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Thesis for the degree of D. Sc.:

A Research in Egyptology:

The ancient Egyptian Canals between
the Mediterranean & the Red Sea:
their problems for the Sciences of
Geology, Geography, Engineering, & History.

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Declaration:—

This Thesis is a record of original research undertaken by me and I hereby declare that the work has been done and the Thesis composed by myself entirely.

Wm. Menzies Alexander

11th Jan 1918.

Introduction.

- (1) This research concerns itself with the Canals ascribed to (1) Sesostrus: (2) Necho ii (3) Darius i (4) Ptolemy ii (5) Trajan: (6) Omar. These Canals all linked up the Mediterranean with the Red Sea, by way of the Trade Sumilat - the narrow valley which, beginning from the neighbourhood of Zaza zig, some 50 miles northeast of Cairo, proceeds eastward to Ismailia, on the Suez Canal.
- (2) This subject has hitherto been treated essentially upon literary principles & has led to conclusions of the most diverse sort. More than 20 of these are set out on pp 28-34 alone.
- (3) This subject has not hitherto been treated expressly upon the lines of the Sciences of Geology, Geography, Engineering, & History. That is done for the first time in this research.
- (4) The Geological Problem concludes by showing that from the Post-pliocene onwards until to-day an arm of the Nile has run through the Trade Sumilat into the Red Sea (a Gulf of Suez) the Heropotike Gulf of the ancient geographers.

- (5) The Geographical Problem concludes, inter alia, by showing that the Red Sea has always had a purely natural connection with the Nile-arm mentioned, in the region of Ismaïlia or Helwan-Pithoum, until about 1350 A.D.
- (6) The Engineering Problem shows that all the old canals were but canalizations of the Nile-arm mentioned as running through the Wadi Sumilat. The ordinary engineering formulae, therefore, do not apply. So-called excavations of this Wadi Sumilat Canal were never more than simple repairs, possibly on a considerable scale at times. These canals were only seasonal canals, not perennial.
- (7) The Historical Problem shows that four canals are in view: (1) The Wadi Sumilat Canal: (2) A Helwan Canal: (3) An Isthmian or Northern Canal to run directly between the two Seas, repeatedly attempted, never carried out: (4) A Southern Canal running southwards on the line of the present Fresh-water Canal from Ismaïlia to Suez.

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* BUVBAGTUS, now commonly called Bubastis

Foral Classical Sources:-

Herodotus. ii. 158-159: (c 450)

Now Necho was the son of Psammeticus and ruled over Egypt. He was the first to attempt the canal leading into the Red Sea, which, & arises the Persian, excavated a second time. Its length is a four days' voyage, and its breadth was dug, so that two triremes could sail abreast when rowed. The water for it is drawn from the Nile; & it is drawn a little above the city of Bubastis, passing by Pelus (Patoumos), the Arabian city and debouches into the Red Sea. The parts of the Egyptian plain to be first excavated lie towards Arabia, and above the plain is situated the mountain which stretches towards Memphis, in which are the quarries. Well, then, along the foot of this mountain, the canal is led lengthwise from west to east, and thereafter it extends towards the gorges, bearing away from the mountain, towards the south & south east into the Arabian Gulf. But at the point where lies the shortest and most direct route from the North Sea to the South Sea (which is the same as that called the Red Sea), from Mt. Kasios which divides Egypt from Syria - from this point to the Arabian Gulf - there are exactly 1000 stades. This is the minimum distance; but the canal itself is much longer, as

being more winding, and in the excavation of it, there
perished in the reign of Necho, 120,000 Egyptians. Necho,
who was then, in the midst of the work, ceased digging, as
an oracle of this sort prevented him: "He was working for a
barbarian". Now the Egyptians call all men barbarians
who do not speak their language.

But Necho, having given up the canal, turned to milit-
ary matters, and galleys were built, some on the Northern
Sea, others on the Red Sea, in the Arabian Gulf. The
ships of these are still to be seen; & he used these ships
as he had occasion.

Book IV ch 39

Arabia Perpetua at the Arabian Gulf into which Darius
carved a canal from the Nile

Bk IV ch. 42

When Necho had ceased digging the canal leading from the Nile
to the Arabian Gulf, he sent out certain Phoenicians in
ships, ordering them to sail back thro' the Pillars of
Hercules into the Northern Sea & so to return to Egypt.

The Phoenicians, accordingly, setting out from the Red Sea,
navigated the Southern Sea. When autumn came, they
went ashore & sowed the land by whatever part of

N.B. This circumnavigation of Africa has been confirmed
by Bouvart's scarabs.

Libya they happened to be sailing & waited for harvest; then having reaped the corn, they sailed again. When two years had thus passed away, in the third, having doubled the Pillars of Hercules, they arrived in Egypt and told what does not seem very credible to me, but may to others, that they had the sun on their right hand as they sailed round Libya.

Aristotle: Meteor Bk I ch 14 (c 341)

9p. 2
The whole country of the Egyptians, whom we deem the most ancient of mankind, appears to be made, & to be the work of the river. And this is evident to one who surveys the country; and the parts bordering on the Red Sea are sufficient proofs of it likewise. For one of the kings attempted to dig a canal through the isthmus, as they would have secured no small advantages, had the whole region become navigable. Now Sesosthis is said to have been the first to have attempted this, but he found the sea higher than the land. Therefore, he first, and Darius afterwards, ceased digging the canal, lest the water of the river might be spoiled by intermixture with that of the sea. It is evident, therefore, that the sea was once continuous (convex) over all these parts.

Diodorus Siculus: Bk i ch 33:
visited Egypt about the year 60 BC.

From the Delusiac mouth of the Nile to the Arabian Gulf of the Red Sea, there is an artificial water-way. Necho, the son of Psammetichus, was the first to undertake this, and after him, Darius the Persian, who, having proceeded with the works up to a certain point, left it finally unfinished; for he was shown by certain men that, by cutting thro' the isthmus, he would cause the ~~the~~ inundation of Egypt; for they pointed out that the Red Sea was higher than the land of Egypt, to begin with. But Ptolemy ii afterwards completed the canal, & at the most convenient spot, constructed an ingenious lock ($\phi\lambda\delta\omicron\tau\epsilon\chi\omicron\nu\sigma\ \delta\iota\alpha\phi\pi\alpha\gamma\mu\alpha$). Thus he opened ($\epsilon\gamma\nu\omicron\gamma\epsilon\nu$) for the passage of vessels, whenever he liked, then quickly closed it again: the operation being cleverly performed. Now the river ($\iota\pi\omicron\tau\alpha\upsilon\varsigma$) flowing thro' this canal ($\delta\iota\omega\pi\upsilon\gamma\iota$) is named after Ptolemy ($\pi\tau\omicron\delta\epsilon\mu\alpha\iota\omicron\varsigma$), its constructor, & at its mouth ($\epsilon\kappa\beta\omicron\delta\alpha\mu$) he had the city called Arsinoe

Strabo: Bk i ch ii f 13:
ascends the Nile to Syene with Aelius Gallus, prefect of Egypt: 24 BC

As to the navigation of the isthmus (of Suez) or one of the canals (of Egypt) if it had been related by Homer himself, we should have counted it a myth; but as he does not relate it, we regard

it is entirely extravagant & unworthy of belief. We say, unworthy of belief, because ^{before} at the time of the Trojan war (πρὸ τῶν Τρωικῶν) there was no canal. It is recorded that Sesostris, who had planned the formation of one, apprehending that the level of the sea was too high & admit of it, desisted from the undertaking

Bosk XVI ep. iv. f 23

Gallies built not less than 80 bemes & Aremes & galleys at Cleopatris near the old canal (πρὸς τῇ παλαιᾷ διώρυγῃ) which leads from the Nile

Bosk XVII ep. i. ff 25. 26.

There is another canal also, which empties itself into the Red Sea or Arabian Gulf, near the city Arsinoe, which some call Cleopatris. It flows thro' the so-called Bitter Lakes (διὰ τῶν πικρῶν καλούμενῶν λιμνῶν), which were formerly bitter (πικραί), but when the foregoing canal was cut, the bitter quality was altered by intermixture with the water of the River, & now they are well stocked with fish & full of water-fowl (λιμναῖῶν ὀρνέων). The canal was cut originally (κατ' ἀρχάς) by Sesostris before the Trojan war (πρὸ τῶν Τρωικῶν), but, according to other writers, of the son of Psammometricus, who only began the work & then died, but subsequently by Darius I, who succeeded to

(Necho)

Κλειδον ἐπεικδαν τὸν ἐνρίπτον, ὥστε ὅτε βουλοιντο,
 ἔκπλῃν ἀκλυτῶς εἰς τὴν ἑξω θαλάτταν καὶ εἰσπλῃν παλιν.

Πῶσιν ἐκ τῆς Ἀργείας, καὶ ἡ τῶν Ἡρώων ἔστι
 ὕψις καὶ ἡ Κασοπατρὶς ἐν τῷ μυχῷ ...

& the completion of the work; & he, trusting to an erroneous opinion, left off the work, now nearing its completion; for he believed that the Red Sea was higher than the land of Egypt & believed that Egypt would be overwhelmed by the sea, if the intervening isthmus were all cut through. The Ptolemaic Kings, however, having cut it through, closed the tidal-channel (ἑρπιππος) by a sluice, so that, whenever they wished, they sailed without hindrance into the outer sea & back again.

(26) Near Arsinoe are situated in the recess of the Arabian Gulf towards Egypt, are the cities of Hieropolis & Ctesiphon; also harbours & suburbs; more canals & lakes are also near them. There also is the nome & city of Phagrusopolis (city of cells). The canal which empties itself into the Red Sea, begins at Phacusa (Phaccusa), & which the village of Philo is adjacent. The breadth of the canal is 100 cubits, its depth is such as is sufficient for vessels of the largest tonnage (μυριοποροι). These places are near the apex of the Delta

Plutarch: Life of Antony ep. iii: c 100 A.D

The soldiers of Gabinius feared the march to Pelusium more than the war; for they had to pass over a sandy & waterless track of country, past the effluvia of the Sertorian Bog, which the Egyptians called the exhalations of Typhon, this it seems to be due to the ooze & percolation of the Red Sea,

"Hesperia Naturalis" published 27 AD

where the latter is separated from the Mediterranean by a very narrow neck of land

Chapter LXIX

When Antony arrived at Alexandria, he found Cleopatra engaged in a great and perilous enterprise; for, over the neck of land, which divides the Red Sea from the Mediterranean & is regarded as the dividing line between Asia & Africa (Libya) - over this space, I say - which at its point of greatest construction between the two seas is less than 300 stades, -

Cleopatra formed a project of dragging her fleet & launching her ships in the Gulf of Arabia, and so settle abroad with her many treasures & forces, thus escaping slavery & war. But when the Arabs round Petra burnt the first ships drawn over and Antony thought that his army was still in existence at actium, he stopped & began to fortify the approaches of his kingdom

Pliny, the elder: Hist. Nat: Bk VI. ch 33: c 75 A.D

In passing the Atlantic Gulf, there is another Gulf called by the Arabs Acanth, in which is situated the town of Heroun. Here also formerly stood the town of Cambysen, between the Neli & the Marchadæ: the invaders of Cambyses having been settled there. Then

* Another reading is "40 ft"

comes the tribe of the Syrians (gens Tyra) & port Dancion
(portus Dancion). From the latter place, an attempt was
made to form a navigable canal (alveus) to the River Nile,
at the point where it enters the Delta so-called: the
distance between the River & the Red Sea being 62 miles
(M.P.). Sesostris, king of Egypt, was the first of all
men to think of it, then Darius, King of Persia; then,
at a later stage, Ptolemy (ii) who also made a canal
100 ft. broad, 30 ft. deep, & 37 (a 37.5) miles (M.P.)
up to the Better Fountains (usque ad Fontes Amaros)
Fear of an inundation kept him from going further with
his work, as it has been discovered that the Red Sea was
higher than the land in the interior of Egypt, by three
cubits. Some authors do not allege that as the real
cause, but (give as reason) the fear that the water of
the Nile would be spoiled by the introduction of sea-
water: the former being the only source of supply.
Better as it may, the whole of the journey from the
Egyptian (Mediterranean) Sea is usually performed over-
land by one of three routes: — In traversing the one
from Pelusion, the track over the sands cannot be
found except by the help of reeds stuck in the sands,
as the wind obliterates all traces at once. The
second route begins two miles beyond Mt. Kasios,
& after 60 miles, it joins the road from Pelusion.
The Arabian Arabs dwell there. The third route is,

(Amnis Ptolemaeus)

from Burhan, which they call "the thrusters", names them the same Arabs, & is nearly 60 miles shorter, but it is rugged with mountains and ill-supplied with water. ~~At~~ These roads lead to Asienc, a city founded on the Bay of Charandra (in Sinu Charandra) by Ptolemy Philadelphus in honour of his sister's name. He was the first to explore the land of the Troglodytes and called the canal which flows past Asienc of the name of Ptolemy (... *amnem quae Asiencem praefluit, Ptolemaeum appellavit*.)

Claude Ptolemy: Geographia IV & V: c 150 A.D.

Hieropolis	Long. $63^{\circ} 10'$	Lat. $30^{\circ} 10'$
Babylon	Long. $62^{\circ} 15'$	Lat. $30^{\circ} 0'$

"This Hieropolis & the city of Babylon flows Trajan's canal"
 - Ἡ πόλις Ἱερῶν καὶ τῆς πόλεως Βαβυλῶνος ποταμὸς
 Τραϊανὸς ποταμὸς εἶναι

Analysis of the foregoing statements

These reveal the existence of not less than four canals:-

- i. One in the Wadi Sumilat, following generally the line of the modern Freshwater Canal from the Nile to Samarra.
- Thus, in the sake of convenience, we shall henceforth call the

Wadi Sumilat Canal. In whole or in part it is associated with the names of Sesostris, Necho, Darius, Ptolemy ii, Trajan and Omar.

II A supplementary canal which ran from the head of the Delta and joined the Wadi Sumilat Canal near its western extremity, at the mouth of the Wadi Sumilat. Thus, for the sake of convenience, we shall henceforth call ^{it} the Helopolite Canal, as it is shown in the sequel to be the old Egyptian canal of the Helopolite nome. It is associated with the names of Ptolemy ii (Pithomskis), Trajan and Omar.

III A canal to run over the Isthmus of Suez from the Mediterranean to the region of the Wadi Sumilat near Ismailia. This canal was repeatedly projected or attempted but never completed in ancient times. For the sake of convenience, we shall henceforth call it the Isthmian^{can} or Northern Canal. It is associated with the names of Sesostris, Necho (?), Darius, the Caliphs Omar and Harun er-Rashid.

IV A canal running southwards from the eastern extremity of the Wadi Sumilat Canal, along the general course of Fresh-water Canal of to-day from Idfkuh to a point a few miles north of Suez. Thus, for the sake

of convenience, we shall henceforth call the Southern Canal. It is associated with the name of Darius i. inf.

- (1) Herodotus knows of the Wadi Tumilat Canal as ending at Pelusium. He has a confused idea of the Southern Canal.
- (2) Aristotle refers exclusively to the Northern Canal. He is quoted with more or less intelligence by Diodorus, Strabo, & Pliny.
- (3) Diodorus refers to (1) the Wadi Tumilat Canal; (2) the Northern Canal. His ideas about the latter are highly nebulous.
- (4) Strabo refers to (1) the Wadi Tumilat Canal; (2) the Northern Canal. His ideas about the latter are Aristotelian.
- (5) Pliny knows of (1) the Wadi Tumilat Canal; (2) the Northern Canal; (3) the Heliospolis Canal. His ideas of the Northern Canal are confused in the highest degree.
- (6) Ptolemy knows of (1) the Heliospolis Canal; (2) the Wadi Tumilat Canal; (3) and (2) conjoined, forming Trajan's Canal.

21

Views of certain Modern Authorities.

It is necessary to refer to these as showing the status quo of our research. The literature here is very large but space permits only brief reference to leading modern writers on this subject: -

I M. Roziere: one of the Staff of Napoleonic Engineers: -
Description de l'Égypte: Antiquités Mémoires: Tome I. Pl. I:
Pl 127-166

According to the ancients, Sesostris was the first to attempt a connection between the Nile & the Red Sea. Necho eagerly followed up the execution of this project & was only stopped by the difficulties of the work & the discovery that the Red Sea was higher than the land of Egypt. His fear was well founded, the Greeks think otherwise. Darius did not suffer himself to be moved by the fears of Necho regarding the Red Sea. He wanted a connection between the Nile & the Red Sea for binding together his empire, all the more that Scylax had reconnected the route from India to Egypt. In the end, his engineers discovered the reality of the difference between the Red Sea & the land of Egypt, so that Darius abandoned the work. All authorities are agreed that

* The erroneous levels of Ptolemaic Engineers are here in view

the Egyptian & Persian kings conducted the Nile & the Bitter Lakes only. Ptolemy II completed the canal abandoned by Sesostris & Darius; his special part being the construction of the line between the Bitter Lakes & the Arabian Gulf towards Arsinoe*. This was called the River of Ptolemy. Ptolemy used sluices against the tidal waters of the Red Sea. By his canal the waters of the Bitter Lakes were sweetened. This canal was silted by the king of Cappadocia (c 30 B.C.). Communication between the Nile & the Red Sea was re-opened during the reigns of Trajan & Hadrian of a new canal which had its origin at Babylon & ended at Saba Biar (the eastern extremity of the Trade Sumudat).

