Photo by J. H. WALKER.

proceeded apace, and, until this work was completed, the old Church of S. Olave was used as the Abbey Church, and the house was known as the Abbey of St. Olave. In the year 1088, William Rufus, when at York, visited St. Olave's, and finding the accommodation insufficient, he considerably enlarged the donation of Earl Alan, and in the following year, 1089, laid the foundation of a new Church, the dedication being changed from St. Olave to that of most Benedictine Houses, St. Mary the Virgin.

This Norman King also granted great privileges and immunities to St. Mary's Abbey, which rapidly grew in wealth and importance, until, in the course of time, it became the most important in the North of England. The Lord Abbot of St. Mary's and the Lord Abbot of Selby were the only mitred Abbots North of the Trent, and, by virtue of this rank, they sat as Spiritual Peers with the Bishops in the House of Lords. The Abbot of St. Mary's had places of residence at Deighton and Overton, as well as a London house, which was situated near St. Paul's wharfe, for use when his Parliamentary and other duties required his presence there. The Abbot had jurisdiction not only over the Monastery, but in an extensive district known as the liberty of St. Mary. He held courts and sentenced to imprisonment or death. The prison was probably the lower portion of the building still attached to the Abbey gateway, the upper portion being the court-room.

Many Churches were given to the Abbey at various times, including St. Olave's, St. Wilfred's, St. Andrew's, St. Saviour's, St. Michael at Ouse Bridge end, and St. Crux, all in York. In the County of Yorkshire there were thirty-eight other Churches belonging to the Abbey, and several in other counties. Besides these Churches, there were in various parts of the county several cells, or dependent Priories, belonging to the Abbey. Fountains Abbey is also an off-shoot of St. Mary's. For in 1132 a company of sixteen monks, dissatisfied with the discipline of St. Mary's, and desirous of keeping a stricter rule, after a scene of great violence placed themselves under the protection of Archbishop Thurstan, and, under his patronage, founded the Cistercian Abbey of Fountains, near Ripon.

The first Priory of St. Mary was destroyed in the great fire in the reign of Stephen, and in 1271, Abbot Simon of Warwick commenced the work of building a new Abbey Church, Sitting in his chair, trowel in hand, surrounded by the whole fraternity,

he laid the first stone, and lived to see the work completed within twenty-two years. The North Wall of the Nave of this Church is still standing, together with a portion of the West Front; whilst recent excavations have disclosed the foundations of the Choir, as well as of the apsidal ending of the Norman Church of Abbot Stephen. *Plate II.*

The original Priory of Stephen of Whitby was not enclosed by walls, and there was constant strife between the monks and citizens as to the privilege of sanctuary. In 1265 a serious disturbance arose from this cause, and, as a result of this invasion of Abbey grounds, and what were considered Abbey privileges, the Abbot enclosed his Monastery by a line of walls.

Perhaps the most distinguished in the long list of Abbots is William Sever, or Sevyer, who ruled over the house from 1485 to 1502. It was he who rebuilt the abbatial residence, parts of which are still standing. During his abbacy a long and acrimonious controversy was carried on with the city authorities with reference to the rights and privileges of the Abbey.

In the year 1538 the Abbey of St. Mary shared the fate of the other religious houses in the kingdom, and was suppressed and despoiled. The number of Monks would vary from time to time, but when the Abbey, whose annual income according to the late Canon Raine was £1650, was surrendered to the Crown by William Thornton or Dent, the last of the twenty-nine Abbots dating from Stephen of Whitby, the community consisted of the Abbot and fifty monks, as well as many lay brethren and dependents of various kinds.

At the Dissolution the Abbey was retained by the Crown, and it is much to be regretted that, at least, the magnificent Church was not preserved. But York had its Cathedral, and the district its Parish Church of St. Olave, and the retention of a second great Church was deemed unnecessary.

Within a few months after the actual dissolution of the Monastery, the Great Council of the North, which in 1537 had been permanently constituted by a Royal Commission, succeeded in obtaining from the King a grant of "The House which of late was called St. Mary's Abbey without the City of York," for the purpose of holding their Courts and conducting their official business, as well as for the occasional abode of the Lord President, and the ordinary residence of those members of the Council whose duties required their constant attendance.

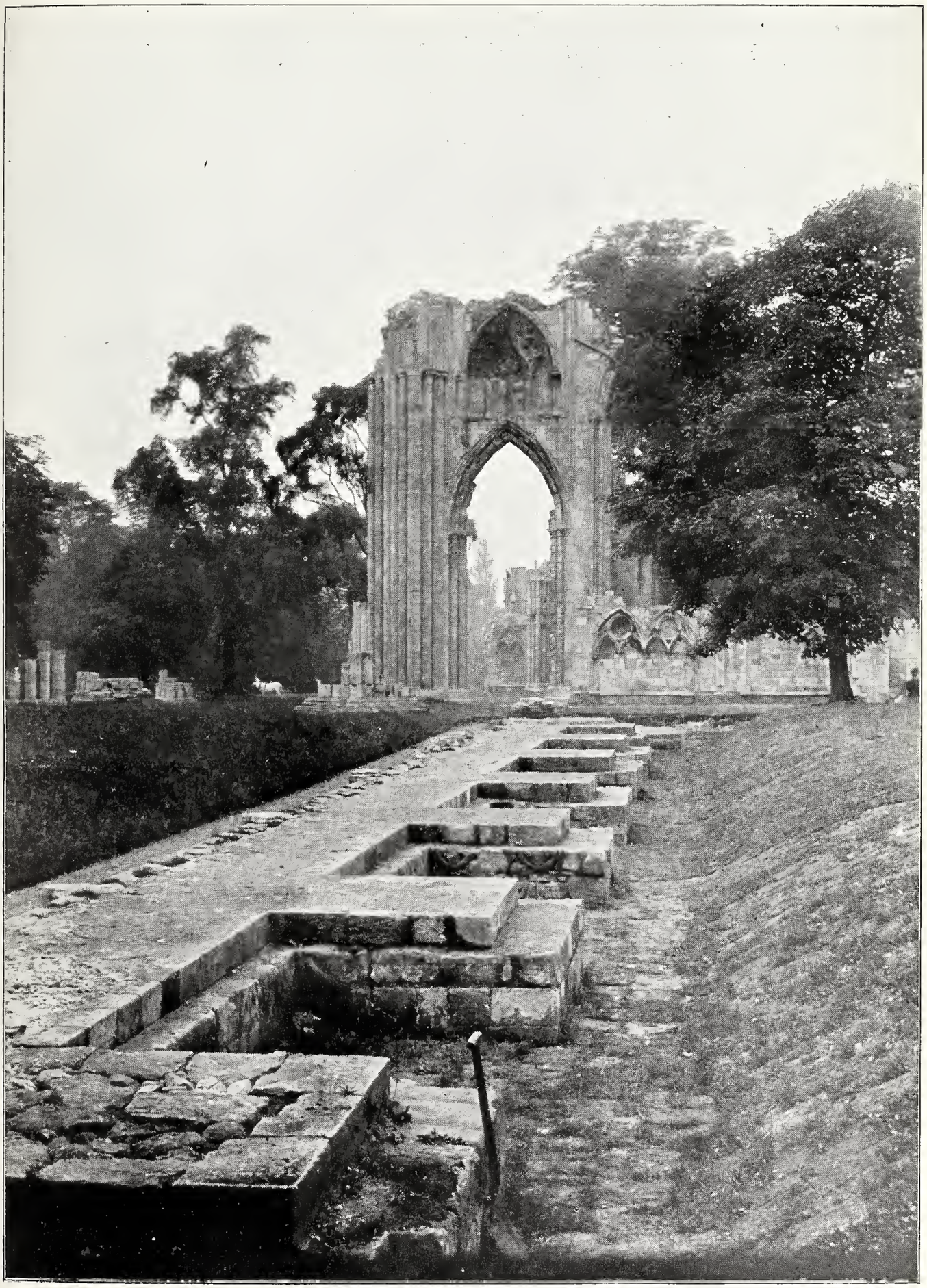


Photo by W. WATSON.

Before the close of the year 1538, the President and Council were comfortably settled in that Mansion of which the Lord Abbot of St. Mary's had been so recently dispossessed, and, in order that its very name and all remembrances of its previous occupants might be lost for ever, they conferred upon it the royal style and title of The King's Mannour.

The first President to reside at the King's Manor was Robert Holgate, Bishop of Llandaff, afterwards Archbishop of York.