II K. R. Lepsius: Die Chronologie: p 356 (1849)

The result we have arrived at with regard to the whole history of this remarkable canal is briefly as follows:—

- (1) c 1350 B.C.: Ramses II (Sesostris) digs this canal from Bubastis & Herakopolis (=Meh far), & with the help of the Israelites, builds near it the towns of Pithon & Ramses
- (2) c 600 B.C.: Necho appears to have conducted the canal as

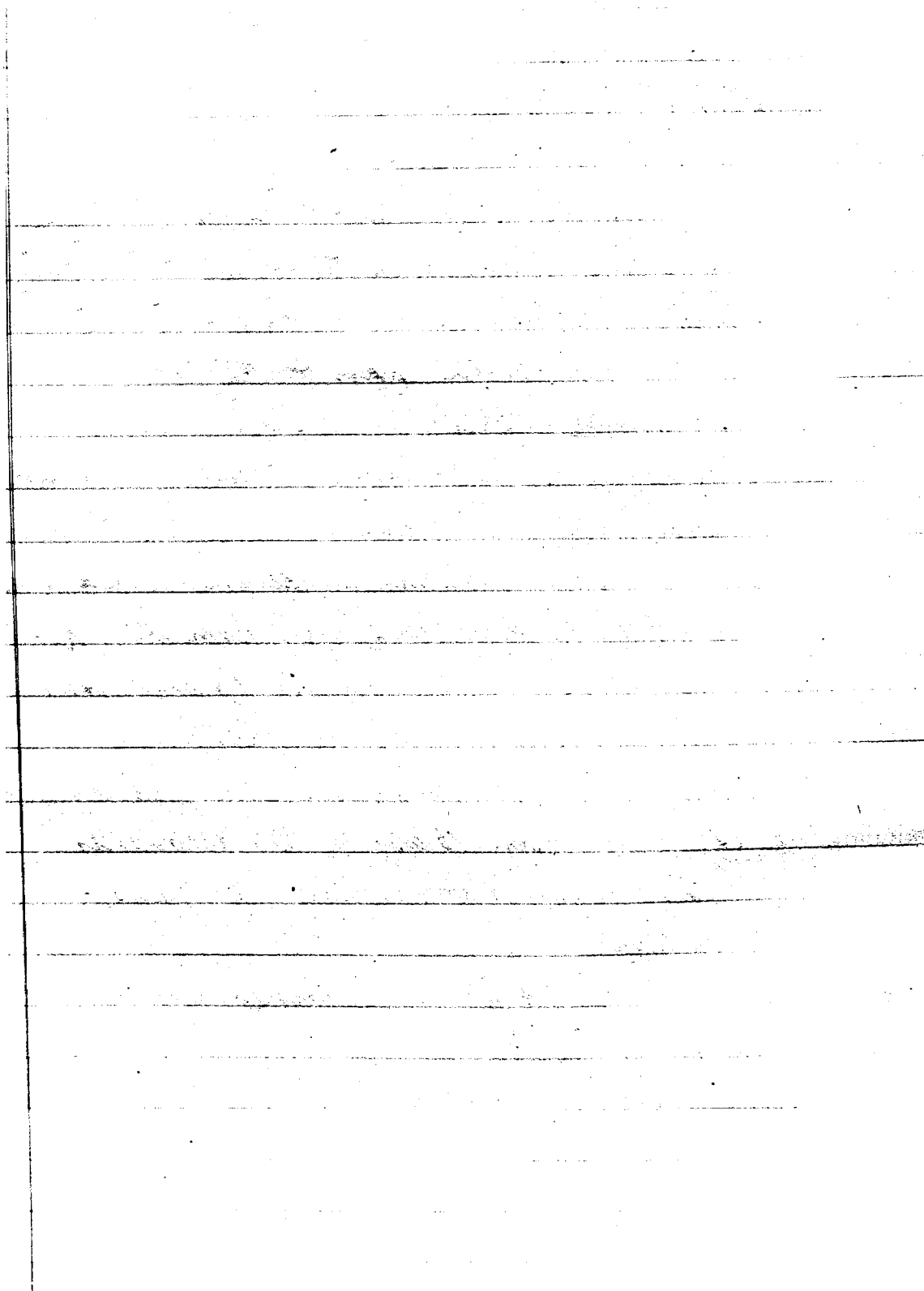
* Placed by our author at 1.5 hour north of Suez

far as the Bitter Lakes, but no further. [There were two cuttings & the undertaken: (a) one between Saba Bida, at the Eastern end of the track Ismailah, up to the Bitter Lakes, about 7000 metres in length: (b) another between the Bitter Lakes & the Red Sea, four times as long. Necho cut through the first & left the second unfinished.]

- (3) c 500 BC: Darius, for the first time, makes the whole connection, since he cuts thro' the elevation between the Bitter Lakes & the Sea (i.e. (b) ut supra: alias Chalauf of Nap.
- (4) c 350 BC: In the time of Aristotle, the canal seems to have fallen into disuse
- (5) c 250 BC: Ptolemy Philadelphus digs a wide canal, the Amnis Ptolemaeus, from the (Red) Sea to the Bitter Lakes, constructs an ingenious sluice & builds Arsinoe, near the (Red) Sea
- (6) c 100 AD: Trajan opens a new canal, the Amnis Trajanus, from Babylon to Hieropolis
- (7) c 643 (644) AD: Omar re-opens the interrupted connection.
- (8) c 762 (767) AD: Mohammed ben Abdullah fills up the canal

* Cf also Lepsius: Egypt, Ethiopia, & Sinai: pp 342. 343.

6. 11. 1944. 117



III Necker Mommsen: Provinces of the Roman Empire: ii. 297-299

e Following apparently on the traces of older structures of Sesi i + Ramses ii, Necho ii (610-594 BC) began the building of a canal, which branching from the Nile in the neighbourhood of Cairo, was to furnish a water-communication with the Bitter Lakes near Ismailia & thence with the Red Sea, without, however, being able to complete the work. That he had in view, not only the control of the Arabian Gulf & the commerce of the Arabians, but that he had already brought within his horizon the Persian & Indian seas & the more remote East is probable, seeing that he executed the only circumnavigation of Africa executed in ancient times. Beyond doubt, this was the thought of Darius i, lord of Persia as well as of Egypt. He completed the canal, but as his memorial stones, on the spot, mention he caused it to be filled up again, probab, because his engineers feared that the waters of the Red Sea, admitted into the canal, would overflow the fields.

The rivalry of the Lagids & the Seleucids was at the same time a rivalry between the Euphrates & the Nile. In the better time of the Lagids, the peaceful offensive was pursued with great energy. Not only was the canal, undertaken by Necho & Darius -

now called the Amnis Ptolemaeus - opened for the first time by Ptolemy II (c. 247 B.C.), but comprehensive harbour structures were carried out at points of the difficult east coast. Above all, this was done at the mouth of the canal leading to the Nile, at the townships of Armenoe, Celestrabus, & Ellysma - all three in the region of the present Suez.

Augustus put in order the land and water routes & the ports of Egypt. Egypt, during the whole imperial period, remained the rendezvous for the commerce of India & Arabia, the routes thence from Myos Hormos & Berenice (on the Red Sea) being in the early Roman period repaired by Roman soldiers. The canal which connected the Red Sea with the Mediterranean remained navigable throughout the imperial period, but was only of secondary importance, being chiefly used for the transport of blocks of marble (sic) & porphyry. Trajan renewed & probably enlarged it, joining it to the undivided Nile, near Babylon: thus increasing its water-supply & calling it Trajan's or the Emperor's River - Augustus Amnis - from which in later times this part of Egypt was called Augustamnica.*

* But cf. Wandering

r.B. Benharis war in the Danube, not the Rhine,
arm of the Nile

IV The H. R. Hall in Murray Handbook for Egypt: pp 49-51.

"There may have been a canal between the two seas in the time of Seti I. Probably Ramesses II (Sewastis) carried out the idea of uniting them by means of the Pelusiac branch of the Nile from Araris & Bubastis, by help of the irrigation canal between Bubastis & Herakopolis, which was then a port; the Red Sea then extending northwards as the Gulf of Herakopolis, including what are now the Bitter Lakes of the Suez Canal. Its length as given by Pliny was 62 M P, which would bring it near to the present head of the Bitter Lakes. Darius continued the work of Necho, clearing out the natural channel - now silted up - between the Herakopolis Gulf & the Red Sea, this canal being about 10 miles long.

Trade between the two seas was effected by ships sailing up the Pelusiac arm of the Nile to Bubastis, thence to Herakopolis, where cargoes were transhipped to Red Sea vessels. Ptolemy II restored the two old canals, joined the fresh-water canal with the Herakopolis Gulf, put in a lock & sluices between these sections, prevented the intermingling of the salt with the fresh water, also averting the former transshipment of cargoes at Herakopolis. The Amnis Trajanus may have been built by

Trajan or Hadrian & seems to have been the old canal which now leaves the Nile near Old Cairo, joining the older canal to the Bahr el Jebel. Yet the canal ascribed to Trajan may have been the work of Amru (639), done at the bidding of the Caliph Omar to relieve the famine then raging in Mecca & Medina.⁹

- N.B.
- i. Rozière's identification of places goes back upon the views of Borchardt & d'Arville, almost entirely.
 - ii. Lepsius, tho' an independent observer, who spent several years in Egypt, is here greatly indebted to Rozière.
 - iii. Mommam largely follows Lepsius

IV. Hall's account has very distinct affinities with the views of Lieblin, in his Handel und Schifffahrt auf dem Rotten Meere in alten Zeiten (1886). space does not allow full reproduction of Lieblin's views

To show the extraordinary state of confusion into which this subject has fallen we subjoin a brief synopsis of the foregoing & other modern authorities:—

(7) N. B. "Wellknown" revised by Birch: Anc. Egyptians, i. 47. 48 (1878)

(12) N. B. Couples this with earlier or earliest canal here of Amenemhat
iii of the 12th dynasty

(14) Brugsch's History of Egypt revised by Ann Dodgich (1891)

Brugsch's view was endorsed by Robinson, Senormant, &c.

Various views of "Canal of Seti I" :-

- 1 D'Anville. —
- 2 Rozière. —
- 3 Lefronne. —
- 4 Lepsius. —
- 5 Duncker. —
- 6 Ebers: Confounds the Pelusiac arm of the Nile with the canal^{*}
- 7 Sir J. S. Wilkinson —
- 8 Rawlinson: Seti I is thought to have commenced canal from Nile to Suez
- 9 Sir William Murray. —
- 10 Wiedemann: Commits mistake of Ebers.
- 11 Hommel: Apparently an older structure by Seti I
- 12 Lieblein: Seti I takes the canal up to the Bitter Lake.
- 13 Néant: Commits mistake of Ebers: supposes neck of land left.
- 14 (Burgsch): Canal attempted by Seti I. (uncut between Nile & Serapeum)
- 15 Erman: In old times a canal thro' the Wadi Tum. & Bitter Lakes.
- 16 Sayce: Seti I makes a canal from the Nile to Suez.
- 17 Harpers: Commits mistake of Ebers
- 18 Gregorovius. —
- 19 Von Max Müller. —
- 20 Budge: Some part of the (Wadi Tum) canal seems to have existed in
- 21 Hall: Endorses (?) the mistake of Ebers. (Seti's time)

* Burgsch is really the author of this view which makes the canalised arm of the Nile at Zaku - "Seti's canal" Cf p.

(3) cf Recueil. vol i pp 136-197 (1842): [also Revue des deux Mondes XXVII [1841] pp 215-235]

(4) In Meir's revised version of Sie von Murs. Caliphate p 164: the canal referred to in Herodot. ii ch 158 is said to have existed under Romans ii.

14 Burgoch's History of Egypt by Miss Bowditch (1891):
revision of first edition by Burgoch himself

ii Diverse views of the canal of Ramses ii (Sesostris): -

- 1 D'Anville. -
- 2 Ruzière. Sesostris takes the canal up to the Bitter Lakes only.
- 3 Lefronne. Sesostris commences a canal: ceases for fear of the Red Sea.
- 4 Lepsius: R. ii digs canal from Nile to Theopropolis (= Magfar).
- 5 Duncker: R. ii digs canal from Bubastis to the Crocodile Lake (Sinnah).
- 6 Elerts: A canal existed in time of R. ii tho. Wadi Sumilat as shown by
- 7 Sir G. S. Wilkinson: Sesostris is thought to have cut (his monuments there)
- 8 Rawlinson: Canal tho Wadi Sum. mainly (a canal from the Nile to Suez.
- 9 Sir Wm Muir. - (the work of R. ii: locks & sluices.
- 10 Niedemann: Canal between L. Timsah & R.C. in time of R. ii.
- 11 Mommsen: Apparently an older structure of (Seti i and) R. ii.
- 12 Sieblein: R. ii deepens Seti's canal: does not extend it beyond Bitter
- 13 Ménant: Canal via W. Sum. to Red Sea before R. ii's ^(Lakes) time.
- 14 (Brugsch): Canal attempted by R. ii, as by Seti i.
- 15 Erman: Continued the old canal: cutting from Bitter Lakes to
- 16 Sayce: Existence of canal as under Seti i. (to Red Sea (Suez))
- 17 Harpers: Canal of Seti looked to XXth dynasty, then silted.
- 18 Gregorovius. -
- 19 Wm Max Müller: R. ii continued canal from Nile to Bitter Lakes.
- 20 Budge: R. ii intended to lengthen Seti's canal to Red Sea
- 21 Hall: R. ii possibly carried out the idea of uniting the two seas by way of the Wadi Sumilat.

- (3) N. B. L. Nubia Necho, now in contact with the Greeks, made this attempt in imitation of the attempt of Pericles to pierce the isthmus of Corinth for a canal (625-585 BC)
- (9) Necho makes Necho attempt to continue the old canal to the Red Sea (B.C.)
- (10) Route to be by Wadi Tumulat, and Bitter Lakes to Suez
- (13) Bitter Lakes not yet formed as separate from the Red Sea, which is supposed still to reach to the Serapeum.
- (16) Cf "Egypt of the Hebrews" p125

iii Diverse views of the Canal of Necho:-

- 1 D'Anville: N. first to build a canal between Nile & Red Sea: incomplete
- 2 Rozière: N. takes canal of Sesostris: stops at Bitter Lakes.
- 3 Lecomte: N. first to attempt to join the two seas by Nile canal.
- 4 Lepsius: N. appears to have led the canal to Bitter Lakes: stops there
- 5 Duncker: N. takes R. ii's canal to Bitter Lakes: stops there
- 6 Ebers: N. undertakes canal between Nile & Red Sea: stops short
- 7 Sir J. S. Wilkinson: Some say N. cut canal to Suez: possibly reopened that
- 8 Rawlinson: N. re-opens communication of R. with E. by (P. Sesostris).
- 9 Sir Wm Murray: N. first to attempt canal between Babatia, to
- 10 Wiedemann: N. determines to join the two seas: fails (R. C. (Suez))
- 11 Mommsen: N. begins canal from near Cairo to Suez: incomplete
- 12 Lieblein: N. deepens silted Sesostris canal: stops at Bitter Lakes.
- 13 Méneant: Only N. reached the canal: stops at Serrapeum (near B. Ls).
- 14 (Brugsch): N. attempts reconstruction of old canal to Suez: fails.
- 15 Erman: N. re-opens R. ii's silted canal, to (C. L. Sea)
- 16 Saucé: N. partly clears out old canal from Nile to Suez.
- 17 Maspero: N. re-opens canal of Sesostris: carries it to Lake Idku (near B. Ls)
- 18 Gregorovius: N. completes canal from Nile to Red Sea of Sesostris (=
- 19 von Max Müller: N. completes canal from Nile to Red Sea (near Dumak)
- 20 Budge: Necho carried R. ii's canal to Suez further (to ?)
- 21 Hall: Necho's canal from Nile near Babatia to Serrapeum.

(5) Ceffert read "destruction" of this canal by Darius himself into the hieroglyphic text. of p

(11) Mommsen accepts mistaken view of Ceffert, ut supra.

(12) Darius did not cut this narrow neck of land between the Wade Sumlat Canal & the head of the Bitter Lakes, but deepened the natural channel of the Newswatko Sulf (of a later day) up to the Suez creek (Sicbleim)

Darius leaves uncut the narrow neck of land between the Wade Sumlat Canal & the Bitter Lakes. Thus perpetuating the need of transshipment of cargoes at this point

IV Diverse views of the Canal of Darius I :-

- 1 D'Arville: Communication between Nile & Red Sea not till time of Ptolemy
- 2 Roziere: D. proceeds with Necho's canal till stopped by the Red Sea (ii)
- 3 Letronne: D. repeats Necho's work: carries it to Red Sea (Suez?).
- 4 Lepsius: D. completes canal to Red Sea by cutting the sill of Chalouf &
- 5 Duncker: accepts completion, like Lepsius: rejects Ceyffert's view (Suez).
- 6 Ebers: D. completes the canal & near Suez: proved by monuments.
- 7 Sir J. S. Wilkinson: Some leave completion to Darius: probably reopened
- 8 Rawlinson: D. reopens communication between Bitter lakes & Red Sea ^(old canal)
- 9 Sir Wm Murray: D. opens communication between Babastis & ^(Suez)
- 10 Wiedemann: D. continues work of Necho: death stops (Red Sea) (Suez)
- 11 Mommsen: D. completes canal, then fills it up & achievement.
- 12 Lieblin: D. deepens Necho's canal to the Bitter lakes & Chalouf
- 13 Ménant: D. has to cut thro' sill of Chalouf: completes ^(section cut)
- 14 (Bungert): D. completes canal to near Suez: on line of stelae: Ceyffert ^(discredited)
- 15 Eiman: D. reopens old canal of (Rii?) Necho, now silted: up to Red Sea.
- 16 Sayce: D. re-opens old Pharaonic canal up to Suez. (Sea.)
- 17 Maspero: Darius completes his canal according to Hieroglyphs ii. 158.
- 18 Gregorovius: D. repairs canal of Necho: does not take to Red Sea.
- 19 Wm Max Müller: D. repairs canal of Necho up to the Red Sea (Suez).
- 20 Budge: D. carried Necho's canal finally to the Red Sea (Suez?).
- 21 Hall: D. continues Necho's canal: clears out channel now silted, between Bitter Lakes & Red Sea (Suez):
 { leaves uncut the neck of land between Wade Jumilat Canal & the Bitter Lakes: so prevents former transshipment of cargoes here }

← at once

(9) N.B. The origin of the canal is shown hereafter & requires the water to run uphill. Cf p 61

(12) P.H. ii thus makes a continuous waterway between the Nile & the Red sea by cutting this neck of land between the fresh-water canal of the Wadi Sumilat & the salt-water of the Bitter Lakes. In the sequel this is shown to be quite imaginary. Cf p 129

IV Diverse views of the canal of Ptolemy II :-

- 1 D'Anville: Ptolemy II achieves the connection between the Nile & the Red
- 2 Nozière: Ptolemy II completes old canals up to Suez. Sea (Suez)
- 3 Lethbridge: Ptolemy II re-establishes the silted canal of Darius (Suez)
- 4 Lepsius: Ptolemy II digs the Amonis Ptolemaeus to Suez region.
- 5 Deuncker: Ptolemy II digs the Amonis Ptolemaeus to Suez region.
- 6 Ebers. —
- 7 Sir J. S. Wilkinson: Some leave completion of old Pharaonic canal to Ptolemy II.
- 8 Rawlinson: Ptolemy II repairs canal of Darius. (conceivably re-opened)
- 9 Sir Wm Muir: Ptolemy II digs a second canal from Fakus to Red Sea
- 10 Wedemann: — (Suez)
- 11 Mommsen: Ptolemy II completes the old canal of Necho & Darius up to Suez.
- 12 Lieblein: Ptolemy II cuts the sill of Tehalouf: clears out old canals, making
- 13 Néant: Ptolemy II clears out the old canal of Darius (and south: lets Nile into Bitter Lake)
- 14 (Brugsch). — from the Serapeum to Suez
- 15 Erman. —
- 16 Sayce: Ptolemy II clears out the old Pharaonic canal to Suez
- 17 Maspero. —
- 18 Gregorovius: Ptolemy II completes the canal of Darius up to the Red Sea.
- 19 Wm Max Müller: Ptolemy II repairs canal of Darius to the Red Sea
- 20 Budge. —
- 21 Hall: Ptolemy II does all that Lieblein ut supra alleges.