For political reasons, Henry VIII., soon after he appointed Bishop Holgate to be Lord President, formed the intention of making a progress to the North and sojourning for a while at York. In contemplation of his visit, the King ordered that a new Palace should be built for his reception upon that part of the site of St. Mary's Abbey which lay between the Abbot's House and the river. His first visit was made in September, 1541, when he and his unfortunate Queen, Catherine Howard, occupied the new palace for a short time. But the building, hastily raised, was doomed as suddenly to disappear. Within a few years after Henry's visit to York, the Royal Palace became as total a ruin as the sacred Abbey upon whose site it had stood. The only part left of this Palace is the spacious vault which faces the South front of the School for the Blind, and is still known as the King's Cellar.

For the first thirty years after the Dissolution, no material alteration was made in the Abbot's House. In the course of time, however, the existing buildings were found to be incommodious and dilapidated ; and in the Presidency of Thomas Radcliff, Earl of Sussex, considerable alterations and additions were made. *Plate III.* (*a*).

It is of interest to note that the expenditure in connection with this work was much in excess of the estimates, and on the Lord President's request for an additional grant of money and timber being refused by Elizabeth's Government, he was constrained to resort to other means of reimbursing himself the money he had expended upon "the Queen's Majesty's house." Portions of the fines imposed upon offenders by the Council of the North, and of the fines exacted from those implicated in the rebellion of the two Northern Earls, Northumberland and Westmorland, were used for this purpose.

Henry Hastings, Third Earl of Huntingdon, whose wife was a sister of the Queen's favourite, Robert Dudley, succeeded the Earl of Sussex in the Presidency of the Council of the North, and it

was during his tenure of office, which lasted twenty-three years, that the large and stately brick buildings standing on the North West side of the King's Manor were erected. *Plate III. (b)*. One large room of Huntingdon's addition still remains, and bears unquestionable evidence of the date of its construction, as well as of the taste and magnificence of the builder. This room contains a frieze of plaster-work presenting a repetition of three designs: (1) a bull's head with the letters H. H. encircled by a garter inscribed with the motto of the order, and surmounted by an earl's coronet—the crest of the family of Hastings, Earls of Huntingdon. (2) An open pomegranate ensigned by dragons—a royal badge of the Tudors. (3) A bear and ragged staff—a badge of the ancient Earls of Warwick, assumed by the Dudleys. In this room there is a magnificent open fire-place, with arch and pilasters richly ornamented with sculpture of rich design. As the Order of the Garter was not conferred upon the Earl of Huntingdon until 1579, it is obvious that this room was not finished until after that year, though it does not follow that the buildings, of which it forms part, were not begun at an earlier period. *Plate IV.*

The Earl of Huntingdon died on the 14th December, 1595, and for the next four years, Matthew Hutton, Archbishop of York, discharged the duties of President, until in August, 1599, he was superseded by a Commission appointing Thomas Cecil, Lord Burleigh, to be President.

On the death of Queen Elizabeth in 1603, Lord Burleigh, who had recently come to his official residence at York, assisted in proclaiming James of Scotland King of England, and received the new Monarch at the King's Manor. He also remained at York to welcome the Queen-Consort, but soon afterwards ceased to be President, and was succeeded by Edward, Lord Sheffield. In the Presidency of Lord Sheffield, which lasted about sixteen years, important additions were made to the King's Manor.

James I. at his first coming to York, gave orders for the repair of the Manor, intending to make use of it as a Royal Palace on his journeys to and from Scotland. The work, however, was not carried out for some years, and it was not until 1624 that Lord Sheffield submitted to the Treasury his accounts, shewing an expenditure on the King's Manor of £3,301 4s. 0d. This work must have included the erection of the large block of building which now forms the northerly side of the principle Quadrangle. The general architectural character of this part of the Manor

Photo by W. WATSON.

(A.)

(B.)

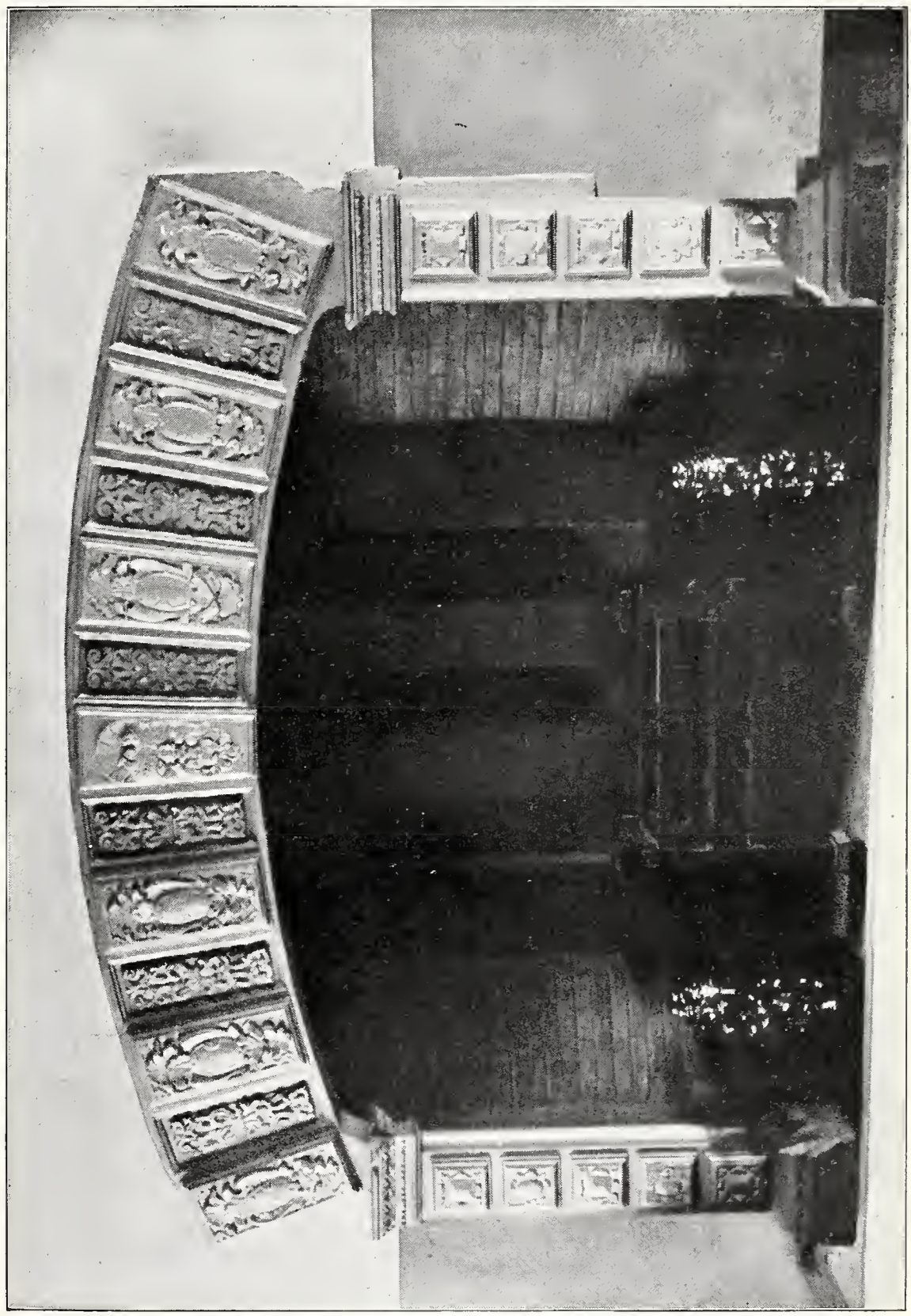


Photo by W. WATSON.

might safely be pronounced Jacobæan, even if the two doorways, on which the Royal initials I. R. are conspicuous, did not clearly show in what King's reign it was constructed.

The last President of the North was Thomas, Viscount Wentworth, better known as the great Earl of Strafford, whose commission bears date 15th December, 1628. An important addition to the Manor was made by him in the erection of a Banqueting Hall, over the door of which the Royal arms were placed, *Plate V.* (*a*), and also a Gallery and a Chapel. Over the doorway on the west side of the Quadrangle Lord Wentworth placed his own armorial bearings, and, *Plate V.* (*b*), at his trial, was charged with unbecoming arrogance in putting his own arms in one of the King's palaces.

Not many days before the execution of Lord Strafford in 1641 the Court of the Great Council of the North was abolished, and the King's Manor, which had been for so many years the seat of arbitrary power, was committed to the charge of a single officer who was styled "the Keeper of the House within the site of the late Monastery of the Blessed Mary, near the walls of the City of York, otherwise called the Pallas, or Manor House, or the Mannor Place."

At the siege of York in 1644, the Manor was converted into a Royalist garrison. When the Parliamentarians blew up St. Mary's Tower, and gained an entrance into the Abbey grounds, the Royalist commander sent a body of his men out by the Water Gate. These troops marched up Marygate, and following the Parliamentarians through the breached tower, succeeded in getting them between two fires, A sharp skirmish ensued, and the precincts of the Manor, it is said, were strewn with the bodies of the slain.

Upon the accession of James II., the King's Manor had a narrow escape from being converted into a Roman Catholic College. It was leased for thirty-one years at the annual rent of ten shillings to a Yorkshire family, whose head at that time was Sir John Lawson, of Brough; and Father Lawson, a member of this family, entered into possession. A large room in the Manor was fitted up and used as a Chapel where Mass was openly celebrated. Shortly afterwards the grant of King James became void, and in 1692 a lease of the whole domain was granted to Robert Waller, of York, attorney-at-law, for thirty-one years at an annual rental of ten shillings.

Waller soon began to make a profit by his bargain, by converting the Manor buildings into separate dwelling houses and letting

them to respectable tenants. Other parts were let for workshops or warehouses, and other meaner purposes. In the year 1696 a mint for coining silver money was set up in one of the rooms, and carried on its operations for two or three years.

Early in the eighteenth century a portion of the Manor was occupied as a ladies' boarding school, and there are many evidences on the glass of windows still existing of the names and tastes of pupils who were at the school more than a hundred years later.

The large Hall, once consecrated as a place of Roman Catholic worship, and now the Manor School for boys, was during this period converted into an assembly room for the nobility, gentry, and ladies at the races, and used as a common entertaining room for the High Sheriffs at the Assizes.

Alderman Waller's lease of the Manor expired in 1723, and a new lease was granted by the Crown to another York Alderman, Sir Tancred Robinson of Newby, Baronet, Lord Mayor in 1718 and 1738. His younger brother, Thomas Robinson, created Lord Grantham in 1761, to whom the benefits of the lease afterwards passed, was an ancestor of the present Marquis of Ripon.

In 1833, upon the death of William Wilberforce, who had represented the County of York in six successive Parliaments, during a period of 28 years, the Yorkshire School for the Blind was founded as the County Memorial of the great work in the cause of humanity of that eminent Christian philanthropist. For this purpose, the King's Manor was leased from the Crown in 1833, at an annual ground rent of £115, (the Manor School enjoying the freehold exempt from rent) and since that date the buildings have been devoted to the work of educating the boys of the City of York, and also of educating, training, employing, and in other ways caring for the Blind of the County of Yorkshire.

The King's Manor has been associated with many important historical events since the time of the Norman Conquest. Kings and Queens, Archbishops, Mitred Abbots, and Great Nobles of our land have lodged and lived within its walls; and it is a cause for rejoicing that this interesting edifice, dignified as it is by so many stirring associations, has suffered but little in its external aspect from the many changes it has experienced, and that it is still devoted to public objects of the highest utility and beneficence.

NOTE.—The foregoing account is largely taken from "Historical Notices of the King's Manor," by Robert Davies, F.S.A., and "Monastic Establishments in York," by Rev. J. Solloway, D.D. (Oxon.)

(*A.*)

Photo by W. WATSON.

(*B.*)

PLATE V.

This abstract, which is reprinted from the 'Geographical Journal' by permission of the Royal Geographical Society, represents the substance of a lecture delivered to the York Philosophical Society on December 19, 1907, by the President of the Society, Dr. Tempest Anderson.

THE VOLCANOES OF GUATEMALA.*

By Dr. TEMPEST ANDERSON.

I SPENT nine months, including the winter of 1906–7, among the volcanoes of Mexico, Guatemala, and the West Indies. The first and last named groups are comparatively well known, while those of Guatemala, though equally, if not more important, have, owing to their remote and inaccessible position, scarcely attracted the attention they deserve from English geologists, though they have been described by a French commission under Dollfus and Montserrat † in 1868, and more recently by Prof. Karl Sapper, ‡ of Tubingen. They consist of a row of giant cones averaging 10,000 to 12,000 feet in height, roughly parallel with the Pacific coast. As viewed from the deck of a Pacific mail steamer they present a most imposing appearance, for though really at a distance of 50 miles from the coast, their whole height is visible at once, as no other range of mountains intervenes, the coast being a belt composed of Quarternary beds which only rise into low foothills. These foothills, the Costa, are covered with coffee plantations, from which the well-known Guatemala coffee is largely produced.

None of these volcanoes is habitually in eruption, like Izalco in Salvador, or Stromboli in the Lipari islands; on the contrary, their eruptions usually take place only after intervals of many years, even centuries, during which the volcano is quiescent and may appear

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* Royal Geographical Society, January 13, 1908. Map, p. 490.

† 'Voyage Géologique dans les Republiques de Guatemala et de Salvador.' Par MM. Dollfus et E. de Montserrat. Paris: Imprimerie Imperiale. 1868.

‡ 'Mittelamerikanishe Reisen und Studiên.' Dr. Karl Sapper. Vieweg. Braunschweig. 1902. 'In den Vulkangebeiten Mittelamerikas und Westindiens.' Dr. Karl Sapper. Stuttgart: E. Nägele. 1905. Also several smaller articles, of which the following especially deals with this district, and has been freely quoted: 'Die Vulcanischen Ereignisse in Mittelamerika,' in Jahre 1902. Karl Sapper. 'Neuen Jahrbuch für Mineralogie, etc.,' 1904, Bd. I. Stuttgart: Nägele.

extinct. Then a terrific explosive eruption occurs in which discharges of ash and fragmentary material predominate, though the outflow of lava is not unknown, and the whole country for miles round is devastated. The cones are in most cases separated by an interval from those adjacent in the chain, and, where the vent has shown a tendency to shift and form parasitic or subsidiary cones, the new opening has usually been nearer to the Pacific ocean. An apparent exception to this rule mentioned by Dollfus and Montserrat was the case of Santa Maria, 11,480 feet, and Cerro Quemado. The former is an old volcano, and was supposed to be extinct. The latter, adjacent but further inland, is more recent, and had been active in 1785, when it poured out some large flows of andesitic lava. In 1902, after a severe earthquake which almost destroyed the adjacent city of Quezaltenango, Santa Maria opened out an enormous new crater, nearer the sea than its old one, and of course than that of Cerro Quemado, and is thus no longer an exception to the general rule.

This eruption is so important in relation to those of the Soufrière in St. Vincent, and Montagne Pelée in Martinique, that the associated phenomena deserve special mention.

On January 18, 1902, there was a severe earthquake.

On February 26 an unusual tidal wave was observed along the coast of Salvador and part of Guatemala.

On April 18 a very severe earthquake almost destroyed the town of Quezaltenango, and caused subsidences at Ocós.

On May 7 and 8, the great eruptions of St. Vincent and Martinique, on the other side of the Caribbean Sea, burst into full activity, after premonitory signs lasting a few days.

On May 10, Izalco in Salvador, to the south of Guatemala, resumed activity after 15 months' quiescence.

On June 25, Masaya, in Nicaragua, after forty-three years' inactivity, resumed slight activity, which continued for several weeks, and the neighbouring crater of Santiago showed similar signs, as did also Momotombo, which had been at rest for many years. Colima, in Mexico, above 700 miles distant, also showed signs of awakening energy. These phenomena culminated in the great outbreak of Santa Maria on October 23 and 24, and following days. I and my colleague, Dr. Flett, have elsewhere fully discussed the general sequence of these volcanic phenomena.* The details of the above must now be discussed separately.

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* Anderson and Flett. 'On the Eruptions of the Soufrière, etc.' Part I. *Phil. Trans.*, Series A, vol. **200**, 1903, pp. 532. Parts II. and III., 1908, will contain the later history, the petrology, and a bibliography.

The Earthquake of January 18, 1902.

Guatemala has always been considered a district particularly subject to earthquakes, especially at the changes of the seasons in April, May, and October, November, but they had been less frequent than usual for some years before 1902.

On January 18 a severe shock was felt widely over the Republic. San Martin, a village near Quezaltenango, had some houses thrown down; and at Ocós, on the Pacific coast, three parallel ridges, sloping gently towards the sea, but steep towards the land, were formed in the sand. List, quoted by Sapper,* writes, "Just as at any moment one may see a wave break on the shore, so the volcanic breaker remained modelled in the sand of Ocós." The ridges were in general parallel to the coast-line, and could be traced for a distance of about an English mile. The earth-waves passed through a coffee shed, and some of the steel pillars had sunk 2 feet. The waves on the pier are described as having a length of 25 to 30 metres, and a depth of 25 to 30 cms. As showing the strength of the shock, it is mentioned that two locomotives, weighing 20 tons each, were moved 6 feet in the direction of the earth push. Similar appearances were observed on the Mexican coast near San Benito. Sapper considers the earthquake tectonic in character, *i.e.* caused by readjustments of the Earth's crust, in this case probably a slip somewhere under the Pacific.