- 2 The communication opened during the reigns of Trajan & Hadrian was not the old canal of the Sages (Phoenicians)
- 3 Trajan added 60 kilometres to the old canal = Bubastis to Babylon

9 Trajan's canal navigable till end of third century

19 Possibly in use until the time of Septimius Severus

VI Diverse views of Trajan's Canal:

- 1 D'Anville. —
- 2 Rozière: The communication between the Nile & Hieropolis was new.
- 3 Letronne: The Ptolemaic canal was navigable in Nero's time: Trajan's
- 4 Lepsius: Trajan's canal, ut supra, was new. (canal was new)
- 5 Duncker: Trajan opens a new canal, ut supra, between Babylon &
- 6 Ebers. — (Hieropolis)
- 7 Sir J. S. Wilkinson: After the Annex of the Caesars, Caligula reopens the old
- 8 Rawlinson: Trajan reopens line between B.T. & R.C. [Trajanic] canal.
- 9 Sir Wm Murray: Trajan deepens one of the lines of the old canals (to Suez)
- 10 Wedemann. —
- 11 Mommsen: Trajan renews the old imperial canal (& Suez).
- 12 Sieblein: Trajan repeats the Ptolemaic canal.
- 13 Ménière: Trajan clears out the Ptolemaic canal, silted in
- 14 (Brugsch). — (Cleopatra's time).
- 15 Erman: Trajan and Hadrian re-open the old canal.
- 16 Bayce: Trajan clears out the old Pharaonic canal.
- 17 Maspero. —
- 18 Geyrovius: Trajan restores Ptolemy's canal.
- 19 Wm Max Müller: Trajan repairs the old canal to the sea (Suez).
- 20 Budge. —
- 21 Hall: Trajan (or Hadrian) cuts new canal from Babylon. This seems to have been the old canal which now leaves the Nile near Old Cairo.

VII Diverse views of Suez Canal: -

- 1 D'Arville. -
- 2 Rozière -
- 3 Lecomte -
- 4 Leprieux: Suez re-opens the interrupted communication between the
- 5 Dunkerque: Suez reopens communication as above (Aussias).
- 6 Elers. -
- 7 Sir J. S. Wilkinson: Suez re-opens the Ptolemaic Canal.
- 8 Rawlinson: Suez re-opens the communication between Bitter
- 9 Sir Wm Miller: Amru clears out Trajan's Canal (Lakes & Red Sea)
- 10 Wedemann. -
- 11 Mommson. -
- 12 Lieblein. -
- 13 Menant. -
- 14 (Brugsch). -
- 15 Erman: Amru made Trajan's Canal navigable for some time
- 16 Sayce: Amru clears out Trajan's Canal
- 17 Maspero. -
- 18 Egremonius. -
- 19 Wm Max Müller -
- 20 Budge. -
- 21 Hall: Suez makes a new canal from old Cairo to Suez

Conclusions regarding the views of Modern Authorities

- (1) There are more than a hundred divergent views, nearly incapable of ^{being reduced to} any moderate number of classes. No other problem in Egyptology comes near this in point of diversity of view.
- (2) All these views, however, agree in one point, viz: There was no natural connection in historical times between the Nile & the Red Sea. Such connections were always artificial
- (3) Writers sometimes suppose the existence of but one canal as necessary to join the Nile & the Red Sea: sometimes of two canals, cut at different times & by different parties
- (4) Writers sometimes think of the Red Sea as extending beyond Suez up to the head of the Bitter Lakes: some- times of it as extending only to the region of Suez
- (5) The literary sources have been found, as above, to be incapable of solving the problem presented by these ancient canals. The object of this research is to utilise the literary sources, old & new, classical & monumental, in conjunction with the Sciences of Geology, Geography, & Engineering, to attain some more reasonable results than the foregoing.

Verified by Linant in 1847 & by the international
Commission of Engineers in 1848. These were Negrelli
(Austrian), Lalabot (French) & R Stephenson, son of
the inventor of the locomotive engine. Negrelli left his
work to his assistants. Linant re-verified his results
in 1853 & 1856

- (6) This leads to novel & quite definite results, showing that these ancient canals, associated with the joining up of the Mediterranean & the Red Sea, were four in number:- i The Wadi Tumilat Canal: ii The Hebopolite Canal: iii The Northern Canal: iv The Southern Canal. cf pp 19.20.

The Geological Problem

Interest in the Geology of Egypt had its origin in the proposal of Napoleon I to join the Mediterranean & the Red Sea by a ship canal. Having appointed Lepère surveyor, he himself on the last day of the year 1799 traversed the proposed route of the canal from Suez to Belbeis. Lepère's survey, which brought out a difference of level between the two seas, amounting to more than 30 ft (9m 9cms 7mm) arrested the project, the Laplace & Fourier, both most eminent mathematicians, contested the correctness of Lepère's figures. Not till 1841 were these corrected by Linant (Bey), & not till 1859 was the excavation of the Suez Canal begun. The interval between 1799 and 1859 was marked by considerable diligence in studying the geology of the lithology of Suez. Here may be mentioned the names of Du Bois Aymé, Lepère, Rozière, Laurent, Renard, Carter,

Buist, Captain Newbold, Wilkinson, Lepsius, Salabert, R. Stephenson, Min. Corbeaux, Leneup & many others. Their theories are of little consequence now, but their records of facts of observation are important & are included in this review. Among recent works of first rank must be mentioned those of Prof. Suess, Sir G. W. Dawson, & Prof. Hull; and very specially the reports & memoirs of the Egyptian Survey Department, along with Prof. Gregory's work - The Great Rift Valley. The relevant portions of this large body of literature are set forth & correlated in the sequel. As the scope of our subject is limited to points concerning the Nile in relation to the Mediterranean and the Red Sea, we need not go further back than the Tertiary Period of Geology: -

1. The Eocene & Miocene Periods:

Transgression of the Mediterranean into the region of the Red Sea

Here we have reference to the region of the Gulf of Sinai with its corresponding ranges of hills on either side. Mr. J. Barron, in his memoir on the Topography & Geology of the Peninsula of Sinai - Western Portion - (1907), points out that with the exception of a few patches of Upper Eocene on the Sinai side & one small piece of Eocene at the Wadi Tagila, the foregoing area was a land surface prior to Miocene times. At the close of the Eocene period or during Lower

Miocene times, when denudation seems to have been most active, there was a subsidence of the whole area comprised under the Isthmus of Suez, the district between Cairo & Suez along a line joining Jebel Surra & Jebel Akaka; also the district between Jebel Akaka & the northern Ballala (Kalalla?) range & the region extending from the foot of the present Red Sea hills & the Pelosium of El Dik in Sinai, as far south as the latitude of Abu Shar ($\approx 28^{\circ}S$). Into this region depressed came the waters of the Mediterranean Sea & the deposition of the Middle Miocene strata was begun. The Mediterranean had thus invaded the Red Sea area; but the Red Sea itself was not yet in existence. This transgression of the Mediterranean into the region of the Red Sea is proved by the Miocene fauna of Suez having affinities with ~~that~~ of the Miocene fauna of the Mediterranean & none with that of the Red Sea (Indian Ocean): thus proving that the Red Sea itself was not yet in being; for, had it existed contemporaneously, an intermingling of Mediterranean & Red Sea (Indian Ocean) species would have been inevitable. Cf. d.c. p. 181. This transgression of the Mediterranean into the Red Sea region belongs to the Second Mediterranean Stage of Suess. Cf. Suess i. 324. 379

ii the Pliocene Period:

Formation of the Great Rift Valleys of the Nile & the Red Sea:
Confluence of the two seas in the great Bay of Lower Egypt.

The close of the Miocene period was marked by land elevation: this being continued into Pliocene times & issuing in great Rift-Movements in the crust of the earth, caused by tangential contraction therein, productive of lines of fracture, with subsidence of the rifted area from above downwards - cf Suess Tr. 281. The net result is a trench - subsidence (grabenversenkung) - or Rift Fault. Rift movements & rift valleys are discussed by Messrs Barron & Hume in the Synography & Geology of the Eastern Desert of Egypt: Central Portion (1902). They are more elaborately discussed by Suess of Tr. 268-286. The two with which we are now concerned are those of the Nile & the Red Sea. Both have been studied by Blanchenbom, who holds that all the evidence & Land makes it fairly certain that none of the greater Rift Movements existed before the Miocene period & forces the two under consideration to the Middle Pliocene period. cf op. cit. pp 158. 214. Beadnell, however, with fuller knowledge & after detailed examination sets them down to the Lower or the Middle Miocene period cf op. cit. p 159

* Still a somewhat elusive phrase

Shama te haziana of the Nile

The Rift Valley of the Nile

This is traceable from the Mediterranean along the course of the Nile up to Esna, at least, some 650 miles above the Mediterranean. According to Blanckenhorn, this newly formed rift-valley was invaded by the sea: the invading sea being the Mediterranean at the Third Mediterranean Stage of Suess. Cf. op. cit. 158. 214. This marine invasion or transgression was of short duration. Gradual elevation of land followed, producing here a chain of brackish lakes, which latterly became effluent: thus allowing the formation of the River Nile & the carving out of its channel northwards. Blanckenhorn fixes the date at the middle of the Diluvial period,* whilst Beadnell prefers the later Pluvial of op. cit. 158. 159. There is little to choose between these dates; & Israel holds that the Nile, during the Oligocene period, entered the "Arabic depression" along the Jordan-Arabah section of the Great Rift Valley (of the Red Sea). Cf. op. cit. 158: also Suess TV. 280. Sir J. W. Dawson might be claimed in support of this view - Cf. Science. p. 215. Bauermann's discovery of Spatha lehaziana in the alluvial land of Ghennet, at the mouth of Wadi Nagarah in Western Sinai, might also be cited in support of the foregoing - Cf. Suess 1.384. These cases need not be further discussed, as they are decisively

set aside as confirmation of Isidore's view, by the demonstration of Prof. Gregory that the fauna of the Lower Nile is conspicuous by its absence in the "Arabian depression" or Wadi-Arabah depression; whereas their presence there is required by Isidore's view. Cf. Prof. Gregory: Great Rift Valley 255. 256.

On the other hand, it is regarded as certain that, in Pliocene times, the Levant was a land surface, over which roamed such characteristic African fauna as the hippopotamus, the rhinoceros & the crocodile: there remains being found in Samos & Crete, whilst the crocodile survived in the island of Rhodes until at least the first half of the 14th century, as attested by the encounter of the knight Deodat von Gozen, with a reptile of this class. Crocodiles are ^{still} also found in the Crocodile River, near Caesarea. Prof. Gregory regards it as practically certain that the Nile must have been continued further northward & westward than its present mouth, during the Pliocene period. Cf. Gregory: Great Rift Valley pp. 252. 253: also Suess i p. 385.

The Great Rift Valley of Central Africa, &c.

The title - Great Rift Valley - is a convenient one, ~~that~~ the area to which it is here applied is much greater than that described by Prof. Gregory in the work thus called.

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The Great Rift Valley has been traced by Blanckenhorn from Lake Nyassa up to the Taurus Mountains, over more than 52 degrees of latitude. It comprises the great lakes of Central Africa, the depressed area of North Abyssinia, the Red Sea, the Gulf of Akaba, the valley of Coele-Syria, up to the Taurus Mountains.

In the Oligocene period, the Jordan-Arabah section was filled with a large fresh-water lake, as shown by the terraces of the Jordan & the Dead Sea areas. Prof. Gregory contests the view of Prof. Bull that this lake found outlet into the Mediterranean & proves his point by showing that ^{the} Mediterranean fish fauna is absent from the Jordan-Arabah basin. He shows further that the foregoing lake found outlet by a river flowing southward from Palestine along the Red Sea section of the Great Rift Valley, falling into the Indian Ocean, somewhere near Aden. This river, he calls suggestively - "the Erythraean River". He holds that it was probably united with another river from the highlands of Central Africa, flowing along the African part of the Great Rift Valley from the northern end of Lake Rudolf, along the course of the rivers Omo & Atbara, thence across the Basin of Afar, so joining at last "the Erythraean River". This water-system of the two rivers & their lakes, accounts for the fish-fauna which are common to the sea of Tiberias & the lakes of Central Africa: i.e.

* N.B. The point at which the Nile was said to join the Red Sea was near the Iole of the Serpent King, which is the Ephrosia of Agatharchides, Akemudorus, & Strabo: the Nekron of Pliny, & the Agathonis of Ptolemy.

common to the Jordan & the regions of the Upper Nile:
the Nile itself below these regions forming a separate water-
system, ultimately falling into the Mediterranean far to
the north-west of its present outlet. cf St. Rift Valley: 255-260

A curious confirmation of a river flowing from Central
Africa into the region of the Red Sea, as above, may be
found in the belief prevalent among the Egyptians of
the 12th dynasty (2000-1788 BC) that the Nile thus
flowed into the Red Sea in the region of the Holy Land
of Punt - which region at this era meant, in a general
way, the district between Suakim & Massowah. cf
Nasrallah: Struggle: p 247.

Confluence of the Mediterranean & the Red Sea in the great Bay of Lower Egypt.

The transgression of the Mediterranean into the Red Sea region
in the Miocene period (pp 37.38) was followed by one of
elevation, in process of which the strata of the region under
consideration suffered rupture along the edges of what is now
the igneous & sedimentary ranges of the Red Sea hills & the
Sinaitic Peninsula. Thus were formed at length the
Isthmus & the Gulf of Suez towards the close of the
Upper Pliocene period.

But, as part of the cosmic movement of this era, sub-

N.B. Imel makes the Red Sea post - Pleistocene. Hume
accepts this of the invasion he thought it began
in the Pleistocene period.

sequence followed, involving not only the areas named above, but also adjacent regions, including the lower reaches of the Nile & the Red Sea section of the Great Rift Valley. The Indian Ocean entered the latter upon formation of the Straits of Babel Mandel. The "Erythraean River" thus became the Red Sea, towards the close of the Pliocene period or near the beginning of the Pleistocene. The newly formed Red Sea [the Mediterranean became confluent; & ~~then~~ confluence] invaded the adjacent stretch of the Nile. The Red Sea & the Mediterranean became confluent; & their confluence formed the great Bay of Lower Egypt. Cf. Barrow: Topography & Geology of the Peninsula of Sinai: Western Portion (1907): pp 180-182. Prof. Gregory: Great Rift Valley: pp 255-259: Prof. Hull: Survey of Western Palestine: pp 70, 71.

The proof of this confluence of the two seas is found in three notable raised beaches, whose approximate elevation is 200 ft above present sea-level: i That of the pyramidal plateau of Giza on the western side of the Nile: ii Its counterpart on the Mshattam hill on the eastern side of the Nile: iii Traces of an ancient sea-beach described by Prof. Hull on the eastern margin of the Gulf of Suez, near Suez. The fossil contents of these hills cannot be here described. It is enough to note that the centre of interest here is

* NB. So-called, because they contain remains of Calyptaster
seppiacus

is "the Cypessian sands" of the Siza beds, two miles south of the Sphinx. These contain remains of Cestreus Forskali & Pecten Euphracensis - forms which now live in the Red Sea and which by their fossil remains at Siza, as above, prove the intermingling of the waters of the Red Sea & the Mediterranean in this Bay of Lower Egypt. cf. Hull: Survey of Western Palestine: Introd pp 70. 71. Suess i. 380: Dawson: Science: 215-218. Very different views have been assigned in this intermingling of the two seas by Fraas, Schuëinfurth, Sir D. W. Dawson, Prof. Hull & others. Neumayer, followed by Blanckenhorn, sets it down to Middle Pliocene times cf. Barron & Hume: Topography & Geology of Eastern Desert of Egypt: Central Portion (1902): p 214. But the dominating factor here is the formation of the Isthmus & Gulf of Suez. Barron, as noted, (p 43) assigned it to the close of the Upper Pliocene period. On that view, one may date the age of the Siza & Mokattam beds & therewith the intermingling of the two seas here, as towards the close of the Pliocene period or the beginning of the Pleistocene. Thus last, Prof. Gregory accepts. St. Rapt valley: p. 251

In contents of the Siza & Mokattam beds, see Hull as above:
(a) brony molluscs, scallop shells ^{cyprina} &c: (b) turbidulac, scallop shells, cyprina &c

* The Pliocene being the First Continental Period.

In these bounds see Proceedings of the Royal Socy:
No. 39: p 213 &c. No 61: p. 82 &c.