The earthquakes of April 18 were considered by List at Ocós to be of the same nature as that of January 18, *i.e.* tectonic. In that of April 18, the sinking of the sand continued further inland than in January. Sapper does not consider it clear whether it was a general sinking of the coast or merely a local sinking of the sand inland due to the shaking. At Quezaltenango the shock was especially violent. Mr. Walter S. Ascoli,† who was on the spot, relates that while he was quietly reading about 8.20 p.m., without the slightest warning or premonitory tremor, the Earth began to sway violently, and the ornaments in the room all lost their balance and fell to the floor. This oscillation continued for twenty seconds, then suddenly the motion became vertical and much more violent. Later on the shocks seemed to come from all directions. Loud "retumbos" (underground noises) were heard. Scarcely a single house or building in the town remained habitable, and those on the slopes of the Cerro Quemado, consisting chiefly of *adobe* (*i.e.* dried mud), were entirely destroyed. As showing the violence of the shocks, the church of San Sabastian, which was built soon after the Spanish

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* Sapper, 'Neues Jahrbuch,' *ut sup.*, p. 49.

† In a letter to Dr. Anderson. Much information has also been obtained from Mr. A. H. Gehrke, of Rösing Bros., London and Guatemala; Don Carlos Moesly, of Helvetia; Herr John Lisser, of Retalhuleu; besides Sapper's works; to all of whom my thanks are due.

occupation, and had resisted all the earthquakes since that time, was completely ruined. Mr. Ascoli considers that the deaths in Quezaltenango really exceeded one thousand, though reported at a much smaller number. This earthquake was very widespread. It was felt from the city of Mexico, and even San Francisco, as far as Salvador, especially along the Pacific slope, the coffee zone at the foot of the volcanic range having suffered severely, but it was curiously local. It was probably most severe at Quezaltenango and San Pedro and along the high lands to Sololá, but some villages within a few miles of the former town escaped almost entirely, and so did Totonicapam, only a few miles north of Sololá. It was noticed that brick houses suffered more damage than those built of stone, and these again more than those with wooden frames; while the native ranchos, built of poles covered with thatch, bound together with bands made of creepers, suffered scarcely at all. Many landslips were traced to the shock.

After April 18 a series of small earthquakes occurred, and on September 23, another severe one. Rockstroh, who visited the damaged districts after the occurrence,* considers the three earthquakes of January 18, April 18, and September 23 all tectonic; while List, who observed them all personally at Ocós, considers the last of quite a different character to the others. The smaller ones were probably volcanic, and connected with the approaching outbreak of Santa Maria. Some were more local in their distribution, and more severe towards the Salvador frontier. They may have been connected with the renewed activity of Izalco.

The tidal wave of February 26, 1902, is reported by Aurelio Arias, director of the Meteorological Observatory of San Salvador,† to have extended along the coast of Salvador about 120 kilometres, especially at Barra del Paz, and to have reached as far north as Acajutla. At about 7 p.m. three waves, of which the first was the smallest, swept on the land and caused great damage. Their height is not mentioned, but about 100 persons were killed at the village of Santiago, and 85 at Barra del Paz. Loud "retumbos" (subterranean noises) were heard, and thought to proceed from under the sea.

The Cerro Quemado, also known as the volcano of Quezaltenango, is near the town of that name, and as viewed from the Plaza, seems actually to overhang it. Though it had a small and perhaps doubtful outbreak in 1891, its last eruption of importance was in 1785, and while no accurate records are preserved, it is probable that, at any rate, some of the lava-streams which form such a conspicuous feature of the mountain were formed in that year. As mentioned above, most of the eruptions of these Guatemalan volcanoes have been of the explosive type,

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* Report to the Government, quoted by Sapper, p. 49.

† *El Siglo*, San Salvador, **20**, No. 3, 184 (June 20, 1902).

and characterized by the emission of large quantities of fragmentary ejecta, ash, lapilli, and pumice, while often no lava is poured out. The last considerable eruption of Cerro Quemado was an exception, for not only were enormous quantities of lava discharged, but the form of the streams was peculiar. They consolidated on quite deep slopes, and often terminated in almost vertical walls, perhaps 100 feet or more in height. The lava appears to have been quite pasty at the time of its discharge, and to have quickly consolidated into a crust, which, as the lava under it continued to flow, broke up into blocks of varying but generally considerable size, and these have been pushed and rolled forward till they have formed a sort of wall, and have so helped to prevent the further progress of the lava. This, of course, is not unusual, but I have seldom seen the final slopes so steep, though another similar case occurs at Colima, in Mexico. As confirming the theory that the lava must have been pasty and almost consolidated at the time of its emission, I found in the crater of the mountain several well-marked bread-crust bombs, which are considered as characteristic of the Vulcanian type of eruption, *i.e.* where the explosions have taken place from among lava more or less consolidated. The idea is that the mass of lava before its ejection had cooled sufficiently for its surface to have consolidated, while the interior still remained pasty or even liquid, and that when it was thrown suddenly into the air, and the outside pressure relieved, the vapours, which in different degree always exist in the lava, became separated and formed vesicles, and so swelled the mass and caused the crust to crack. One of these bread-crust bombs is shown in Plate I., and is indistinguishable from others I have seen on Vulcano, after the typical Vulcanian eruption of 1888, and also on Colima, where they appeared to be associated with the above-mentioned lava-stream. The crater itself presents confirmatory appearances. It is a large hollow filled chiefly with blocks and slabs of well-consolidated lava with definitely broken edges, showing that they were quite solidified before they took their present position. It contains a few insignificant fumaroles, and some sparse pine trees are striving hard for a precarious existence. At the foot of the volcano are some hot springs at Almolonga, and at Zunil some small geysers.

The volcano of Santa Maria, as viewed from the slopes of the Cerro Quemado, from which it is only a few miles distant on the south, appears as a very regular cone (Plate II.). It is covered to the top on this, its north, side with vegetation, which appears to have been only partially destroyed by the great eruption of 1902. It was ascended in March, 1902, only a few months before this eruption, by Mr. Walter S. Ascoli, who found a small crater on the summit, consisting of an irregular, shallow, rocky depression some 120 feet in diameter. At the bottom the rocks were split up, leaving narrow clefts between them, from which, however, no steam or vapour escaped. The beds forming the mountain

dipped outwards in every direction in the manner usual in volcanic cones. The volcanoes mostly spring from a plateau about 5000 feet above sea-level, and Santa Maria is no exception, standing at the edge of the high land. The country to the north is all an elevated region, while to the south are the foothills, the "costa," which slope gradually down to the coastal plain. They are mostly formed of fragmentary volcanic materials, and are much cut up into steep, narrow ridges separated by deep valleys similar to those on the flanks of the West Indian volcanoes. These ridges were, before the eruption, the seat of coffee plantations, which were then devastated, and have only partially recovered. At the foot of the mountain was a comparatively flat piece of ground overlooking this system of valleys, which was somewhat less sloping than the surrounding parts, and had consequently been selected as a camping-ground by the engineers engaged in making a survey for a railway from the coast round the mountain to the town of Quezaltenango behind it. It was covered with a dense tropical growth like the rest of the mountain, from which it showed no special difference.

It was from this place that the eruption of October 24, 1902, broke out. Slight earthquakes were felt in the neighbourhood during the day, and about 5 p.m. a loud and increasing sound was heard in San Felipe, a neighbouring village. This sound appeared to come from the direction of the mountain. It was compared by some to the noise of a waterfall, by others to a gigantic boiler blowing off. The noise lasted half an hour. About this time dark clouds were noticed from Quezaltenango and elsewhere in the direction of the mountain. They were at first ascribed to a thunderstorm. Towards evening a slight sprinkling of sand occurred at Quezaltenango, which soon covered the landscape with white. The wind changed from south to east, and ashes began to fall at Helvetia, a coffee plantation 6 miles to the south-west. About 7 p.m. a glow began to appear, and lightning was noticed in the neighbourhood of the present crater, and roaring sounds were heard. About 8 p.m. the air had sufficiently cleared for an enormous black cloud to be visible to persons at a distance from the mountain. It was seamed with countless curved lines of red and green electric discharges; violent claps of thunder were noticed (but it is not mentioned at what distance they were best heard). About 1 a.m., October 25, stones began to fall at Sabina, a bathing establishment at the foot of the mountain towards the south-east. At 3 a.m. pumice-stones fell abundantly in Helvetia. They measured 15–25 centimetres, and weighed $\frac{1}{2}$ to $\frac{3}{4}$ lb. They were first cold, then hot, and later were mixed with stones of heavier material as big as the fist. Lapilli the size of peas fell at Quezaltenango, 10 miles north-north-east. The eruption increased in violence, and the whole district was enveloped in darkness. The maximum intensity was reached about 11 a.m. on Sunday the 25th, though it remained severe till nightfall. It was not

until midday on the 26th that the air began to clear a little and the light to return. The eruption continued with varying severity for most of the week. Towards the end of the eruption, as is generally the case, outbursts of whitish steam began to preponderate over the dark ash-laden clouds. Don Carlos Moesly, of Helvetia, gave me a graphic description of how a building at Suiza, in which a large number of people had taken refuge, collapsed by the weight of ashes on the roof. With the assistance of a French machinist * and some natives he extricated twenty-two alive, but eighteen were left dead.

When all was clear again, it was seen that an entirely new crater had been formed at the base of the mountain, and that the whole surrounding country was devastated and deeply covered with ashes. This crater is oval in form, with the long diameter parallel to the coast, and as far as my plane-table observations, which were made from the Finca Helvetia at a distance of about 6 miles, can be relied upon, this measures from $\frac{3}{4}$ to $\frac{7}{8}$ of a mile. The shorter diameter is not very much less, probably from $\frac{1}{2}$ to $\frac{5}{8}$ of a mile. The whole side of the mountain was blown away, exposing a section of several thousand feet in height, in which the dip of the strata mentioned above is very evident. Owing to the dip being with the slope, landslides almost constantly take place, and are gradually filling up the crater, though the latter is still apparently from 1000 to 1500 feet in depth. It has a lake at the bottom and two very active fumaroles, or perhaps rather hot springs, from which steam and hot water escape with a violence almost worthy of the name geyser. These fumaroles issue from the foot of the cliff, at a point where traces of a great radial crack in the mountain are visible. Observations on these points are, however, very difficult. Helvetia, my base, was fully 6 miles distant, and direct access was cut off by many impassable ravines. The ascent, as mentioned below, was only possible by making a long *détour* to the south-east *viâ* Palmar, from which side ridges lead more or less in the desired direction. The crater was almost constantly full of a cloud of dust which drifted away before the wind, and looked very suggestive of commencing eruption, but careful examination showed that this was due solely to the falling stones, except an occasional puff of steam from the fumaroles, which now and then rose above the lip of the crater. When a view of the great cliff was occasionally obtained, I could see many beds of tuff and agglomerate, but could never be certain of any compact lava. The mode of origin seems a perfect example of that attributed by Sir Charles Lyell to the Val del Bove on Etna, and in order of magnitude it is enormously greater than that of the eruptions of the Soufrière and Montagne Pelée in the same year.

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* The French machinist was the only man who stayed with Mr. Moesly all through the eruption, and he is still employed there at increased wages.

The eruption cloud rose to a great height. It was seen from the sea. The captain of one steamer * measured the height with a sextant, and recorded it as 17 to 18 miles. Another put it as much as 30, but this may be merely an estimate. The sounds accompanying the eruption were loud, and, as has been observed elsewhere, were heard even louder at distant places than close to the mountain. Thus at Guatemala city, the capital, the detonations were at times so strong that they were supposed to proceed from the neighbouring volcanoes.

There is no evidence of the occurrence of any incandescent avalanche or hot blast like those which occurred in St. Vincent and Martinique, but there are unconfirmed rumours of explosions having taken place in the hot ash, like those which occurred in the islands just mentioned, and which were there traced to the action of water on that material. The ashes measured later on were 7½ English feet deep at Suiza, and 4½ to 5 feet at Helvetia, the place to which the works were moved after the catastrophe. At Nil, more to the north-east, and nearer the mountain in the track of the main discharge of ashes, the depth was 10 to 12 feet. Still nearer the mountain the depths were much greater. At San Antonio the top of the chimney was all that remained uncovered, from which it is concluded that the deposit was about 14 metres in thickness. At the Baths of Sabina, near the foot of the mountain, the ashes were at least 30 feet thick, while nearer the crater the depth was not less than 100 feet, and may have been 200 feet in places. The ashes were carried widely over the district to the west and north-west, and even into remote parts of Mexico, such as Acapulco and Colima. Mr. Gehrke, a partner in a firm of coffee merchants, who had large interests in the crops which were destroyed, and who visited the district soon after the eruption and measured the depths of the deposit, estimates the total amount in the district as not less than twenty thousand million tons, without reckoning that carried away to a distance by the wind. Sapper mentions maps showing the distribution in Mexico as having been made by more than one observer, but states they only agree in broad general features. It will be remembered that "Krakatoa" sunsets were observed in Europe in the autumn of 1902 and were attributed to the West Indian eruption in the previous May. There was always a difficulty in understanding this late appearance, and there is now, I believe, no reasonable doubt that they were due to Santa Maria.

The ash deposits immediately after the eruption presented a pretty uniform surface, the old valleys, at any rate near the crater, having been in great measure, if not entirely, filled up. The surface was at first quite soft and incoherent, and difficult to walk on without sinking. Torrents of rain fell either at the time of or directly after the eruption, a large portion of which sank into and consolidated the new deposits,

* Captain Saunders, of the Pacific Mail S.S. *Newport*.

reducing the measured thickness at the same time. A large portion of the rain, however, ran off, producing a feather-pattern erosion, shown in some of the earlier photographs, like that noticed in St. Vincent and Martinique.* As in those islands also, the torrents of water and mud flowed in new courses independent of the old ones, which had been filled up, and formed new channels, in many cases cutting deep into the soil and subjacent beds which previously existed. Thus a deep and narrow ravine, about 80 or 100 feet deep and perhaps 100 or 120 feet wide, now exists to the east of, and not many yards from, the Plaza of Palmar. It has been cut out of the old tuff and agglomerate, and now conveys the water from the river Nima, which formerly ran in quite a different direction into the Samalá (see Plate III.). In other cases the floods carried away bridges and deepened the old ravines, and the mud brought down blocked up the river Ocosito near Ocós, and altered the configuration of the coast in that neighbourhood. All these changes strikingly recall similar ones in St. Vincent.†

When the surface of the ash deposits had become more consolidated, and before denudation had had time to produce much effect, access to the mountain was easy, but as the rain and atmospheric agencies did their work, deep gullies were formed, divided by narrow ridges. In the low grounds, where change had been less active, the ridges, at the time of my visit, were generally flat-topped, where the crust had protected the underlying, less-consolidated material. This often weathered into almost vertical walls, till another somewhat harder layer was reached, which formed a new shelf, the whole making a succession of steps, such as to remind one of the tops and keyboards of a succession of pianos placed end to end, along the tops of which it was not difficult to walk (see Plate IV.). Further up the mountain, where the process was further advanced, intermediate blocks had often been entirely washed away, and this necessitated constant ascents and descents, which were decidedly fatiguing. Further up again, as in Plate V., the whole top crust had generally been removed, and the ridges were often reduced to mere knife-edges, which were liable to give way and precipitate the traveller into the deep crevasse on either side. This plate, which is taken on the south-west of the mountain above Palmar and the site of the Baths of Sabina (from which direction the wind was blowing at the time of the eruption), exhibits well the comparative thinness of the ash on that side of the mountain, as shown by the dead tree-trunks, which still project through the ash. Nearer the crater the ash becomes much thicker and the barrancos deeper. This plate also exhibits the structure of the mountain, with the beds of tuff and agglomerate dipping conformably to the slope. This shows that they

* Anderson and Flett, part i. plate 28 ; Sapper, 'Ereignisse,' Taf. vii.

† Anderson and Flett, *loc. cit.* ; Anderson, *Geographical Journal*, March, 1903.

were deposited as ejecta from the old crater on the summit, and not from one in the position of the new crater. The thick beds of ash with their deep barrancos extended far beyond the left of the plate. All this presents a striking resemblance to the corresponding localities on the slopes of the Soufrière. On some of the ridges in the lower ground, as, for instance, in the coffee plantations, the resemblance is still more striking. Plate VI. is practically indistinguishable from a plate to appear in the Soufrière Report, Part II., and may be compared with Part I., Plate 35, which shows a similar place directly after the eruption. In each the ridge and slopes had been covered with a thin layer of ash. On the ridge this only received the rain which actually fell on it. This mostly sank in, and a firm crust was produced which offered considerable resistance to further change. On the slopes on each side the ash was exposed not only to the rain which fell directly on it, but also to the wash from the higher parts, and in many places had been carried away, and thus exposed the soil, on which vegetation is returning in many cases from the old roots.