III The Pleistocene & Post-pleistocene Periods:
Formation of the Delta of Lower Egypt and diver-
sion of the Nile in whole or in part to the Red Sea.

The subsidence of the land which gave origin to the Bay of Lower Egypt was very considerable. Sir J. W. Dawson, judging by the terraces of sea-caves on the Mithram hill, reckoned it at 500 ft. or more. *cf. Science* p 216. With the retreat of the ice-cap in the Northern Hemisphere, the land began to rise: thus introducing the Post-glacial age, often called the Second Continental Period. Lower Egypt shared in this elevation of the land and entered upon its Pluvial Period. Denudation proceeded apace on the emergent surfaces of the land; the eroded materials helping to fill up the Bay of Lower Egypt. The borings in the Delta conducted by Figari Bey, Horner, Colonel Adagh, & others have revealed a thick series of sands, gravels, & lenticular masses of stiff clay underlying the Nile alluvium & partly intermingled therewith. The thickness of this alluvial deposit varies greatly, showing that it has been deposited on an uneven bottom, consisting of sands, gravels, & clays as above. The borings conducted by Prof. Dudd, especially at Dantah in the centre of the Delta, showed that the quartzose sands of these borings were really desert-

blown sands. From this it has been inferred that the Bay of Lower Egypt had become blocked by eroded material & desert sand; the Bay thus itself becoming a desert & obstructing the Nile in its northward course, causing it to turn eastwards, by what is now the Wadi Tumilat into the Red Sea
 cf Dawson: Science p 218

Proofs that the Nile did flow eastwards into the Red Sea, as above, during the Post-pleistocene period

- (1) The vast deposits of Nile mud in the Wadi Tumilat. These are continuous in character & deposition with those of the Delta. The two sets of deposits have grown pari passu, so that the Wadi Tumilat is to all intents & purposes an offshoot from the Delta.
- (2) The existence of fresh-water beds around Lake Timsah, as discovered by Schweinfurth. These contain Nile shells, one species of which - Aethuria Caillaudi - is now confined to the Delta Nile above Asuan; also bones of hippopotami, crocodiles, & Nile fishes. The adjacent ridges of El Bucor & the Serapeum also contain Nile deposits. cf Dawson: Science pp 279-281

In (a) see Jo. of Bombay Asiatic Society viii. (1846) p 355

In (b) see Mus Corbeaux: Athenaeum (1851) p 684

In (c) see Suez i. 382

N.B. Stephenson found "a few fluvial shells
near the mouth of the upper canal, near the
Serapeum". He was a very careful & competent
observer, tho' he gave his voice against the
construction of a Suez Canal.

- (3) Traces of Nile mud & Nile shells in the Bitter Lakes, discovered, when there were desiccated basins, before the construction of the Suez Canal, by (a) Captain Newbold (1842), (b) Robert Stephenson on his official survey for the proposed canal (1848), (c) by Renaud in borings carried through the thick salt crust at the bottom of the foregoing lakes.
- (4) Regular beds of Aetherea semilunata & Spatha Nilotica, discovered by Vaillant at a few points south of Lake Timsah; also near the Serapeum & the Ithalouf. Cf. Suen i. 38v. 382. These forms still live in the Nile above Aswan.
- (5) Nile deposits overlying the Miocene strata at Ithalouf. These contain the teeth of crocodiles, bones of hippopotami, and remains of other African quadrupeds. Cf. Baedecker: p 171.

From the foregoing, it is now self-evident that the Nile in whole or in part, once found an outlet into the Red Sea, via the wadi Tumilat, beginning in the early Post-pleistocene or early Modern Period

How long did the Nile, at least in part, continue to flow down the wadi Tumilat towards the Red Sea?

The average is $1\frac{7}{8}$.

Authorities are unanimous in confining this efflux of the Nile to prehistoric times; but this is demonstrably a colossal error.

Continuance of a Nile-arm eastwards ^{into} the Red Sea
from the present day until early Post-pliocene times

1 The Historical Evidence.

- (1) The Fresh-water Canal, which to-day flows thro' the Wadi Sumilat & onwards to Suez, is essentially an effluent of the Nile. Its length, over this space, is 225 kilometres, having in its course 13 locks. Its "head" at its "off-take" in the Nile is some 10 metres & it reaches Ismaelia some six metres above the level of the Suez Canal there, and arrives at its final lock at Suez some three metres above mean sea-level. It is thus run to be a very vigorous effluent of the Nile into the Red Sea. Cf Sir Wm Willcocks: Egyptian Irrigation: Map 164a: p 183 &c: also passim.

- (2) Before the construction of the Fresh-water Canal was begun (1858), Mohammed ^{Mehemet} Ali, Viceroy of Egypt, attempted to drain off the excess waters of the Nile inundation in the Wadi Sumilat to Lake Timsa & Balah, but failed. Cf Jackson: Irrigation Works: p 205. It is

(Shrinkage by way of 9" embury)

* With the exception of the Northern & the Southern Canals: pp
19.20

predecessors had similarly tried, but in vain, to shut off the Nile inundation from the wadi Sumilat by three dykes across it at different parts. Cf. p.

- (3) Abu Salih, "the Armenian", writing in the 12th century describes the old canal of Lemar as still navigable from the Nile up to As-Sadih, in the province of Sharkiah: this As-Sadih being in the region of Lake Timsah. Cf. p.
- (4) Al-Kindi, "the philosopher of the Arabs", speaks of the old canal of Lemar as now defunct; yet the waters of the Nile inundation still percolated to the marshes of Kolzum (Telysma), in the region of Lake Timsah. Cf. p.
- (4) Lemar's Canal, constructed c. 623 A.D., was Trajan's Canal, running thro' the wadi Sumilat up to Hieropolis, in the region of Lake Timsah. Cf. p.
- (5) St. Silvia of Aquitaine, returning from her pilgrimage to Sinai, found the Nile flowing past Pithom (Hieropolis) - Pars quaedam fluminis Nili ibi currit.
Cf. Bernard. St. Silvia [38]. Cf. also p. The date is between 379 & 388 A.D.
- (6) The canals of Nechus, Dariusⁱ, Ptolemyⁱⁱ, & Trajan -
(in part)

NB * Reference is to the inhabitants of Ramesseum as
ship-owners For Ramesseum as
a garden-city, see p

all flows thro' the Wadi Jum^{ilat}, being simply canalizations of the Nile in this region. That of Ptolemy II is called - NOTANUS by Diodorus, and Amnis by Pliny. That of Naxos is call NOTANUS of Ptolemy & otherwise Amnis. This last finally becomes in the later imperial period Amnis Augustus or Royal Canal

Ramesses

- (7) The town of Ramesses built or re-built of Ramesses II in the Wadi Tumilat & excavated by Prof. Petrie recently At Tell el-Retabeh, was a sea-port town in the time of Ramesses II, as shown by the ~~first~~ Egyptian scribe, Panhesa. (Papyrus Anastasi III). His description of the place & people is too long to quote in full, but three sentences are decisive: - (1) "Their sea-ships enter the harbour." (2) "Those who dwell near the sea come with fish" (3) "There was beer from Khati (Sahlee) in the harbour" Cf Brugsch (Brugsch): Egypt under the Pharaohs: pp 13-76. Prof. Breasted emphasises the connection of Ramesses-town with the sea or seas, close at hand; most evidently the Red Sea as extending to the eastern mouth of the Wadi Tumilat or further up the valley

- (8) During the XVIIIth dynasty, Queen Hatshepsut (c 1500 BC) sends out a fleet of five ships to

922
 * N. B. Darius iii, shortly after Athens, returning from
 his eighth campaign in Syria finds his fleet
 returned from Punt, awaiting his return to Helles
 in October - season of the inundation. Ancient
 Records of Egypt ii p 486 p. 204

* N. B. Darius in the first place & Ptolemy Philadelphus
 in the second had to make such a change of ports,
 evidently for the same reason

"the Divine Land" - Punt. These chips, as depicted on the reliefs of ^{the} Der el-Bahari Temple at Thebes, are one & the same whether represent^{ed} on the Nile or on the Red Sea. There is no mention or suggestion of transfer of cargo from the Nile to the Red Sea or vice versa. The clear inference is that the fleet has had a continuous voyage both ways; & the only route for such a continuous voyage must have been by the Wadi Sumilat, at or about the time of the inundation: thus implying an abundant effluent of the Nile to the Red Sea. cf Breasted: [History of Egypt: p] Ancient Rems: ii

(9) The cessation of this eastern arm of the Nile in the time of Ramses III of the XXth dynasty (1198-1167 BC) must not be inferred from the fact that his fleet of ships to Punt is felled out^{at} & returns to a point on the Red Sea opposite Copt on the Nile. This change in the port of departure & return is more easily explained by the perils involved in navigating the northern part of the Red Sea where heavy north winds prevail for most of the year or by the perils to vessels proceeding via the Wadi Sumilat on account of the Syrian League against Ramses III, or by both sets of circumstances.

(10) The discoveries of Prof. Petrie at Tell el-Retabeh - the site of Ramess-Arma (p) prove occupation of the Wadi Sumilat by soldiers from the home of the

+ Cf Stone vases of the Old Kingdom &c.

N.B. The occupation of the Wadi Sumilat by
Bedouin herdsmen is attested for the XIIth
dynasty & the story of Sinuhet, the fugitive prince:
cf. p.

N.B. The deposits fairly uniform in thickness but
tapering off northwards on a line between Cairo
& Zagazig, see Captam Lyons: The Nile: p 339: viz
Hass el Nil, Bahig & Zagazig

N.B. The memoir of the Egyptian Survey Dpt. on the
Soil & Water of the Wadi Sumilat (1903)
was not obtainable, tho' three expressly sent
for Cairo, nor was it otherwise available.

the XXIIIrd dynasty backwards to the first six dynasties;
 & such occupation requires a water-supply, in this rainless
 region, best represented by an arm of the Nile flowing
 eastwards to the Red Sea. Cf Nysson & Israelite Lakes: pp
 28-34. Cf also Duncan: Exploration of Egypt: pp 167-175

- (14) The existence of the fortification, called the wall of the Prince,
 situated in the Wadi Sumilat (p) proves occupation
 military of this region as far back as the first four
 dynasties; requiring us to postulate an abundant
 water-supply, as an effluent of the Nile eastwards.

ii The Geological Evidence

- (1) This is found in the great thickness of the Nile alluvium
 in the Wadi Sumilat. The deposits of it there are uniform
 with the adjacent deposits of the Delta, evincing no
 breach of continuity by faulting or otherwise. This uniformity
 of character & thickness, in these parts, indicates equality of
 age & leads back to the Post-pleistocene period; there-
 fore to a pristine Nile and a pristine Nile-arm
 How the Wadi Sumilat
- (2) Finally, there is some evidence that the slope of the
 Wadi Sumilat towards the Red Sea may once have
 been steeper than now, as there may have been

N.B. This is apart from the secular movement north
& south, which runs as its axis [the Wadi Sumilat] El Guisar
Cf. Dawson: Science p 285. The elevation in the
region of Suez is three metres since the time of
Cesar Cf Suez i. 382. The depression in the north
going near to Lake Menzaleh, & beyond, according
to Makrizi and Masoudi, a century before the
Arab conquest of Egypt (251 of the Coptic era = 535
A.D.) Cf Quatremere i. p 287 ff

secular elevation of the land along the eastern borders of Egypt in modern times. In proof one might point to the disappearance of the Pelusiac arm of the Nile, after 640 A.D. or thereby (Laurent), the shallowing of the Damietta and the deepening of the Rosetta branches of the Nile (Hutchings: Eg. Drainage: p 33) Captain Lyons rather inclines to this view (The Nile: p 349). All that can be said at present is that, if such elevation has occurred, from the mightier & the swifter might we expect the Nile effluent to the Red Sea to become, as we go further back in time.

Conclusion: - The current view becomes untenable, which asserts, in the words of Captain Lyons; that "the ancient Nile arm which dejected the Nile at Hierakon in the trade Sumilat as far as Ismaia" was "unknown as a natural channel in historic times" Eg. Nile: pp 348. 349. The foregoing evidence proves that the Nile, at least in part, has never ceased to flow down the trade Sumilat to the Red Sea from the early Pleistocene period until the present day.

N.B. Sieard - not Sieart, as with the Germans.

* notamment, les savants français de l'expédition d'Égypte -

The Geographical Problem

Interest in the ancient Geography of Egypt precedes the French occupation of Egypt, 1798-1801. Excellent work had already been done upon it by D'Anville (1697-1782). He was a geographical genius, whose work, as a whole, has magnificently stood the test of time. His method was soundly scientific, being preceded by a profound study of ancient measures & itineraries. In this respect, he owed much to his learned predecessors - N. Bergher (1567-1627) & Claude Sicard S.J. (1627-1726), an accomplished scholar who travelled much in Egypt & the Levant. Amongst the experts who took part in the scientific work of the French Expedition, as above, were the eminent geographers - M. Gosselin & Larcher. These however & others accepted almost without demur the identifications of d'Anville, whose health did not allow him to travel abroad: - "Pour ce dernier pays (l'Ég.) n'ont pu constater l'étonnante sagacité de ses (d'Anv.) inductions" (Larousse). But to d'Anville must be traced several fundamental errors, which still prevail, & the confusion of our subject. These are noted in the sequel.

The literature of our research is overwhelmingly abundant. The classical geographers are often in evidence as we proceed, & need not be named here. The same may be said of the Arabic geographers & historians. Among modern

x whose names might be cited,

+ Peutinger Map
Antonine Itinerary
Theodosian Tables

56
authors are & all, carefully considered in our subject, - are
thus named - Leprieux, Rozière, De Bois Arène, Langlet,
Mannert, Ritter, Quakerme de Quincy, Laurent,
Fr. Leseep, Lecomte, Champollion (le jeû) Bunsen, Sir J.
S. Wilkinson, Linant Bey, Weil, Lepsius, Chabaz, Raw-
linson, Duncker, Schœlten, Leprieux, Mariette Beulé,
Brugsch Bey, Roberi, Lecomte, Ebers, Erman,
Dümichen, Forbiser, Sayce, Sieblin, Lublin, Langlet,
W. Max Müller, Kuntz (etc) Medemann, Naville,
Petrie, Dargatzis, Renant, Leprieux, Stenisch, Griffith,
Gardner, & many others, & space permit. The data fur-
nished by these latter writers are of great importance,
being derived largely from Greek & Egyptian sources.
The newest results have been constantly sought out,
compared and correlated; thus permitting & requiring new
conclusions to be formed on many points connected with our
Geographical Problem.

Ancient Itinerary Measures

These require attention, as older identifications of Egyptian
sites often depended upon them, & the mistakes of D'Aville
& others have, in no small measure, been due to a natural
but undue confidence in the figures furnished by the
Persinger Map, the Antoine Itinerary, Ptolemy's
Geographia, & the Theodosian Tables. Modern

- (1) Griffith: (2) Lyons: (3) Hultsch: (4) Griffith (Edfu):
(5) Griffith (Arv 2 1/2)

4 or 60 stades. The variations in the length of the stade must also be kept in view: -

- (1) Attic stade = 606.9 ft.
(2) Olympic stade = 630.8 ft.
(3) Roman stade = 607.0 ft.
(4) Asiatic stade = 485.1 ft (Herodotus + Xenophon)

research still finds these documents indispensable, but now uses them with caution. Egyptologists are well agreed that an old Egyptian itinerary measure underlies the positions set forth in the foregoing work. This is variously called ar, ater, atru, atour. cf. Brugsch

Proc. of the Society of Bibl. Archaeology. xiv. 408 ff: xv. 305 ff: also Lyon: Leadschal Survey of Egypt (1908): also Prof Petrie: Naukratis. Pt. i. p 91 (1885): Hyksos pp 61-67 (1906). &c. The following values have been assigned to this ancient measure (1) Atou of Tell el Amarna: 10 stades; [= 3600 Eg. cubits.]: (2) 13 stades [= c 2000 m.]: (3) 32 stades [= 6.3 kms]: (4) 40 stades: (5) 70 stades

Following Brugsch, this old Egyptian measure is taken as the equivalent of the Greek οχλivos. (1) Herodotus reckons it as equal to two parasangs (ii. 6). This agrees fairly well with his estimate of the distance between Heliopolis & Chelbi; but the οχλivos falls to about 30 stades (-) in his estimate of the length of the Egyptian littoral along the Mediterranean (ii. 6) (2) Xenophon reckons the οχλivos at 30 stades; (3) Eratosthenes at 40; (4) Pliny at 32, (5) Strabo at 30, 40, 40+, 60 & 120 (xvii. i. 24). Prof. Petrie in his critique of distances in the Geographica of Ptolemy makes the οχλivos approximate to 60 stades cf. Naukratis. i p 91. In his critique of distances in the Antonine Itinerary, he takes 12 M.P. as the nominal equivalent of 2.5 οχλivos; thus making

* NB. When he takes the EXOIRS as equal to $30,000/2.5$ cubits, the EXOIRS is c 30 shades.

* An idea underlies the Persian farssad & the Swiss stunde

of Persian stunde and

the δX & δY approximate to 40 stades⁺ of Hydrog pp 66-67. These results are not correlated with each other for our author. It is enough to note that localities fixed only by itinerary measures must be treated with a certain degree of caution as to their correctness of position.

As regards latitudes & longitudes in the Geographia of Ptolemy, we can only note that he gives scientific precision of form to data which are very unscientific - namely itineraries set forth for sea & land in terms of the days' work*. He also fixes position down only to the twelfth of a degree; & his degree represents 500 stadia, instead of the better figure of Eratosthenes - 600 stadia. Ptolemy's longitudes are thus erroneous & his latitudes are much more so.

Yet the geographical data of the Antoine Itinerary, the Geographia of Ptolemy, the Pentinger Map, & the Theodorian Tables, when applicable to any given case, in whole or in part, yield very reliable results in the main.