The loss of life is supposed to have been very great, but, unfortunately, no accurate statistics are available, as the victims were chiefly Indians who had come down from their villages in the mountains into the coffee zone to assist at the harvest. Still the opinion of those on the spot puts it at possibly two or three thousand.

The lake of Atitlan is not only one of the most interesting, but also one of the most beautiful places in the world, and its interest is much increased by the survival of several villages of Indians who retain many of their primitive customs, and still wear curious costumes. The lake is, roughly speaking, nearly circular, or would be so if it were not for several big volcanoes on its south bank, beyond which the plateau slopes rapidly down to the coastal plain. Its longest diameter is about 20 miles. On the east, north, and west, where there are no volcanoes, the slopes are usually very steep, though in a sufficiently advanced state of denudation to be a good deal cut up by valleys of rivers and brooks which flow into the lake. It has generally been supposed that the basin of this is only a continuation and union of these valleys, and that after they had been excavated, the volcanoes broke out on their beds and formed the lakes by blocking the exit for the water. This supposition is certainly plausible. The north shore is formed of volcanic tuffs and conglomerates of recent geological age, and sufficiently denuded to agree with either this or with the hypothesis that the lake itself is a crater, while the dip of their beds is so complicated that its evidence is not conclusive either way. I noticed, however, that the west shore of the lake extended in a well-marked, almost precipitous bank right round to the south of the volcanoes of San Pedro and Atitlan, and was perfectly separate from the slopes of the former, and to a large extent from those of the latter. I visited it, and found it composed of beds of tuff all dipping to the south

towards the Pacific and away from the lake. Thus both the naked-eye form of the ridge, and the geological structure, suggest that it is the lip of an enormous crater, and that the volcanoes of San Pedro, Atitlan, and Toliman, giants as they are, are merely secondary cones thrown up on its floor. If that is so, this crater lake must certainly be one of the largest, if not the largest, in the world.

I made the ascent of Atitlan along with the proprietor of the steamer on the lake, with whom I was boarding, and a party of his friends. We started from San Lucas, at the east end of the lake, and rode first through cultivated fields, then through a woodland track, crossing one or two lava-beds exposed in the bed of a stream, till at a clearing we left the horses, which could be got no further, and we entered on foot the virgin forest which clothed the slopes of the mountain. We soon had to have a path cut, which rendered progress slow, but we pushed on as far as possible till nearly nightfall, when we camped under a sailcloth brought for the purpose. Plate VII. shows the view from our camp, which was naturally the most open spot we could find. The trees are covered with mosses and lichens, which in places depend in festoons, and with hanging roots which grow down from the branches till they reach the ground and take root on their own account. The Mozo has a machete in his hand, such as is used for cutting a path. The foliage overhead is so dense that the place is quite gloomy, even in broad daylight. The night was not particularly cold, but the ground was damp and disagreeable. We heard the cries of various animals in the night, but they did not come near us. Next morning we were up before daylight, and, without any special adventure, reached the top. The way for the last few hundred feet was over large, rather loose scoriæ, and the actual top was a sort of plain with a slight depression in it, which might be supposed to be the remains of a crater. The surface was a mass of small blocks of compact lava, with cracks from which vapours escaped here and there. The view was very striking. The whole Lake of Atitlan was at our feet, except where hidden by the volcanoes of Toliman and San Pedro. The crater ring surrounding the lake could be distinctly traced, while the whole volcanic range from Santa Maria or beyond, on the west, to Fuego, Acatenango and Agua on the east, was distinctly visible. The coastal plain lay below us, and we got occasional glimpses of the ocean beyond, but soon the moisture condensed, as usual before midday, and instead of the Pacific we looked down on an ocean of clouds. I have seen this wonderful spectacle from many other heights, but never more grandly than on this occasion. On our descent, as we got to the level of the sea of clouds we had an opportunity of watching their formation. The warm moist air from the Pacific met the cold dry air from the plateau above the rim of the old crater of the lake, and the rolling, seething mass of cumulus clouds formed a mass never to be forgotten.

The volcanoes of Fuego, 13,120 feet, and Agua, 12,286 feet, are other members of the chain more to the east, and are near to the city of Antigua Guatemala, once the capital of Spanish America. Fuego has been repeatedly in eruption in historic times, the last date being 1880, but its outbreaks, which are of the explosive type, present no special features beyond their violence. It has a large and very deep crater open towards the Pacific, and this has such a characteristic aspect that it is of great value as a landmark, for even a glimpse of it, through a break in the clouds, cannot be mistaken, and gives the navigator a sure bearing. Agua presents a well-marked crater breached to a certain extent in the direction of a valley leading down to Antigua. It has not had an ordinary volcanic eruption during the historic period, but in 1541 a great flood of water descended the mountain and destroyed a still older capital, Ciudad Vieja, situated at its base. It has been supposed that the flood proceeded from the bursting of a lake in the crater. This, however, extends to a depth at least 50 feet below the old breach, and I could not see either a raised beach, or any other evidence of the crater having held a lake. On the whole, therefore, I am inclined to believe that the flood was really the result of a cloud-burst on the mountain and not a volcanic phenomenon at all. After this catastrophe the city of Antigua was built, and in its turn was destroyed by a violent earthquake in 1773, in consequence of which the present capital was built, and the seat of government was removed to it. The ruins of Antigua, including many churches overgrown with vegetation, are very picturesque and interesting.

Guatemala appears to have a great future before it. Up to the present time access to it has been almost entirely by steamer on the Pacific *viâ* Panama or San Francisco, in either case a most circuitous and expensive route; but now two new ways are in process of being opened—one through Mexico *viâ* the Tehuantepec railway across the isthmus of that name, at either end of which magnificent new harbours have been constructed at Coatzacoalcos and Salina Cruz; and the other by a new railway direct to the capital from Puerto Barrios, also a new port on the Atlantic seaboard, to which steamers already run from New Orleans direct.

My cordial thanks are due to Sir Edward Grey, of the Foreign Office, and Mr. Carden, the British Minister at Guatemala, for their good offices with the Guatemala Government, and to Señor Juan Barrios, Foreign Minister of Guatemala, who exerted himself most effectively on my behalf with various local authorities. I found these gentlemen uniformly courteous and obliging, and to their kind assistance in obtaining trustworthy guides, porters, and other facilities too numerous to mention, much of the success of my expedition was due. I wish also particularly to thank Mr. Walter G. Ascoli, F.R.G.S., of Manchester, Guatemala, and Quezaltenango, Mr. Gehrke, F.R.G.S., and Mr. Moesly,

of Finca Helvetia, as well as other planters too numerous to mention, for their kind assistance and hospitality. Their local knowledge in a country like this was simply invaluable.

Colonel Church: It is with much regret that I have to announce that our President is unable to be present this evening owing to a slight illness. Our lecturer this evening is already known to you, and about four years ago he entertained us with his experiences, his studies, and his wonderful photographic plates of the volcanic eruptions in Martinique and Mont Pelée. I may mention that not only did he greatly distinguish himself by his analysis of those eruptions, but that he is also familiar with many parts of the world where he has done good work in the same direction, work always characterized by a thoroughness which is worthy of admiration. He has taken care to possess himself of everything in the shape of mechanical appliances known to photography, and consequently what he does is perfectly reliable. He was accompanied in his examination of Mont Pelée and Martinique by Dr. Flett, of the Geological Survey. The country from which he now returns with so much valuable information is one of the great volcanic centres of the world. I will now call upon Dr. Tempest Anderson to read his paper.

Dr. Flett: Listening to Dr. Anderson's descriptions to-night, and seeing on the screen the beautiful series of photographs of Guatemalan scenery and volcanoes, I could not help being struck very greatly with the similarity which exists between the volcanic phenomena in Guatemala and those with which Dr. Anderson and I became acquainted in the year 1902, when we had the opportunity of visiting together the volcanoes of the West Indies. There is some connection between the volcanoes of St. Vincent, Martinique, and those of Guatemala, because in May, 1902, when Montagne Pelée in Martinique and the Soufrière in St. Vincent burst into eruption, there were earthquakes in Guatemala; and six months later, while the volcanic activity was still going on in the West Indies, this great eruption took place of which Dr. Anderson has shown photographs to-night. One feature of the outbursts in both these districts was that the products were principally ashes, sand, and dust, so that the scenery of the Guatemalan volcano is very like that of the volcanoes in Martinique, where the whole surface of the ground was covered over with thick layers of ashes and sand.

Equally striking to us, perhaps, who are accustomed to temperate climates is the extraordinary rapidity with which these great masses of ashes are swept away from the bare surface of the ground in tropical climates. The photographs, for example, shown us to-night, when compared with the photographs taken in 1902 and 1903 by Prof. Karl Sapper, show that, vast as was the quantity of material ejected, the greater part of it has been swept away from the higher ground by the rivers, and transported to the sea. In the same way, in the West Indies, the larger part of the material which wrought devastation there was very soon removed, and with it part of the underlying soil, which had been, of course, left bare and unprotected by the destruction of the vegetation. I think you will agree with me that the year 1902 is one which will be marked with a red letter in the history of volcanic activity. In that year we had three volcanic outbursts of great magnitude: these were, the eruptions at Montagne Pelée, at the Soufrière in St. Vincent, and at Santa Maria in Guatemala. It is a curious fact that the greatest of these three in physical magnitude, namely, the Guatemalan eruption, is one which has been least known hitherto to English and American geologists, whereas the one which was least in point of mere magnitude has, on account of its fatal action on the town of St. Pierre and the loss of nearly thirty thousand lives, and the extraordinary nature

of the volcanic phenomena which it presented, become so famous as to be almost a household word to geologists. The service which Dr. Anderson has rendered in visiting Guatemala and bringing before us so careful an account of the volcanic phenomena in that quarter, is one which I am sure the scientific public in England will highly appreciate.

Mr. Maudslay: I can add very little to what Dr. Anderson has told us. I certainly do know these volcanoes very well, having ascended the Volcan de Fuego once and Agua three times. I quite agree with what Dr. Anderson has said about the destruction of the first city of Guatemala. It must have been a cloudburst, and not a volcanic eruption, that destroyed it. We must remember that Guatemala—the city of Guatemala, as it was called even in those times—was a very, very small affair indeed. The wife of the conqueror Pedro de Alvarado lost her life in that cloudburst, and no doubt it made a great impression upon the people in the country, but I have gone carefully through the accounts of it, and it is quite clear that it had rained very hard for three or four days, and that it was a wave of mud from the slope of the mountain that overwhelmed that small town. The few inhabitants took refuge in the chapels, where they were most of them smothered. You have seen from some of these photographs the very beautiful outlines of the volcanoes in that country, and I do not think one really could exaggerate the beauty of Agua and Fuego and the lake of Atitlan. The view at sunset or at sunrise from the top of Agua or Fuego, with the sun tinting that long line of peaks, is exquisite. And the cloud effects are unrivalled. It is extremely interesting to me to see these photographs of Santa Maria, because the last time I saw it it was a perfect cone, and Quezaltenango was then a flourishing city. I can do no more than congratulate Dr. Anderson upon the work he has done, and thank him for the photographs he has shown us.

Mr. Ascoli remarked that he had been in the country at the time of the eruption and of the previous earthquake, but that the details were too numerous to go into that evening. A feature of the eruption not mentioned by Dr. Anderson, and which might tend to elucidate the mystery of the destruction of Ciudad Vieja, was the following: During great activity of the crater, at night-time, about a week after the first outburst, the village of Santa Maria, situated on the south-eastern flank of the volcano, was awakened by a terrific roar, which continued during several hours. On investigation the following morning, it was seen that a tremendous torrent of water had swept down the mountain-side from near the summit, and had cut a channel about 17 feet deep and 33 yards wide from the road about a quarter of a mile below the village, carrying everything before it. Up to the present no satisfactory explanation has been given as to the origin of this torrent, for on no part of the mountain-side is there room for any quantity of water to have collected. It is surmised that the occurrence was due to the rapid condensation of steam emitted from the crater; but this seems hardly compatible with the immense quantity of water which descended the mountain-side.

Mr. A. H. Gehrke: The pleasure we have all had to-night in hearing Dr. Tempest Anderson, and viewing the magnificent photographs that he has shown us, is in my own case greatly enhanced in finding some notice taken at last of one of the greatest volcanic eruptions of modern times, which, in respect of its intensity and scope, considerably overshadows those other and much more celebrated eruptions which took place in the same year at Martinique and St. Vincent. True, the loss of life was, fortunately, not so great as at Martinique, though we probably lost more than two thousand in Guatemala, but the exact number will never be known. It was a remarkable fact, to us of the British colony, that the Press in England barely noticed the eruption, some only mentioning it as a rumour

from Washington. The *Standard*, for instance, published not a single word of it that I could find. The contemporaneous German papers were, however, better informed of an event of such magnitude, and, indeed, in Germany volumes have been published by Dr. Karl Sapper, of Tübingen University, who had arrived in Guatemala the very night before the eruption broke out.

In order to give you some idea of the magnitude of the eruption, I must mention that Captain Saunders, the commander of the Pacific Mail s.s. *Newport*, which was off the coast of Guatemala at the time, says that he measured the height of the column of matter ejected, by his instruments, from the bridge of his steamer, and it was between 17 and 18 miles high, as near as he could reckon. The stuff was ejected in a north-westerly direction, and the fall of the so-called ashes extended as far as Acapulco, in Mexico, fully 600 miles away. On the other hand, the sound of the explosions travelled in exactly a contrary direction, to the south-east, and at Punta Arenas, in Costa Rica, also 600 miles away, it was so loud that people there thought that a warship was firing her guns all day long, "round the point." The deposit of the so-called ash—in reality pumice-stone, granite pieces, and their smaller particles forming a kind of sand—was, of course, deeper nearer the crater, where it still lies over 200 feet in depth, but it rapidly diminished with distance, till, at the frontier with Mexico, about 60 miles away, it only measured 13 or 14 inches, and from there on it tapered away gradually for 500 miles, until at Acapulco it was a slight layer of white dust. A rough calculation of what fell on Guatemalan territory alone—and it was only on that south-west corner that any stuff descended—shows the quantity to weigh well over 20,000 million tons, all ejected in those seventy-two terrible hours of complete darkness. And that is without taking into account the vast area in Mexico, thousands of square miles of deposit, inches deep. On our estate, "Helvetia," of which Dr. Anderson has shown you some interesting photos, and which has an area of about 5000 acres, the scoria lay from 7 to 12 feet deep, as it is situate only about 6 miles from the crater, and the total quantity we had on our land, we reckon, is not less than 50 million tons. The coffee-trees, which I can liken in size and shape to a good-sized lilac bush, say from 12 to 15 feet high, were just about buried in the ash, only a few twigs, leafless, of course, showing themselves above the surface. The houses and machinery had all been crushed flat; practically all the big forest trees still standing about on the estate were charred stumps, killed by lightning during the eruption; and the scene of devastation of what was once one of the finest coffee plantations of Central America, or indeed of anywhere in the world, was terrible to see. At the time of the outbreak there were nearly a thousand people working on the property, and that more were not killed is entirely due to the courage and devotion of the manager, Mr. Moesly, who stuck to his post, and imperilled his own life fearlessly in order to bring his labourers into as safe a place as possible; which was not very safe, however, as we lost some fifty lives as it is, amongst them that of the assistant-manager, Mr. Hartmann, who, with seventeen others, was crushed to death by a falling roof.

Some months afterwards, on revisiting the place with Mr. Moesly, we found some signs of promise. For one thing, there was more of the coffee-trees visible above ground. The heavy rains, most remarkable in their intensity, and due to the condensation of the immense quantities of steam continually issuing from the crater, had beaten down the sand to a more compact mass, and washed away a great deal besides, so that to-day, after five years, we have only a deposit of from 3 to 5 feet on the place, which we are anxious not to lose, as we find it useful in keeping down the growth of weeds, besides other advantages. When we looked at the place five years ago, and four months after the eruption, and saw a few leaves

appearing, we realized that the trees we thought dead were still alive, and we determined to do our best to save at least some of the estate. We had a bitter struggle, and had to spend an immense sum of money, but we have succeeded in bringing the plantation to a state of perfection that it never had before, and the crops are, as a rule, much heavier and of better quality than previously. One of our greatest troubles was that of sickness, owing to the balance of Nature having been upset by the eruption, which, having killed all the birds for some hundreds of miles, enabled the flies, mosquitoes, and rats to multiply to such an extent that life to man became nearly unbearable. The immediate consequence was an epidemic of malaria, which cost more lives than the eruption itself—many times more. It has passed, happily; the birds having come again, the breeding of these pests is checked, and the district again enjoys the excellent reputation for health that it deservedly had before.