Sites of Places, &c

Q Map p 139

1. The Wadi Tumulat

This is that narrow valley which begins near the Hammad Station, some 58 miles NE of Cairo on the Cairo - Suez Ry. [~~from Suez to the Gulf~~]

⁴
This doctrine lies with our purview but is capable
of being mathematically tested on the lines adopted
by (Sir) G. Dawson. Cf. Philosophical Transactions: Nov. 1876

Its length is about 30 miles; its breadth varies from 0.5-2.0 miles; its average width is about one mile. Its narrowest part is somewhat east of Ras el Wade, where it is about half a mile broad. Through this valley flowed the Nile, at least in part, from the early Post-pleistocene period until the present day. It is the ancient Land of Sosen & still abounds in fertility. It was once broader & deeper, as the sands of the surrounding desert have thru all the ages been encroaching upon it. At the time of the French Expedition (1799) its southern margin was marked by sand dunes, some 40 to 50 ft high; its depth below the general surface of the surrounding desert was 20 to 30 ft. Traces of the old canal of Semar were conspicuous at its western extremity at the time of the French Survey (1799-1801). The fresh-water Canal of to-day follows the old tracks, not only down the wadi Jumilat, but even on the section between Ismailia & Suez (Hoseps). So decidedly is the terrain of this wadi an integral part of that of the Delta, that the rise of the former has kept pace with that of the latter. Suess [Suess] repeatedly refers to this phenomenon under the cryptic phrase - "the stationary state of the Nile" (i. 381. 383. 384). This he associates with his doctrine of changes in the stand-lines. This common stability of the Delta in the region of the wadi Jumilat with corresponding stability in the, [at least] the wadi Jumilat itself.

* Sometimes - Γακκνυσα

is of the utmost importance to our further research, as bearing upon the gradient of the Wadi Jumilat Canals of early times Cf. p.

ii. The site of Phacusa - φακوصα.

This is of importance to us as the point of "off-take" (ἀρχον) of the Ptolemaic canal, according to Strabo. cf p. 15. Herodotus gives as "off-take" for the canals of ~~Necho~~ Necho and Darius, Bubastis on the Tanitic Nile. cf p. 10. Prof. Naville, after excavations (1887), placed the site of Bubastis at Zagazig, some 48 miles by rail from Cairo, towards the north-east of the Delta. The same authority, after excavations, (1884), located Phacusa at Saft-el Kenna, some five miles east of Zagazig (cf Goshen). But the trouble is that this is not convincing to many even yet; & indeed the geographical evidence was by no means exhausted by Dr Naville. Many would still identify the Phacusa of Strabo with the modern Fakus, which is some 15 miles N.E. of Saft el Kenna. Then other two places require to be dealt with: (1) the Phacusi of the Peutinger Map & the Theodosian Itiner; doubtless the same as the Phagusa of the "Geographer of Ravenna"; (2) the φακوصα of Ptolemy. The site of (1) is set down as 36 M P from Pelusium. That of (2) works out at some 26 M P upon Ptolemy's data: -

* Herospolis. Long $63^{\circ}10'$ Lat $30^{\circ}0'$
 Pelusium. Long $63^{\circ}15'$ Lat $31^{\circ}15'$
 Head of Herospolite Gulf. Long $63^{\circ}30'$ Lat $29^{\circ}50'$

28

Cf Quatremire: i p 2. (Tarabiah has 25 towns.)
 Cf Makrizi in Mémoires de la Mission Archéol. au Caire:
 Vol XVII p 25, p 207

Pelusium Long. $63^{\circ}15'$ Lat $31^{\circ}15'$
 Phacusa Long. $63^{\circ}10'$ Lat $30^{\circ}50'$

Now it can be shown from the relevant data of Ptolemy^x that his estimate of the breadth of the Sathumus works out at 80 M P; whereas the estimates of Herodotus, Strabo & Pliny work out at 125 M P. The former figure is certainly too low, whilst the latter is fairly correct. Ptolemy's figures for the part of the Delta, therefore, require to be raised by the factor $125/80$; & when this is used, the preceding 26 M P, becomes 40 M P; which figures are sufficiently near to each other to make it fairly certain that the Phacusi of the foregoing itineraria is also the Γακουσα of Ptolemy. But the latter is too far down stream to be the "head" of any canal passing down the Wadi Sumilat. Dr. Naville's site for the Γακουσα of Strabo is thus anew established; & entirely new corroboration of it is found in Makrizi, where among the towns of Zarabiah he mentions Fakous; for this Zarabiah (Kouf) is the name of Arabia & this Fakous is clearly the Γακουσα of Strabo. The latter is thus abreast of the ancient Butastis, showing that the old canals of Necho & Darius drew both from the Janitic & the Pelusiac arms of the Nile: such an (such) an

an arrangement being a common one in ancient & modern times.

iii. The site of Arsinoë - Ἀρσινόη

This is of cardinal importance to our research as fixing the outlet of the older canals in the region of Ismailia or in the region of Suez. This is one of the fundamental questions in the system of d'Anville. The city was founded by Ptolemy II in honour of his recently deceased sister & wife, Arsinoë Cyp. The site has not yet been recovered by excavation, and it does not contribute to simplicity to know that this being founded 18 cities of this name, three of which, at least, belong to Egypt. Stephanus Byzantius knew of eleven (11) Arsinoes in his time (6th cent.^{AD}) - the sixth is "ἑκτατὴ τοῦ Δεῦτα"; the eleventh is in the land of the Troglodytes. The chief point of issue here is the placing of Arsinoë at the eastern end of the trade route or placing it on the Red Sea, by Suez. d'Anville is prime authority for the latter (Anc. Geog. ii. 165); he having identified the bitter lakes - πικραὶ ... λίμναι - of Strabo (xvii. 1. 25) with the Bitter Lakes, now forming part of the Suez Canal; & having relied on Ptolemy's longitude & latitude for Arsinoë. Lejeune, Ruzière, Sonnelin, Saëcher, followed suit. So did Rennell, Mannert, K Müller, Rawlinson, Lepsius, Mommsen, Donner, (Donne

Geographia IV ch V p 278 (Willberg)

Larousse, Du Roum Mur, Mémoires, Sues, Sayce, Bunsbury, Schoof, and a host of other writers scarcely less eminent. It seems an adventurous thing to dissent from the views of such a multitude of savants. Nevertheless it is easy to prove by one thoroughly mistaken. Ptolemy's data are these: - Heropolis Long $63^{\circ}10'$ Lat $30^{\circ}0'$
Arsinoe Long $63^{\circ}20'$ Lat $29^{\circ}30'$

The latitude is the important element & has two other readings, viz $29^{\circ}20'$, also $29^{\circ}10'$ of Willberg p 278: also Lepsius: Lebensbeschreibung p 348.

Heropolis is now well known and its site is the central point for joining adjacent sites. Its site was reviewed by Prof Naville (1883) ^{at Dithom} & was again explored by Curdell in 1904. Dithom is in the Nadi Jum^{ilab}, some 12 miles west of Ismaïlia or some 45 miles east of Maharma on the Ismaïlian Railway. These three readings of Ptolemy would place Arsinoe some 30, 40, or 50 miles south of Heropolis - Dithom. Many think that Ptolemy has confounded this Arsinoe with the well known Arsinoe of the Arsinoite nome (Dayoum) thus:

Arsinoe of the Arabian nome Long. $63^{\circ}20'$ Lat $29^{\circ}30'$.

Arsinoe of the Arsinoite nome Long. $61^{\circ}40'$ Lat $29^{\circ}50'$.

Such a mistake is quite possible; but it becomes certain that Ptolemy is useless here. When one knows elsewhere, the site of Arsinoe is no longer doubtful: -

Book iii ch 79

(or his brother)

- (1) Agatharchides, who was Author to Ptolemy Schol. II, writing when the Arsinoe was active, more than 250 years before Ptolemy the geographer, places this town in a low-lying district, with a marsh and an arm of the Nile near it. Ptolemy T. 80 in Müller: Geographi Graeci Minores: vol. I. pp. 166. 167
- (2) Diodorus, who visited Egypt $\leq$ 60 BC, & had good opportunities for knowing her, [~~places Arsinoe on the right hand of persons~~] makes it a port of departure, marked by brine springs in its neighbourhood -
 Αἰνὸς πόλις τοῦτον Ἀρσινόης κομισθῆναι
 παρὰ τὸν δεξιὸν ἑπείρου... Cf Müller, ut supra:
 Vol. I. p. 167.
- (3) Strabo, who visited Egypt in 24 BC, makes Arsinoe adjacent to Heropolis & Teleopatus (XVII. i. 26). Indeed Arsinoe is sometimes called Teleopatus (XVII. i. 25): & Teleopatus is near the mouth of the old canal which leads from the Nile (XVI. iv. 23). There can be no doubt whatever, therefore, about this Arsinoe. Its site is near Heropolis - Dithon on the eastern extremity of the Wadi Sumilat. It has nothing whatever to do with Suez.
- (4) Ptolemy places Arsinoe on the Red Sea, 125 MP from Pelusium Cf Hist. Nat. V. 12. Now these 125 MP brings us exactly to the region of Heropolis, for the breadth of the Isthmus is precisely 125 MP or

A^{*} for the springs mentioned by them as adjoining *Assine*:
these springs being in all probability the *Fentes Amari*
of *Puny*. Cf p.

the 1000 stades of Herodotus (ii. 158) & Strabo (xvii. i. 21; XVI. ii. 30; i. ii. 29).

- (5) The Pentinger Map places Arsinoe at the head of the Sinus Arabicus at a distance from Babylon on the Nile, fairly corresponding to the distance between Pelusium & Phacusi (p. 00), which is 36 M.P. That would place Arsinoe in the wadi Sumilat, not far from Heropolis-Pithom. (c. 150-250 A.D.)
- (6) Sicard, quoted by Gosselin, mentions the occurrence of warm brine springs at the ^{eastern} mouth of the wadi Sumilat, in a site such as Agatharchides, Artemidorus (in Strabo) & Diodorus required. Cf. Müller at supra i. 167.
- (7) [Naville] in an earlier edition of his "Pithom" pp. 21.22 identified Arsinoe with Magfar, in the wadi Sumilat, some three miles east of Heropolis-Pithom. Maspero endorsed this view - cf. Popular Stories: p. 73. There is excellent reason in the preceding data for accepting precisely this site, tho' Naville himself has departed from it in his third edition of "Pithom", (p. 27), preferring there to identify it with the Serapiu of the Antonine Itinerary, 18 M.P. from Heropolis. But the preceding views (1) - (6) do not allow this identification. Magfar suits all the data; even those of the Pithom Stela (p. 1); & Arsinoe may yet be unearthed on the site of this village of Magfar. In this connection we cite the report of the

+ Cf. Alex.: - "Mogfaï offre des ruines qui ont caractère d'un établissement public, qui on pourroit considérer comme ayant servi de douane, ou de poste pour la sûreté de la navigation. Cet établissement, qui est sur la rive nord du canal, a pu être considéré..." Cf. Description.. État Mod. i pp 39-40

engineers of the French Expedition, not hitherto cited in this regard: - Mouqfâh (Magfar) - situé au nord et près des bords du canal (of the Wadi Sumilat), paroît avoir été un poste militaire ou une douane: on y trouve toutes les fondations d'un vaste bâtiment de forme carrée de 40 à 50 mètres de face, bâti en briques crues: les dispositions intérieures renferment des chambres à la manière des ogêls ou magasins des commercans des villes d'Égypte - cf Description.. État Mod. i p 165.

The foregoing can hardly be other than the Asimoe of the Pithom Stele (p 129); for its characteristic features are all here present - namely (1) a town near the mouth of Wadi Sumilat at its eastern extremity (2) a custom-house, ~~an~~ store-house, & a harbour: (3) the store-house, clearly like that unearthed of Naville at Pithom. In proof of these points we read in line 25 of the Pithom stele (p): "When he (Phoenix ii) arrives, the chiefs bring him their tributes;... they gather their treasures in his storehouse of this harbour" (Asimoe). One may therefore well believe that excavations on the site of Mouqfar (Magfar) will be attended with sensational success.

Naville thinks Asimoe was not of long duration, but was replaced by Celysma, before the time of Con-

* Seeck commits the common error of putting Arsinai at Suez.

* NB the Arabic equivalents are Qulzum & Kolzim, evidently corruptions of the Greek. Abu-Salih indeed uses the form Kulzum - a weaver's cord (= Greek Kλωσua - a thread: Mayflower); but Abu-Salih was an Armenian, not an Arab. To couple the Arabic - Kolzim - (= destruction), as a place name with the destruction of Pharaoh's hosts at the Red Sea is rather trivial.

stantine (Pilthomp 26). This view, however, finds no support in history; for Arsinoe was, according to the Periplus of the Erythraean Sea, c 60 A.D., a place where stoles & cloaks were manufactured cff 6.9. Again, in the Stela Dignotatum of the fourth century, Arsinoe appears in mutilated form as - see, where was stationed - "ala octava Vandilorum" cf Seeck p 59. Finally d'Anville shows that the bishop of Celestus (= Arsinoe, according to Strabo), signs the Acts of the Robber Council of Ephesus in 449 A.D. cf Quakerie i. 171

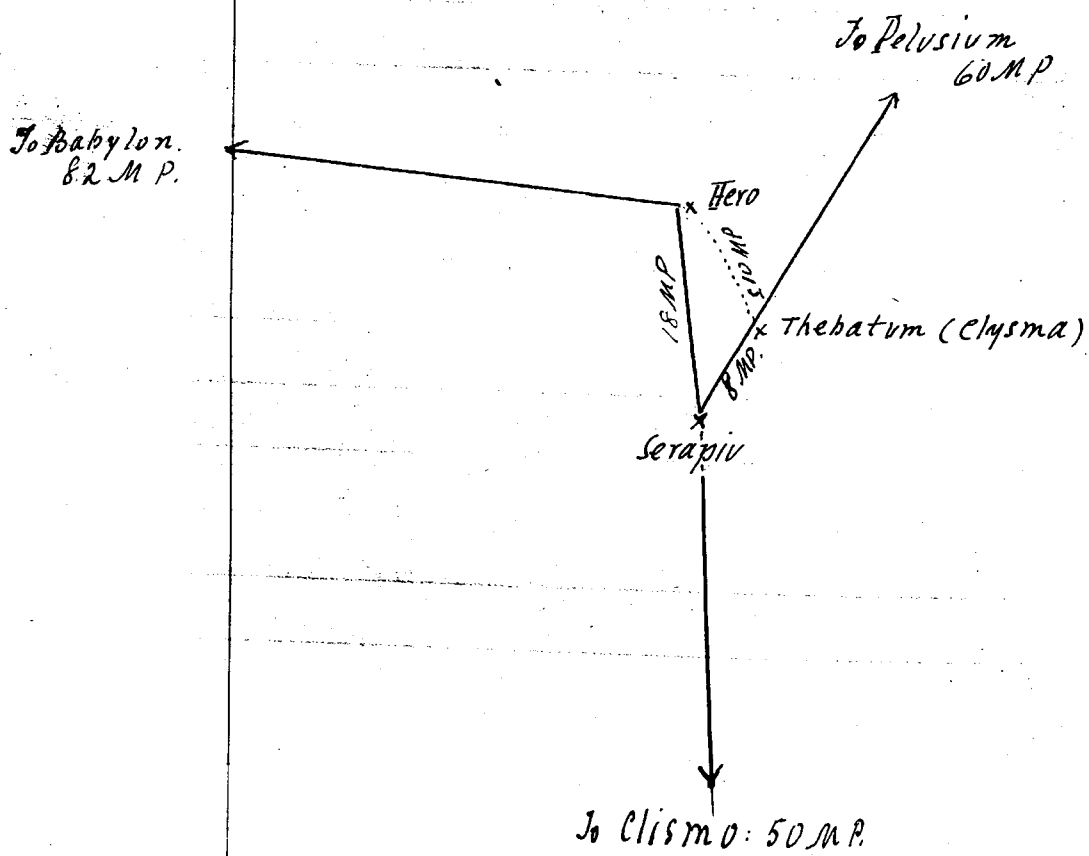
IV The site of Elysma - Kdvoμα

This is a baffling problem but one of vital importance in relation to the extension of the Red Sea northwards beyond Suez in early times. The name is variously spelt - Kdvoμα, Kdcioma, πi-Kdvoμα, Celisma (Ant. Str.), & Celisma (Silvius Perseus). There are also multiple forms - Kdvoμα καοτρον (Hierocles), & το καοτρον του Kdvoματος (Epiphanius). Kdvoμα denotes a sea-beach, & our difficulty is the location of this sea-beach - whether near Ismailia or near Suez or two places of the same name on these sites. Close study of the available data reveals Two Elysmas - one in the north, another in the south. The existence of the latter has long been admitted: the existence of the former has

been much disputed; & not all the relevant evidence has been mustered hitherto.

The southern Celisma - near Suez.

- (1) This is the Celisma of the Antonine Itinerary, 68 M P from Kero, which is Keroopolis. [c 230 A.D. ?]
- (2) This is the ΚΑΒΟΜΑ of Ptolemy. Its position relatively to the head of the Herosputake Gulf being thus: -
 Head of the Gulf Long $63^{\circ} 30'$ Lat $29^{\circ} 50'$
 Celisma, above mentioned Long $63^{\circ} 20'$ Lat $28^{\circ} 50'$
 This agrees very well with the preceding. [c 130 A.D. ?]
- (3) This is the Celisma of the Pilgrimage of St Silvia. It is a fortified place - "castrum". It is "four desert stations" or five days' journey from "the city of Kabra", in the "Land of Goshen" (the wadi of Umilat): thus comparable to (1) and (2). Cf Bernard pp 19-20 [38]. [379-388 AD].
- (4) It is the ΚΑΒΟΜΑ ΚΑΟΤΡΟΝ of ~~[Ephraim]~~ of Hierocles; being put of him in the second ΕΠΑΡΧΙΑ ΑΥΓΟΥΣΤΑ ὕπὸ τῷ ΕΜΟΥΧΑ: this ΕΠΑΡΧΙΑ being the southern division of the earlier undivided ΕΠΑΡΧΙΑ ΑΥΓΟΥΣΤΑ cf ΣΥΝΕΚΔΟΜΟΣ: Wesseling p 728 [^{Hevelius} Platanus of Durtman's day] [c 450 AD]



The Northern Celysma - near Heropolis

- (1) This is the Celysma of the Pentinger Map. Its site is at the head of the Sinus Arabicus or Red Sea. It is opposite Assuol: it being on ~~the~~ eastern side of the Gulf, whilst Assuol is on the western. [c 200 A.D.]
- (2) This is the Celusma of Nauville: - "H Ero in Celusma, M. VIII - O" From Heropolis to Celysma - nine M.P. cf Ptolem: 3rd edit. p 21. [c 306-307 A.D.]
- (3) This is the Celysma of the Nobitia Dignotatum Imperii. It is near Thebatum, which is the Thaubasio of the Antonine Itinerary, eight M.P. from Serapiu. This Serapiu is the starting point of two routes: (a) one to Pelusium on the Mediterranean: (b) the other to Babylon on the Nile via Hero (Heropolis). The interval between Serapiu & Thebatum (Thaubasio) is 8 M.P.: that between Serapiu & Hero (Ero, Heropolis) is 18 M.P. The interval between ^{Hero}Thaubasio, is thus about $18 - 8 = 10$ M.P. But the Celysma of the Nobitia is near Thebatum; therefore about 10 M.P. from Hero. Thus the Celysma of the Nobitia is evidently the Celysma of both (1) and (2). cf Seeck: Nob. Dignot. Or 28 l. 39: p 60. [c 350 A.D.]