I wish to point out that when we commenced work on the plantation after the eruption, we did not know very well how to set about it; conditions were all changed, former experience was useless. There was no information available, and though there was advice in plenty, it was contradictory and not practical at all. We and all the planters on the coast were left to invent our own devices and methods, and whilst many may have been successful, others have not. Even to-day, now that it is all over, and the individual planters have either sunk or swum, it is not clear what was exactly the best way, and what was the real cause of failure or success. Now, I think that here there is scope for a proper scientific investigator, with a taste for seismology, to put on record the eruption itself and its after history and effects, especially with regard to agriculture. He would find a field of absorbing interest; he might confer great benefit to future victims of these occurrences in other parts by telling of our experiments and their results as compared with those of other planters on that coast, and he would find a hearty welcome at Helvetia, where we should be glad to extend him the usual hospitality and good cheer, and tell him as much as we know. I give the invitation from no selfish motive, as our results are attained, and we are out of the wood, and it is inconceivable that we should have another eruption of this nature in this neighbourhood, seeing that the open vent now acts mildly as a safety-valve. In fact, our volcano will now probably rest content with its little fling for a few centuries. The common experience of volcanoes, in Central America at least, points to the fact that heavy eruptions are never followed by others in that particular district. It is generally another volcano that has a turn; so we consider our situation as particularly safe and sound, and pity other poor people who have eruptions still to come.

Colonel Church: Guatemala is not a little country by any means. Its area is about 47,000 square miles, and it is the most densely populated of any of the Central American states. I desire to call attention to the treaty which has been made very recently in Washington between the five Central American nations. In this, their representatives have agreed to abandon all their differences, to respect each other's territorial possessions, and to end revolutions. Should this lead to a federacy of those states, it is of extreme importance to the commercial and political world, and to the general peace of the American continent.

In the admirable paper to which we have listened, one item has struck my special attention, and that is the enormous distance to which volcanic dust is carried. Dr. Anderson said it was 600 or 700 miles. That reminds me that, about six years ago, I was visiting a cousin of mine in the United States, on Narragansett bay, near the famous watering-place of Newport. He has a country seat there, and he told me that soon after the eruption of Mont Pelée, perhaps about

ten days afterwards, he had a barn painted, and before the paint dried there came a fall of volcanic dust, which evidently had travelled all the way from Mont Pelée, about 1200 geographical miles. But, worse than that, a lady, who happened to be calling at the house during the dust shower, had not only her gown but her best new hat spoiled. All that remains for me now is to echo your wishes, and convey your heartiest thanks, not only to the lecturer, but to the gentlemen who have kindly favoured us by taking part in the discussion.

Dr. Tempest Anderson: I thank you for the very kind manner in which you have received my name. I assure you it has been a great pleasure to come here to-night to speak to you.

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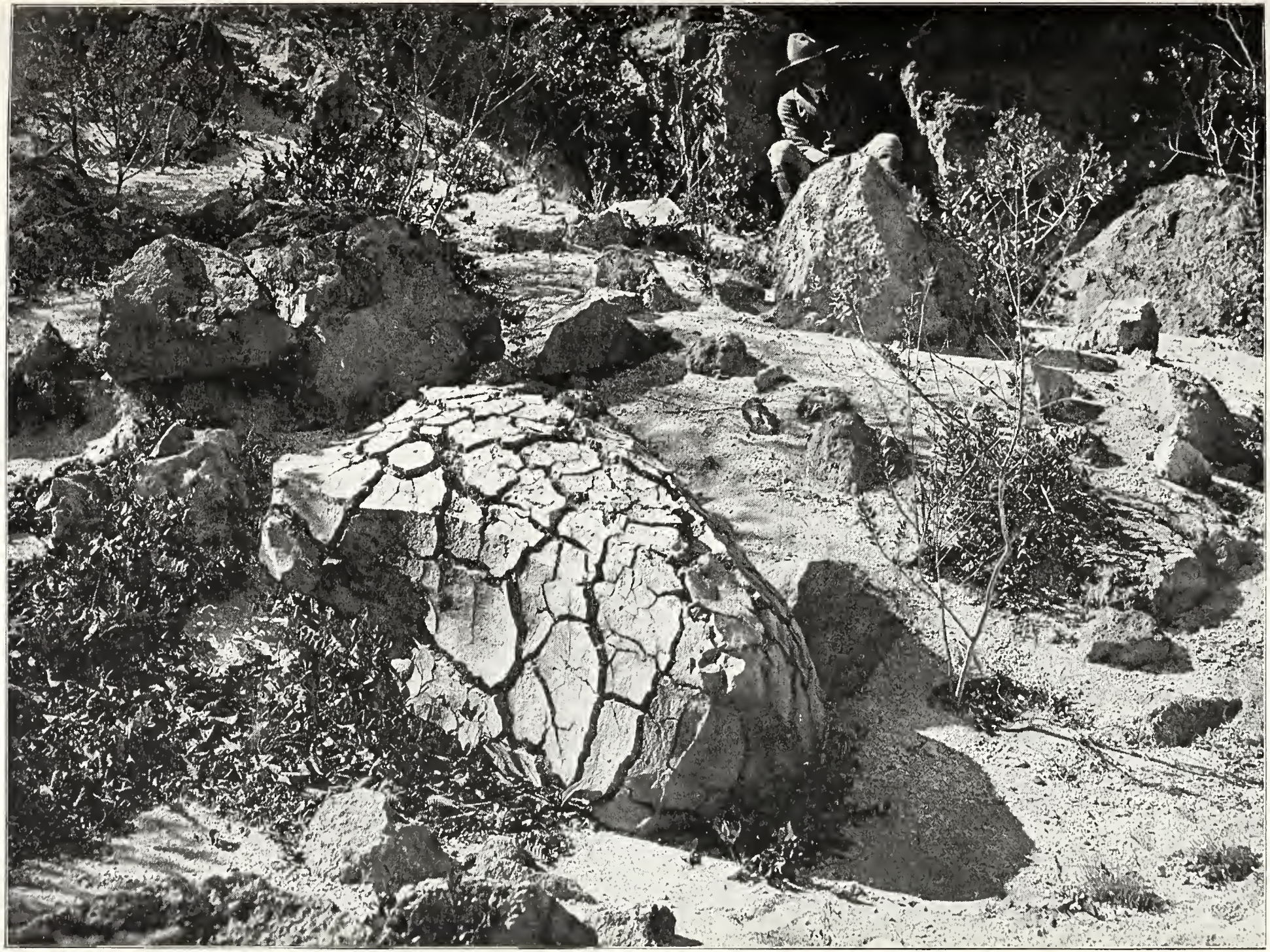

Tempest Anderson, photo. *The Swan Electric Engraving Co. Ltd.*

BREAD-CRUST BOMB IN THE CRATER OF THE CERRO QUEMADO.

Tempest Anderson, photo. *The Swan Electric Engraving Co. Ltd.*

SANTA MARIA FROM THE SLOPES OF CERRO QUEMADO.

PLATE II.

Tempest Anderson, photo. *Swan Electric Engraving Co, Ltd.*

NEW GORGE OF RIVER NIMA AT PALMAR.

Tempest Anderson, photo. *The Swan Electric Engraving Co. Ltd.*

A RIDGE IN THE NEW ASH ON SANTA MARIA.

Tempest Anderson photo. *Swan Electric Engraving Co, Ltd.*

THE CRATER OF SANTA MARIA, FROM ABOVE THE BATHS OF SABINA.

PLATE V.

Tempest Anderson, photo *The Swan Electric Engraving Co. Ltd.*

A RIDGE COVERED WITH CONSOLIDATED ASH, HELVETIA.

PLATE VI.

Tempest Anderson, photo *The Swan Electric Engraving Co. Ltd.*

TROPICAL FOREST ON THE SLOPES OF ATITLAN.


MAP OF
part of
GUATEMALA
to illustrate a paper by
Dr TEMPEST ANDERSON.
Scale 1: 500,000 or 1 Inch = 7·89 Stat. Miles
Heights in feet.
Railways shown thus
LAKE ATITLAN
GULF OF MEXICO
CARIBBEAN SEA
GREATER ANTILLES
LESSER ANTILLES
BAHAMA ISLANDS
LEEWARD ISLANDS
WINDWARD ISLANDS
MEXICO
GUATEMALA
HONDURAS
NICARAGUA
COSTA RICA
PANAMA
COLOMBIA
VENEZUELA
CUBA
HAITI
JAMAICA
Scale 1: 20,000,000 or 1 Inch = 316 Stat. Miles
Tejutla
Momostenango
Totonicapan
Quezaltenango
Retalhuleu
Mazatenango
Champerico
Chimaltenango
GUATEMALA
Antigua
Amatitlan
Escuintla
Chiquimulilla
Guajiniquilapa
Zarangoza
Patzicia
Sololá
Tecpan
Pauzum
Nahualate
Sesecapa
La Gomera
S. Jose
Istapa
Naranjo
Tecojate
Tescuaco
Velasquez
Playa Grande
Don Garcia
S. Maria
S. Luis
Champerico
Caballo Blanco
Guatemala
Havana
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