- (4) This is the K'lvoma of Philostorgius. He points out that the Red Sea ends in two distinct gulfs - (a) one running in the direction of Egypt & called the Gulf of Celysma: (b) another in the direction of Palestine, having the town of Aela at its head. This (b) is clearly the Adramitic Gulf (Gulf of Akaba), showing that the other must be the Heropotike Gulf (Gulf of Suez), with Celysma at its head. This is the first time that the Heropotike Gulf is called the Gulf of Celysma. The latter name still clings to it in the Arabic form - Bahr Quolzum.
- The phrase describing Celysma, as at the head of the Gulf of Celysma, is a forceful one - καὶ ἵ τ' ἐδ' εὐτα - i.e. where the Gulf dies away & terminates. This Celysma is evidently one with
- (1) (2) (3) - in the region of Heropotis of Philostorgius.
^{Chamier History}
 Herodotus: iii ch 6 & (p 618) [c. 374 A.D.]

- (5) This is the K'lvim of Masudi (c. 890-957 A.D.). Its site is at a place called the Tail of the Crocodile - la queue du crocodile. Quatremere i p 174. The Crocodile is Lake Sumakh & the Tail is its prolongation up the wadi Sumilat. [c. 950 A.D.]

- (6) This is the K'lvim of Makrizi (c. 1358-1435 A.D.). It is also called M-Kodai & is distant from Fierma a journey of a day & a night. Quatremere i p 182.

This Ferma is the modern Ferama, near the ruins of Pelusium, on the Mediterranean. A camel-journey of a day & a night is some 50 miles, which brings one to the region of Smailia. This Kolzim is therefore adjacent to Heropolis c. 1400 A.D.

In the light of these clear locations, we can now understand these additional references to what is evidently Northen Clysma:-

- (1) Lucian, the Greek satirist, who was in later years a Roman official in Egypt, c. 200, tells of a young Paphlagonian, studying at Alexandria - παίδευομενος ἐν Αἰγύ: who having sailed up to Clysma - ἀναπλευσας ... ἀπὸ τοῦ κλύσματος - takes shipping for India. Cf Dindorf: Alexander xxvii. 44... Lucian's statement indicates that there is a clear water way between Alexandria & Clysma. Ptolemy, a little before this, testifies to Trajan's Canal as a "going concern" (c. 160). By sailing up the Nile to the head of the Delta, at or about the time of the inundation, it was easy for the young man to reach Clysma in the region of Heropolis & thus get off to India at the best season of the year for such a voyage.

- (2) Epiphanius mentions κλύσμα καὶ στρόν as one of the three harbours of Egypt - the others being Aila & Berenice. Cf Παράριον or Heresies: Bk ii c. 66 (p. 618). (c. 375 A.D.). This Clysma is almost certainly the same as the following one: -

cf p 68

* There is but one Avyovota in the St. Petia Digni-
katum. Two occur after the time of Herodotus II

- (3) Hierocles mentions $\kappa\lambda\upsilon\sigma\alpha\ \kappa\alpha\sigma\tau\rho\omicron\nu$ as one of the cities of the Second Province of Augusta, the inland division of what had once been the undivided Province of Augusta = Ἐπαρχία Αὐγούστα . He enumerates its towns from west to east - Leontis, Athribis, Helion, ^{Teubastis} Pharziythos, Arabia, & $\kappa\lambda\upsilon\sigma\alpha\ \kappa\alpha\sigma\tau\rho\omicron\nu$ (c-v). As Arabia is here the "Civitas Arabia" of St. Silvia in the wadi Sumilat, we may safely place $\kappa\lambda\upsilon\sigma\alpha\ \kappa\alpha\sigma\tau\rho\omicron\nu$ in the region of Heropolis. Cf Weneling: $\Sigma\upsilon\nu\epsilon\kappa\delta\eta\mu\upsilon\varsigma$: p 728. [c 450 A.D.]

The teplymas of Eusebius, Athanasius, & Cosmas Indicopleustes evidently belong here, but require discussion, leading too far from our present purpose

Conclusion: - It is now certain that there were two teplymas - both frontier towns & both fortified - $\kappa\lambda\upsilon\sigma\alpha\ \phi\rho\omicron\nu\upsilon\pi\iota\omicron\nu$ in the south & $\kappa\lambda\upsilon\sigma\alpha\ \kappa\alpha\sigma\tau\rho\omicron\nu$ in the north. Queen-Mavia seems to have passed by the former in her invasion of Egypt with her Saracens in 377 A.D.; but that war ended in the simplest diplomatic settlement - a Roman general for the Queen's daughter & a bishop for her picturesque ruffians. The Southern teplyma has no further interest for our research. But the Northern teplyma is highly important. It is a post for India in Lucian's time. It apparently continues to be such in the times of Eusebius & Hierocles. i.e. well into the fourth century of our era

It is therefore a ^{valley} valley within the extension of the Red Sea northwards, beyond Suez, up to the neighbourhood of Herakleopolis and thus discredits some venerated views.

V. { The Bitter Lakes of Shabo - αἱ πικραὶ λίμναι: cf p 14.
 { The Bitter Fountains of Pliny - Fontes amari: cf p 17.

Their exact situation is of the utmost importance to our enquiry, especially as bearing upon the extension of the Red Sea northwards, beyond Suez, in ancient times. The Bitter Lakes of Shabo & the Bitter Fountains of Pliny are, without known exception, assumed to be identical by historians & geographers. So much is this the case that Pliny's Fontes Amari are nearly always cited as Lacus Amari; tho' there is no doubt about the correctness of the former reading. Further, almost all writers assume that the πικραὶ λίμναι of Shabo & the Fontes Amari of Pliny are represented by the modern Bitter Lakes so-called on the southern section of the Suez Canal, Sineat Bay & Prof Naville are practically alone in dissenting from this view. Yet again, the term λίμνη is usually taken to denote a very considerable body of water; but the term alone gives no clue to dimension; for it sometimes denotes an artificial pool; more often, it denotes a marsh, resulting from the overflow of a river or a sea, such as λίμνη Μοίρις of the Fayoum or λίμνη Ἐρβωρίς of Lower Egypt.

* This applies also to the Helwan Canal as joining the older Canal from Phacusa. Cf pp 19.20

* L. mant Bay, as a first-rate engineer, told that the Bitter Lakes of the Suez Canal, if taken as the $\Delta\mu\alpha\iota\ \Pi\iota\kappa\mu\alpha\iota$ of Strabo could not have been thus sweetened of the Nile. This is now easily demonstrable: - (1) Area of these Bitter lakes = 436×10^6 sq. metres. (2) Let 6 m.m. represent daily evaporation (Cf Lyons: Nile p 250). Then (3) annual evaporation is $\approx 9.20 \times 10^6$ cu. metres; whilst (4) efflux annual of the fresh-water Canal = efflux of old trade Ismailia Canal $\approx 9.40 \times 10^6$. Thus in the end influx of fresh-water = evaporation $\therefore$ salinity remains unchanged. Q. F. D.

It can be shown beyond doubt that the Bitter Lakes of Shabou & the Bitter Fountains of Pliny have nothing whatever to do with the Bitter Lakes of the Suez Canal; tho' D'Arville, Lepère, Rozière, Quatremère, Sépauls, Kiepert, von Max Müller, & a host of other authorities assert the opposite view; for, on the clear showing of Dioscorus, Shabou, & Pliny, as well as on the unimpeachable evidence of the Pithom stele, the Canal of Ptolemy II, which ran thro' the Wade Sumilat, ended at Herakopolis. It lay therefore entirely within this valley. But the Canal passed thro' the so-called πικρα διμυαί on its way to Herakopolis. They are entirely within the Wade Sumilat. They have nothing whatever to do with lakes in the eastern frontier of Egypt. ~~[They are not even salt;]~~ They are mere sour marshes lying near the eastern outlet of the Wade Sumilat Canal, which were cut through in the construction of this Canal, losing their sourness, perhaps their saltness, & the influx of the fresh water of the Nile. These πικρα διμυαί are evidently none other than "the pools of Pithom", mentioned in the inscription of the eighth year of Merneptah, son of Ramesses II, of the XIXth dynasty, relating how the 'Shasu of Akuma (Edomite Bedouin) have been allowed to obtain a living for themselves & their cattle in the great estate of Pharaoh.' Cf. Brewster: Anc Records of Eg. iii § 638

* Cf. *Encyclopaedia Britannica*: "Enodus" f. 157. fm

Then, as to Pliny's Fontes Amari, so frequently called
Lacus Amari, the case is equally against the prevalent
 view of Egyptologists. Fontes + Amari ~~should not be~~
 should not be confounded. The former ^{are} ~~is~~ live things, the
latter are stagnant. How many ^(sic) Muller charges Pliny
 with making the "amaros fontes" - navigable! Pliny's
 mind was not very critical; yet he remains one of Rome's
 greatest scholars. He does say stupid things at times,
 as when he ascribes a sense of justice & religion to elephants.
 But he was never stupid enough to call the Fontes Amari
 navigable. He speaks with scientific precision, when he says
 that the Canal of Ptolemy extended up to or as far
 as the Bitter Fountains - usque ad Fontes Amaros. And
 these are the brine springs of Diodorus, attested by E. Sicard
 S. T., before the construction of the Suez Canal, (cf pp. 64. 65):
 attested also by the French Engineers in 1779 as at 4,040
 metres ~~of~~ east of Maghar. Cf Description: Etat Mod i. 166.
 These seem to have given to this eastern part of the
 track the name of Saba Biat (Seven
 Wells). Tho' the Fontes Amari have ^{long ago} ~~vanished~~, we still ~~had~~ the
 corresponding phenomenon before the digging of the Suez Canal,
 noted by Suess, viz, the rising & sinking of the wells of the
 Isthmus with the waxing & the waning of the ~~tides~~ ^{ice} tides, proving
 the existence of a common subterranean sheet of brackish
 water between the two seas, - a phenomenon still observ-
 able in the region between the Rhine & the Danube, proving
 the existence of a common underground sheet of fresh water

+ Cf. Wm Max Müller: Europa und Asien: pp. 39-45
The identification of Km-nr with the Herakleotic Gulf
& its derivation of the Yam Suph from a tissue
of speculations is the re plus ultra of Egyptology.
His scholarship otherwise is not here in question.

between the two rivers. Cf Suez. i. 377

Conclusion. The position of the ΠΙΚΡΑΙ ΔΙΟΥΑΙ & the Fontes Amari are now firmly fixed; thus removing a mass of error & leading to clear views about the extension of the Red Sea northwards. Space does not allow us to deal with the Km-vr or Great Black (Water) of the ancient Egyptian inscriptions & its supposed relation to the Bitter Lakes of the Suez Canal, the ΠΙΚΡΑΙ ΔΙΟΥΑΙ & the Fontes Amari, beyond saying that these supposed relations are demonstrably false, in the light of the foregoing classical data.

VI Extension of the Red Sea northwards beyond Suez.

This is the most disputed & most difficult, also the most perplexed item, in the whole of our research. We use for heading the current conventional phrase in this regard. And at the outset of our investigation here, we must carefully note the marked differences between the old & the new nomenclature :-

Geographically speaking the Red Sea of to-day is that arm of the Indian Ocean which extends from the Straits of Babel Mandeb northwards to the southern extremity of the Peninsula of Sinai where it divides into the Gulf of

Cf Shato: XVI. ii. 30

of Suez & of Akaba. There are the two uvxoi of Strabo's Arabian Gulf, which is the Red Sea of the present day*. The oldest ^{egyptian} designation for the Red Sea is the same as that for the Mediterranean, viz Uaz-vr i.e. the Great Green (water); whilst the oldest Hebrew name for it is (in general) - Yam Suph or Sea of weeds (Reeds); but neither the Egyptian nor the Hebrew name is of any consequence to us at present. The classical nomenclature is that which lies at the root of the problem in hand. -

- (1) The Red Sea of the classical geographers - ἡ Ἐρυθρὰ Θάλασσα or Mare Rubrum is the Indian Ocean.
- (2) Men Arabian Gulf - ὁ Ἀραβικὸς κόλπος or Sinus Arabicus is our Red Sea.
- (3) Mein Heropolite Gulf - ὁ Ἡρωπολιτικὸς κόλπος or Sinus Heropoliticus is practically our modern Gulf of Suez. It is really to the Gulf of Suez that the phrase - "extension of the Red Sea northwards" strictly applies in the sequel: -

The alleged "extension of the Red Sea northwards" must not at all be confounded with the confluence of the Mediterranean & the Red Sea in the Bay of Lower Egypt, already discussed (pp 43-45). W. Max Müller sums it all

* cf. Suess, [following Laurent], slightly differs from this view, which is founded on the later observations of Sir J. W. Dawson. cf Science p 280 Cf also Suess i p 377

- x cf Mémoire sur les limites de la Mer Rouge in the Description: Et. Nov. Partie I
o cf Recueil des Travaux y p 127

into this mistake of Encyclop. Britica: Exodus of 15. That great Bay of Lower Egypt was filled up in prehistoric times; & for its final completion, the Mediterranean, the Nile, & the Red Sea, took part, as shown of existing surface deposits. The agency of the Nile has been already dealt with here (pp 46. 47). Three zones are well marked in the Isthmus along the line of the Suez Canal: (1) the Mediterranean zone from the Mediterranean to the southern end of Lake Balah: (2) the Nilotic zone, beginning at the latter spot & going on to the northern extremity of the Bitter Lakes: (3) the Erythraean zone, extending from the latter spot to Suez.

The present Gulf of Suez ends at Suez;—in our conventional phrase, we should say the Red Sea extends up to Suez. Even inquiry is as to its extension at an early date up to the region of Ismaïlia or Herakopolis. With many others, Schleiden would allow such extension for prehistoric, but not for historic, times of de Land-enge von Sués (1858). D'Arville believed in extension northwards up to the head of the Bitter Lakes for early history. So did Leprieu, Rozière, Du Bois Peyroné, Mégnant, with others. Leprieu, on the other hand, held that such extension of the Red Sea northwards was clearly disproved by the traces of the Canal of Darius on the route marked by his stelae up to the neighbourhood

of Suez (cf pp 22, 23); since, according to this authority, no such canal could have been cut, had there been an open marine channel alongside of it. But this proves too much; for "by the same token" no fresh-water canal should have been dug alongside of the present Suez Canal from Ismailia to Suez. Yet Sayce & others have given their adhesion to this theory of Lepsius. Linant Bey, on the other hand, goes too far in his assertion here, when he makes the Red Sea, in the 19th dynasty extend up to Lake Balah; for that lake is quite outside the Erythraean zone already mentioned (p 79). Sir J. W. Dawson, on geological evidence, believed in the extension of the Red Sea up to [the Bitter Lakes] at the time of the Exodus. Cf Science p. 276. Nowville's view of the Exodus assumes such extension of the Red Sea for this period. Our thesis is that the Red Sea extended up to the region of Magfar at least, in the time of the 18th dynasty, & continued so to do until these happenings: —

(1) Its northern extension above Suez was cut off by the Coptic Christians of the Roman Empire, as a precaution against Arab invasion ~~under~~ at the rise of Islamism.

(2) The channel was cleared out again by Amru, under Umar - "Prince of the Faithful" - about the

Ali: Manamur: 754 - 775: founder of Bagdad.

year 642 A.D., to permit the conveyance of supplies from Egypt to Mecca + Medina, then devastated by famine. The channel was closed again by Al-Mansur in 767 A.D. Cf p 91

(3) The channel was re-opened by Al-Mansur's son about 775 A.D., and remained open for some 200 years. Cf p 91.

(4) The channel was probably re-opened by Hakim, "the mad Caliph" about 1000 A.D., but was silted up some 200 years later. Cf p.p 91-92

Proof of the extension of the Red Sea northwards in earlier + later times may most conveniently start with Strabo's time, as a sure + convenient hermeneus a quo, proceeding backwards, + then downwards, as far as the evidence will carry us. Our inquiry, therefore, divides itself into two parts: (1) relating to the remote past: (2) relating to the present parts of more modern times.

i Extension of the Red Sea to the Wadi Tumilat from the time of Strabo backwards to the time of the 18th dynasty

Herodopolis - Pithom is a forced + well-known point, since the excavation of the site by Prof. Naville, + it furnishes now the pivot for our research: -

The evidence of Strabo: c 24 B.C.:-

- (1) Heropolis is situated ~~in~~ the recess of the Arabian Gulf
 - ἐν τῇ κοίτῃ τοῦ Ἀραβικοῦ κόλπου. Strabo: Geographica
 XVI. IV. 2: xvii. iii. 20. This recess is alias the Heropolitic
 Gulf, here seen to extend to the region of Heropolis.
- (2) Heropolis is itself a sea-port. Ships sail from it to
 the hunting grounds for elephants in the land of the Trog-
 lodytes. cf. cit.: XVI. IV. 4.5. This again is proof that
 the Red Sea extends up to Heropolis in the Wadi Jumilat.
- (3) Near Heropolis are the towns of Arsinoe & Cleopatris
cf. cit. xvii. i. 26. Near Cleopatris is the exit of the
 "old canal" of the Wadi Jumilat, where Aelius Gallus
 built 80 pteromes & biremes & galleys for his expedition
 against South Arabia. These ships sail thence di-
 rectly, without let or hindrance of canals, & thence
 come in Arabia: XVI. IV. 23. Strabo knows of no
Bitter Lakes on the site of the modern Bitter Lakes of
the Suez Canal, strung together by canals. He knows
of no canals in this region, except the Wadi Jumilat
Canal. This is clear proof that the Red Sea now ex-
 tends right up to the region of Heropolis in the Wadi
 Jumilat.
- (4) The "old canal," ut supra, near Cleopatris, was clearly in
 working order in Strabo's time. It is as close to Arsinoe
 that it sometimes bears that name (p 44). It is near
 Arsinoe that the Wadi Jumilat Canal "emphases itself
 into the Red Sea or Arabian Gulf": cf. cit. xvii. i. 25.

cf p 73

Here the Canal is filled up with a lock or sluice, "two" which ships ~~pass~~ sailed into the outer sea; xvii. i. 25. The canal is, therefore, on the inner or western side of the lock or sluice; whilst "the Red Sea or Arabian Gulf" is on its outer or eastern side. Nothing could more conclusively show that the Red Sea extended up to the region of the Wadi Sumilat.

II The evidence of Diodorus: c 60 B.C.:- He notes the completion of the Canal of Ptolemy II, with its ingenious lock at its distal extremity - near Arsinoe on the Red Sea. He evidently regards it as a sea-port: (p 64). Like Strabo, he knows of no canals or Bitter Lakes preventing absolutely free navigation from Arsinoe southwards to the land of the Troglodytes (in Upper Egypt). He knows of and describes the deep-beeled (βαθύπαραοί) elephant-transports which use the waterway. (Bk iii ch 83). There being no transshipment of these cargoes of elephants possible, these elephant-transports go from the hunting grounds right up to Arsinoe at the head of the Herakleotic Gulf: thus proving its extension to the Wadi Sumilat.

III Evidence of Athenodorus: c 100 B.C.:- He makes Herakleopolis a sea-port for those engaged in the hunting of elephants in Troglodytica. Cf Strabo: xvi. iv. 5. Again, no indication of any canals or Bitter Lakes.

such as the vast majority of modern authorities postulate. The Red Sea ends at Heropolis

IV Evidence of Agatharchides: c 113 B.C. He, in all respects, is an authority of the highest value. His treatise in five books, on the Erythraean Sea, has been preserved in part by Photius & Didore. It has much to say about elephant hunting. It describes the elephant-transport - ἐλεφαντοφυγία - & the profits they pay. Cf. Photius cp. 83 in Müller: Gr. Mon. i. 1713 & Agatharchides prime authority for Didore, Strabo, & Strabo, in the matters on hand.]

V Evidence of the Pithom Stela of Ptolemy II: 269 B.C.:- This tells, inter alia, of the dispatch by Ptolemy II of an expedition in this year, for securing elephants for war purposes. It sails from Assiout & Negro-land & returns to the port from which it departed, with great store of elephants. There is no transshipment, as Wm. Marc Müller suggests: no such thing is possible Cf. Asien u. Eur. p 42. No: "the Ptolemies never helped nature in the south," of any canal there. Cf. cit p 43.

VI Evidence of Theophrastus: c 330 B.C.:- He was Aristotle's successor as head of the Peripatetic School; best known as a botanist, but almost as great as his master in science &

* Herodotus: - Ἐφ' ὃν καταβαίνουσιν οἱ ἐξ Αἰγυπτίου ...
 IV. 7. 2: - ΚΑΤΑ ΤΟΝ ΠΑΡΑΠΛΟΥΝ ὃν ἐξ Ἑρῶν
 ῥέπουσιντο ΚΟΔΠΟΥ ... IX. 4. 4: - ΠΑΡΑ ΤΩΝ
 Ἀναπλευσαντων ἐξ Ἑρῶν ΠΟΔΕΩΣ ...
IX. 4. 9.

* Sanscrit: Casyapa - pur: believed the Carman

of the "Himalayas" at Pithor: and see p 126

philosophy. In his Historia Antiqua, Le Ancy mentions Hieropolis as a sea-port. Cf. Tr. 7. 2: IX. 4. 4: IX. 4. 9: showing that it was in his time a busy place in this respect: proving extension of the Red Sea up to the trade Sumlat

vii. Evidence of Ptolemy. He belongs indeed to the times of Hadrian & Marcus Aurelius, but he makes use of several sources for his Anabasis of Alexander - viz. Ptolemy I & . He twice mentions Hieropolis in this work: but the important reference in this connection is the appointment by Alexander of one - Hiero - to circumnavigate, on a sea-contour, the peninsula of Arabia right up to the Arabian Gulf & Egypt (απὸς Αἰγυπτίας) - up to Hieropolis. Cf. Anabasis VII. 20. 8. The Red Sea therefore reaches Hieropolis still. Again there are no Bitter Lakes: no canals to negotiate before reaching the port of Hieropolis. (c. 323 B.C.)

viii. Evidence of Darius :- He sends out his exploring expedition under Scylax from Caspatyrus, down the Indus to the Indian Ocean. The fleet arrives in the 30th month at the place whence Nectus had dispatched his expedition to circumnavigate Africa. Cf. Herodotus IV. 44. The port of arrival is not named, but it could hardly be other than Hieropolis - Pithon. Dunder adopts this view. After this exploring of the Indian seas, Darius "subdued the Indians & began to frequent this sea" Cf. C. I. IV. 44. The date is c. 512 B.C. It is only at a later date

✓ He visited Memphis in his 5th year: 517 BC

that Darius makes use of the Red Sea & the Nile, via the
Wadi Hammamat, where his inscriptions occur for the 26,"
27", 28", 30" & 36" years of his reign. This lake and of
these parts agrees well with an earlier use of the ~~port~~
port of Hieropolis. Ptolemy ii, for his general sea-borne
traffic, had to change from Hieropolis to the ports of the
Red Sea in Upper Egypt, as more convenient for him
cf Strabo: xvii. i. 45. The extension of the Red Sea northwards is likely
(at this date)

IX Evidence of Necho: - The port from which he dispatched
his expedition to circumnavigate Africa is taken by Herodotus
as already known. It could hardly be other than Pithom, —
the terminus of his Wadi Hammamat Canal, & probably one
of the places of building of his fleet. cf Herodot. IV. 41: ii. 159
His object in circumnavigating Africa was probably commercial
aggrandisement in compensation for his defeat of Nebuchad nezzar
at c 605 B.C. The success of the circumnavigation has
been proved by Boucard's scarabs. His use of the Wadi
Hammamat route, at supra, is attested only for his 8" year;
& the same inference may be drawn as in the cases of Darius
& Ptolemy ii. The extension of the Red Sea northwards to
Pithom (Hieropolis) may well be fairly assumed for this date.
(c 605 B.C.)

XII Evidence of Ramses ii. His extension of the Red Sea
up to the region of Pithom or even beyond is assuredly
proved by the evidence of Ramses as a sea-port for

* Heat. Not. published 77 AD

this period - 1292-1225 BC (1292-1225). Voyages to the Holy Land of Punt were now common. Cf. Maspero: Struggle p 408.

IX Evidence of Queen Hatshepsut: c 1501-1447 BC.

The extension of the Red Sea up to the Wadi Tumilat is furnished by the queen's expedition to the Holy Land of Punt - "the Terraces of Incense". Cf p 51.

Thutmose III continued these expeditions, evidently also of the Wadi Tumilat route.

Conclusion: - So far the case has been made good for the extension of the Red Sea northwards, beyond Suez, up to the Wadi Tumilat from the time of Sesostris up to the 18th dynasty. Students of Geology will have no difficulty in tracing that extension backwards in time to the ^{Post} Pleistocene period. pp 53-54.

Cf. p 81

ii Extension of the Red Sea to the Wadi Tumilat from the time of Sesostris downwards to its creation about the 12th Century

I Evidence of Pliny, the Elder: c 75 AD. His statement is indeed confirmed, but his fixture of Arsinoe on the Gulf of Charandra (pp 18.64.) makes sufficiently clear the extension of the Red Sea in his time to the region of Heropolis. This Charandra seems homophonous with the Kemmerma

* Swon Arica: Cf Willberg: pp 278. 286

* IVa. Evidence of Agathemerus. His date is uncertain but he suffers no injustice in being placed on point of some close to the final redaction of the Ptolemy Map. His outline (ὑποτύπωσις) of geography is somewhat slender; but at the point it gives back upon Strabo & gives quite unequivocal proof of the extension of the Red Sea up to Heropolis - ὁ δὲ Ἀραβίος κόλπος ἀρχεται ἀπὸ ἡρώων ποταμοῦ. Another reading in ποταμοῦ is ποταμὸν - (BCDEH), which would indicate that the Wadi Sumlat Canal was once called the Heropolite Canal Cf Müller: Geogr. Gr. Min. ii p 475

of the Pithom-Stele of p. 129

ii Evidence of Strabo: c 100 A.D. His account of Queen Cleopatra dragging her ships across the Isthmus to escape from Augustus is mistaken in part (p. 129): but his estimate of the Isthmus as very narrow (300 stades?) shows his knowledge of the extremity of the Red Sea up to the region of the Wadi Jumi-lat at this date. Cf pp. 15.16

iii Evidence of Ptolemy: c 150 A.D. He gives these positions: -
 Head of the Herosopolite Gulf Long $63^{\circ} 30'$ Lat $29^{\circ} 5'$
 Herosopolis Long $63^{\circ} 10'$ Lat $30^{\circ} 0'$
 (cf. Bk IV. c. 7). This places the Red Sea, as the Herosopolite Gulf, adjacent to Herosopolis in the Wadi Jumi-lat.

iv Evidence of the Peutinger Map. This is visual testimony furnished by a Roman military map, known otherwise as remarkably accurate. It makes the Sinus Arabicus - or Red Sea - proceed without the slightest obstruction, natural or artificial, to the neighbourhood of Aden & the Bitter Lakes. Cf p 25. It is an indefeasible witness to the entireness of the Red Sea, at supra for the interval between c 150 - 250 A.D. *

v Evidence of Isidore. He holds that Suez's Canal was

* Cf. Recueil: p 197

used for the transport of sulphur & granite from the quarries
 of Debel Dohlan & Debel Faterah in the Jebel (p)
 until about the years 205-209 A.D., when new granite
 quarries were opened at Syene. The inference is that
 the Canal of Trajan had by this time become silted & thus
 new quarries had to be opened on the Nile. This view is
 a precarious one; for many other reasons might operate
 for the closing of the old granite quarries at Debel Fat-
 erah. The argument indeed proves too much; for if the
 export of granite ceased as above, then the export of porphyry
 should also have ceased. Lebonne, indeed, has his answer to
 this, but a very insufficient answer (p^x). Lepsius quotes
 Langley's list, who shows from Makrizi that, until the
 rise of Islamism, vessels brought to Arabia the wares of Egypt,
 but since the conquest of Egypt, the communication was in-
 terrupted, the canal (of Trajan) being obstructed & the
 navigation having been abandoned. Cf Langley's: Nile etc. or
Excavations, Tom VI pp 337. 344. 366. From this, the statement
 of Amru, governor of Egypt under the Caliph Omar, Lepsius
draws the inference that the Canal (of Trajan) had
been designedly filled up by the Egyptians before the con-
quest of Egypt, as an inimical & prudential measure,
 similar to that taken by the Caliph Marwan at a
 later date. Cf Lepsius: Egypt, Ethiopia, & Syria: p 445.
 This inference seems well founded & fits into what
 has often been spoken of with extreme surprise, viz.

* This is opposite to the view of Lepsius himself. Cf p.

* Attributed by Al-Kindi, El-Beldery^a, Makrizi, Schems-Eddin

* The name of the rebel is Mohammed - ben -
Muhammad - ben El-Husein - ben Ali - ben -
Abu Isahak.

* He also built the El-Hakim mosque in Cairo

the completion of the Canal of Amar in six months: of p
 We may well suppose, then, that the Red Sea extended still,
 as of yore, up to the region of the Wadi Jumilat.

VII Evidence of Arab historians. This may be here summarised
 & concluded: - (1) It is a well attested fact that the Caliph
 M-Mansur, founder of Bagdad, ordered the filling up of
 Amar Canal, so as to stop supplies from Egypt to
 Arabia, on account of the rebellion against his authority
 in the city of Medina. The canal was closed. The channel
 was obstructed in 767 A.D. & remained so for some eight
 years, when it was reopened by M-Mansur's son & successor.
 (2) M-Rundi expressly says that the Canal of Amar
 remained navigable until the time of the Caliph Abdul-
 Aziz (975-996 A.D.), when it fell to ruin thro' ne-
 glect. (3) Hakim, son of the preceding, "the mad
 Caliph", is sometimes reported to have re-opened the
 old Canal of Amar. Nahrizi states that in his time,
 the canal bore the name of Hakim. So also does Shams
 Eddin, who wrote a complete history of Egypt (c. 1650). The
 association of Hakim's name with the old canal, could
 scarcely have come about without some such reopening of
 the canal by him. He had, doubtless, an abundant
 supply of labour for such a purpose, as he was a severe
 persecutor of the Christians. The date of such re-opening
 is about 1000 A.D. (4) Abu Salih, writing in the

* Prof. Hull says 7 ft.; no doubt correctly for the
part reviewed, as the salt cake was not
of uniform thickness. cf Survey of Western
Palestine: Barley: p 72

the twelfth century, makes it clear ^{by} that time, if not earlier, the channel to the sea was closed; for wheat, now brought by the Nile boats to the eastern extremity of the wadi Sumilat, at the place called As-Sader, is transferred from the bank to dealers, who travel with it to Mecca & Medina. Cf. Everts: (& Butler) in Anecdota Cuxoniensis (1895): p. 173.

Conclusion: - Taking a conjunct view of the foregoing evidence, it becomes manifest that, contrary to all received opinion, the Red Sea has extended up to the region of the wadi Sumilat from the xviiith dynasty - 1500 B.C. to somewhere near the time of the Caliph Hakim - c. 1000 A.D. From that date on thereby, our problem as to the extension of the Red Sea northwards, is landed back by History & Geology. It is possible that some connection with the wadi Sumilat may have remained till later times, but, if such were the case, navigation had ceased beyond Suez. In the bottom of the Bitter Lakes, before the construction of the Suez Canal, was found at one part a huge cake of salt - some seven metres in thickness of Suez i. 382. cf. Kull also. It can be shown that for such a thickness of salt, there must have been evaporation of a column of Red Sea water, more than 1800 ft. high; & the evaporation of such a column, at the rate of 6 m m, per day, (p. 152) (75a)

* Despite his high doctrine of "stand lines," he here, as occasionally elsewhere, lapses into the phrasology of Lyell: Cf p 378 "creek-line sinking"

would require some 250 years. If, therefore, on the testimony of Abu-Salih (p. 91) we suppose the Nile waters to have been practically cut off from the former basin of the Red Sea in the region of the Wadi Jumilat & the retreat of Red Sea to the head of what are now the Bitter Lakes in the Suez Canal, we may suppose a continuation of the connection of the Red Sea with the basins of these lakes, ^{for} some 250 years after the cessation of the ~~restored~~ Canal of Hakim. These basins of the Bitter Lakes were cut off from the Red Sea by the elevation of the land in the region of Suez; & that elevation was some 10 ft in extent, judged by the remains of the old canal in this region. Suess judges the movements of elevation in the Isthmus to have been rhythmical (i. 398) If so, we might suppose the last step in the elevation of the land near Suez (Chalouf) to have occurred about $(1100 + 250 = 1350)$ years A.D. i.e. in the middle of the fourteenth century or thereabout. There is no concrete history, either for or against this view, & nothing in the sequel is made to depend upon it.

The Engineering Problem

This is essentially the problem of canalising a

* This applies to all the old Canals under consideration, save that which, for convenience, we have already called the Northern Canal cf p 36

* cf Homer: ΔΙΙΠΕΤΑΣ ΠΥΤΑΛΩΣ: Od. IV. 477

* A great puzzle to Dr Livingstone

* Aristotle gives the correct explanation in his Meteora: i. 12. 19.
It was well known even before Strabo's time: xii. i. 5

river, subject to a periodic inundation of great magni-
tude, but of the utmost regularity. The problem here is
as unique as the Nile itself, but the pure technicalities
are of the simplest sort. We have to note, on the
threshold here that there is no problem of excavating
a canal purely de novo. The excavations are all
repairs or slight modifications of a Natural
Channel - excavated & kept open from Post-
pliocene times onward until now, of an arm
of the Nile flowing down the Wadi Sumilat, c/pp 46-54
The case requires us rather to realize the ancient conditions
of the Canalization, as no ~~obvious~~ ^{obvious} problems are ^{to} hand.
Yet the problem, reduced thus to a minimum, remains a
formidable one & requires a very extensive research.

(1) The general conditions of the problem.

The sources of the Nile did not awaken much curiosity among
the ancient Egyptians. Their Hapi - or Hidden One -
was associated with Qerti or Qoriti - "the Two holes"
whence emerged the Nile-god at the period of the inundation.
The Krophi & Mophi of Herodotus (ii.28) are respectively
"the hollow" & "the waters" - of the Nile. Herodotus quotes
the views of Thales, Heraclitus, & Anaxagoras regarding
the rise of the Nile, then gives his own (ii.19.27). "Nero,
had curiosity enough, to send out a party to explore (the)"

* Herodotus has five only: ii. 17

Use carefully!

the Upper Nile and then report would show that they reached the
 marshes of the White Nile. Cf. Pliny: H. N. VI. 29 ff 184-186:
 Seneca: Nat. Quæst. VI. 8. But to follow such points
 is irrelevant to our research at this moment. Rather, must
 we note that, according to Captain Lyons, the length of the
 Nile from the Nijm Falls to the Rosetta mouth of the
Nile is 5,589 kilometres or 3437 miles: its catch-
ment area - 2,867,600 sq. kms. or 1,107,227 sq. miles
 Cf. Nile 5-7. Its mouths in classical times were seven -
 - (1) Pelusiac: (2) Tanitic: (3) Mendesian: (4) Phatnitic: (5)
 Sebennytic: (6) Bolbitic: (7) Canopic. Now there are but
 two - those of Damietta & Rosetta

Mean Discharge of the Nile to-day: -

In Wm Willcocks gives them in his Egyptian Irrigation: c. pp
 48-52: -

- (1) Rainfall of the Nile basin = 2,282,000,000,000 cb. metres per annum
- (2) Mean discharge at Aswan = ⁹⁴~~94~~, 292,640,000 cb. metres per annum
- (3) Mean discharge at Cairo = 82,308,960,000 cb. metres per annum
- (4) Mean discharge into the sea = 64,964,160,000 cb. metres per annum

$$* (a) 64,964 \times 10^6 / 2,282,000 \times 10^6$$

$$* (b) (82,309 - 64,964) \times 10^6 / 82,309 \times 10^6$$

* *Phot*: 1st April to end of July.

Summer: 1st Aug. to end of Nov.

Winter: 1st Dec to end of March.

$$* 946 \times 10^6 / 82,309 \times 10^6$$

cf Girard's Memoire on the Elephantine nilometer to:

Description: Antiquities: vol 1 pp 1-47

- (5) Hence follow two things:—(a) The water which reaches the sea is about $1/35$ of the rainfall: (b) The water absorbed by the canals of the Delta is about $1/5$ of the supply at Cairo.
- (6) For the Ismailia Canal, which is virtually the old Heliopolitic Canal (p. 19.) as far as Ismailia, the discharge figures are for. (1) the flood, 11 cb. metres per sec: (2) summer, 29 cb. metres per sec: (3) winter 50 cb. metres per sec. of which: Aug. 183 The average discharge thus becomes 30 cb. metres per sec., & the annual discharge thus becomes $= 946 \times 10^6$ cb. metres. The average discharge of the Ismailia Canal is therefore about $1/90$ of the whole discharge of the Nile at Cairo. This may be taken as approximately representing the discharge of the old Wadi Rumilat Canals.

The Regimen of the Nile

The Nilometers of As-day are graduated wells with fixed scales to determine the rise & the fall of the Nile. The earliest of all Nilometers is that cut by the officials of Amenemhat III of the 12th dynasty (1842-1801 B.C.) on the rocks of the River at Semna ^{near} the second cataract. The records are marks on the rocks, covering three years of the reign of

Amenemhat III - 3", 5", 7", 9", 14", 15", 22", 23", 24", 30", 32", 37", 40", 41" & 43" years. Lepsius held that these marks on the rock denoted that the inundations of the Nile were some 25-30 ft. higher than those of the present day. Hall has corrected his views; & the apparent lowerings of the inundations in later times are now best explained by the ^{erosion} attrition of the Nile bed, which works out at the very modest figure of one inch per century. Captain Lyon has given a list of ancient Nilotekes from Semna downwards - (1) Semna: (2) Kusbok: (3) Taifa: (4) Philae: (5) Elephantine: (6) Kom Ombo: (7) Silsila: (8) Edfu: (9) Isna: (10) Karnak: (11) Luxor: (12) Thebes: (13) Kom el Giza:

Nile p 316

The rise of the Nile is noticed at Khartoum about the beginning of May; at the first cataract, about the beginning of June; at Cairo, about mid-summer. The inundation, according to conventional ideas, lasts 100 days. Cf. Gen. ii. 19 & onwards. The old Egyptian New Year Day was 15th Sept., as marking the climax of the inundation. The function of the Nile, with reference to the landscape is described in poetic terms by Amru - "According to the changes of the seasons, the face of the country is adorned with a silver wave, a verdant emerald, & the deep yellow of a golden harvest."

The Height of the Inundation

* Now in the Vatican.

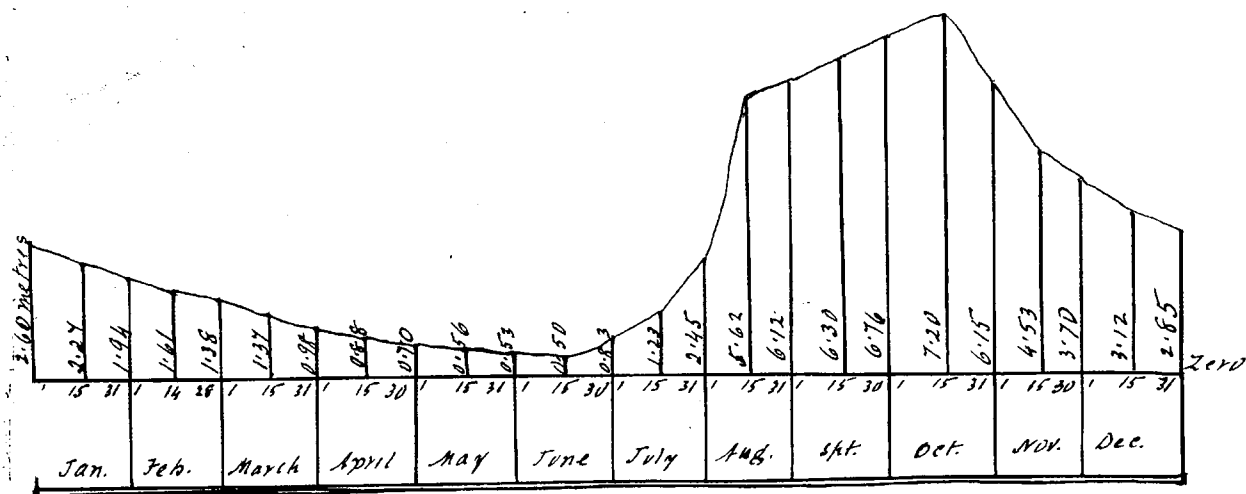
Cf Isis & Osiris: 43

Cf also Shabto xvii. i. 3 Before the Nome of Petonius, governor of Egypt under Augustus, 14 cubits gave the greatest plenty: under him, (the canals were cleared out, and) 12 cubits of a rise (Δραβας) gave a most abundant crop.

* Nubmeku of Semna, Kom Cembo, Silsila, Karnak, & Dehne are not mentioned here

① Nubmeku cubit = $0.525 \text{ m} = 20.6 \text{ inches}$

Public & Chmucanin cubit = $0.450 \text{ m} = 17.7 \text{ inches}$



Curve of Nile surface 1846, taken at Kodak gauge by Mougel Bey, 1846: unknown at the Nile Barrage. This may be considered a typical curve, as the year 1846 presented no unusual features in the regimen of the river.

Minimum above theoretical zero in middle of June = 0.50 m = 1.64 ft
 Maximum above theoretical zero in middle of Oct. = 7.20 m = 23.61 ft.

The Optimism has from early times been reckoned at 16 cubits in the Temple of Peace, Vespasian dedicated, in "basanites" stone, the group representing the Nile-god with his 16 children sporting around him. cf Pliny xxxvi. cp 11. The height of the inundation varies, of course, with the size of the obstruction, & the 16 cubits symbolized in the above group, no doubt, refers to Memphis. Plutarch gives 14 cubits as normal ($\delta\iota\kappa\alpha\iota$); probably he is copying Aristotle. But the place of measurement is not given; &, even, if it had, the 16 cubits, as above, are not the set rule; for Captain Lyons has shown that the Egyptian cubit was not an invariable measure. Measurements made at the ancient nilometers mentioned on page 97, reveal considerable divergences in the value of the cubit. cf History of Surveying and Land Measurement in Egypt: pp 14. 15². He also gives as value of the Nilometer & royal cubit = 0.525 metre; cloth-weaver's cubit = 0.375 metre; public & carpenter's cubit = 0.425 metre of Cadastral survey of Egypt pp 36. 37.

Regularity of the Regimen of the Nile

The cycle of nature here proceeds with amazing regularity, for each season, as also for the ages. Copernicus here cites the conclusions of Dr Borchardt in his paper on "Nilmesser und Nilstandsmarken": - "The height above sea-level of corresponding points of the ancient nilometers in Egypt &

* Preserved in the Palermo Museum.

* First built here by El-Welid c 715: second by the brother of
Wathih c 860: (Yonke Parka 860 n 870: Willcocks: 861 BC.

Nubia have been determined with the aid of the bench-marks of the Irrigation Department; & the zero points of the nilometer scales were found to be in a line inclined to the north. In Nubia, the line is sensibly parallel to the water-slope, but north of Aswan it is considerably less inclined than the flood-slope; consequently a flood was indicated of a higher reading on the nilometer at Aswan than on that of Roda at Cairo. This explains the statement found in the Egyptian inscriptions & in the works of the Greek & Roman authors, that the Nile in very good years rose 28 cubits at Elephantine, 21 cubits at Aswan, 14 at Roda (Memphis?), & 7 in the Delta. From the slope of the line determined by the zero points of the nilometers, the altitude of the ancient nilometer, at or near Roda, may be approximately obtained, & after calculating the regular rise of the bed, it can be deduced that the flood levels about 3000 B.C., which are recorded on the Palermo stone, & the data concerning Nile floods given by the Greek & Roman authors, agree well with those of to-day" Cf Lyons: The Nile: pp 316-317

The Rise at the Roda Nilometer.

This is the Nilometer of to-day, & which all other nilometers can be referred in the light of the preceding statement. It is on the island of Roda, opposite Old Cairo, 27 kilo-

* The Barrage is 23 kms down-stream from Cairo

** Cf The Nile: pp 318-323

metres (from) the Barrage or present head of the Delta. Captain Lyne has very fully discussed the readings of the Roda nilometer for different periods. It is enough, therefore to note two sets of readings on which stress is to be laid: -

(1) In the years 1825-1872: (2) In the years 1737-1800

Maximum = 7.17 metres,

Maximum = 7.02 metres,

= 23.52 feet

= 22.96 feet

The mean of these two maxima works out at 23.24 feet. We may, therefore, reckon it in a general way as equal to 23.50 feet, & on the strength of the statement of Borchardt, we may suppose this to be the dominant maximum rise of the inundation up to & beyond historic times.

Economic Aspects of the Rise of the Nile.

These throw light, not only upon the condition of the Delta, but also upon that of the Nile's ^{summit} ~~flow~~ which makes the most desirable height of the Nile, 16 cubits; if less, it does not overflow the whole (cultivated) land; if more, cultivation is retarded & ^{the} time for sowing may be lost. When it rises only 12 cubits, famine ensues; at 13, hunger still results; 14 cubits is production of gladness; 16 produces unbounded transports of joy. (Bk V. ch 10). But the economic effects of the rise of the Nile have never been stated so well as by Salaboth, one of the international engineers appointed to the survey for the Suez Canal

+ Nuisible

Au-dessus de 5m 40	Famine
De 5m à 6m	Crue insuffisante, disette
De 6m à 7m	Récolte faible
De 7m à 7m 50	Récolte favorable, abondance
Au-dessus de 7m jusqu'à 8m	Crue forte, devenant de plus en plus nuisible
Au-dessus de 8m	Crue extrêmement nuisible, famine certaine, danger de peste

Secular Rise of the Nile-bed:-

This must be distinguished carefully from the rise of the flood-plain. The cause is the same in each case, viz - the deposit of Nile mud or alluvium. This is almost entirely derived from the highlands of Abyssinia, thro' the Atbara or Black Nile:

Secular rise of the River-bed

There is the balance between the material eroded in the bottom of the stream during the inundation, & the silting of the bottom of the stream, with the slackening of the inundation. The French engineers (1794-1801) made careful observations on the rise of the Nile-bed by measuring the accumulation of the alluvium in the niches for long periods.

M. Guad & Rozière reckoned this rise of the river-bed at 12 centimetres per century, for the region of Cairo & Memphis. Since the foregoing date, other observations have been made & may be thus summarised:-

cf Venke Pasha in Zeitschrift für Aeg.
Sprache xxxiv. (1896) reckons the
rise @ Karnak at 0.096 inches
per century: cf pp 103. 101. The Epm
Syms would raise somewhat. cf Nile
p 315

* But see Nile pp 313. 334 - 10 cms

- (1) At Elephantine, dating from the year 100 A.D. until to-day, a rise of 3 m 18 cm has been ascertained. Rise, therefore, = 16 cms per century. (Borchardt).
- (2) At Elephantine again, dating from the middle of the reign of the Emperor Severus $\approx$ 200 A.D. to 1800, the rise is 2 m 11 cm in 16 centuries. Rise, therefore, = 13.2 cms per century. (Willcocks)
- (3) At Karnak, dating from the reign of Osorkon II, $\approx$ 860 B.C. until to-day, rise is 2.68 metres in 27.5 centuries. Rise, therefore = 10.0 cms per century. (Legrain: corrected).
- (4) [Yontie Pasha] At Roda nilometer, dating from 861 A.D. to the present time, the rise is 1.22 metres in 10.30 centuries. Rise, therefore, = 12 centimetres per century. (Willcocks).

It is thus apparent that the rise of the Nile-bed is not uniform, & such a thing is to be expected. All we are concerned with here is the rise of the Nile-bed in the region of Cairo; & all authorities are well agreed in fixing that somewhere about 12 centimetres per century.

This is the figure given by Girard & Rozière; by Sir Wm Willcocks 12 to 13 cms per century on mountains. Cf. Eq.

Long p 41 Captam Gons agrees to 12 cm per century. (?) Cf. Willcocks: Egyptian Drainage. Prof. Petrie, ¹² 12 cms per century for ^{the} region of Naucratis. A general view

of these figures would suggest 4.5 inches per century as a good working hypothesis for the region of Cairo at large.

Secular Rise of the Flood-plain.

This is a matter of rather small ^{ex} importance for our research, as it is really a quantity which varies with locality. The largest deposit of alluvium occurs near the banks of the river, where the overflowing water is first checked. The deposit tapers away with the distance from the margin of the river. The exact measurements of Horner & the difficulties involved in these are too well known to require discussion. His figures, viz 3.8 inches ^{per century} of rise, for the flood-plain at Helopolis, & 3.5 inches per century (of rise) for the flood-plain at Memphis are now regarded as too low. Cf. Philosophical Transactions, 1855: pp 105-138; 1858: pp 53-87. A few figures to hand may be of interest regarding the secular rise of the flood-plain: -

- | | |
|-----------------|--|
| (1) Elephantine | 6.3 inches per century (Wilkinson) |
| (2) Kainak | 6.5 inches per century (Venturi Pasha) |
| (3) Memphis | 3.5 inches (Horner) |
| (4) Babylon | 12.0 inches (Bottu) |
| (5) Cairo | 4-5 inches (Girard) |
| (6) Roda guage | 5.5 inches (Venturi Pasha) |
| (7) Helopolis | 4.0 inches (Wilkinson). |
| (8) Khair | 5.3 inches (Borchardt) |

* i.e. the "flood-plain"

** Cf Zeitschrift für N. Sprache Bd. XXXIV (1896)
pp 95-107.

* He regards the evidence as insufficient to establish rise
of land as faster than rise of river-bed

Does the Nile-bed rise faster than the flood-plain?

Now is the question which arises out of the relation of the rise of the river-bed & the rise of the flood-plain. It has immediate relation to our research, as bearing upon the "off-take" of the radi Sumilat Canals. Venturi Pascoe, from observations at Karnak, made the rise of the cultivated soil = 0 m 143; whilst the rise of the river-bed was found = 0 m 096 - per century^{xx}. In the 28 centuries under review here, the rise of the soil exceeds the rise of the river-bed by 1 m 32 or 4.33 ft. Such a gain of the flood-plain upon the river-bed would scarcely be appreciable in practice. For the Delta, the view of Girard & Ruzière that both advance pari passu seems fairly well founded. Cf. Reception: also Dalaly & Rowe p 486 Captam Gims, however, inclines to a somewhat different view. Cf. Nile p 317

Shiftings of the Head of the Delta

This seems to throw a little light upon the foregoing problem. The slope of the Nile in the Delta is very slight & diversion of the stream is therefore easy; but it seems more reasonable to ascribe changes in the Head of the Delta to the flood-plain failing to

* Fork of the legs of Osiris

* In the time of Ptolemy II, c 269 BC, head of the Delta
is at Helioptis: this the source of Ptolemy's second
or Helioptis Canal. cf p 131

* (6) and (7) are emphatic sentences of Sir Wm. Willcocks

Near pari-passu with the river-bed. In any case, we find that the head of the Delta has varied very considerably in the course of the ages: -

- (1) In the time of Herodotus: ≈ 450 B.C., it was at Kerkasoros, now Shubra, about 6 miles north of the Roda gauge. (ii. 15)
- (2) In the time of Strabo: ≈ 24 B.C., it was near Heliopolis, about 11 miles north of the Roda nilometer. xvii. i. 30
- (3) In the time of Ptolemy: ≈ 75 A.D., it was 15 M.P. below Memphis, or about 2.5 miles north of the Roda nilometer (H.N. V. 9.)
- (4) In the time of Trajan, ≈ 120 A.D., it was at Babylon, or a little north of the Roda nilometer. Cf. Ptolemy. p. 18
- (5) In the time of Umar, ≈ 640 ^{A.D.}, it was at the same place (Forstot).
- (6) 'From the seventh to the twelfth century, it has apparently been approaching Cairo.'
- (7) 'From the twelfth century, it has been receding from Cairo.'
- (8) To-day it is at the Barrage or about 15.5 miles ^{north of} (below) Roda

We now note that the Canals of Ptolemy ii (second canal), of Irajan, & of Camar were drawn from the head of the Delta, not from Bubastis, nor Phacusa, as was the case with the earlier canals thro' the Wadi Sumilat. The gain, however, from making the "off-take" of a canal from the head of the Delta, instead of lower down-stream, must have been a gain in volume of water only, not a gain in "head" or driving power. This latter, indeed, was not wanted & did not exist, because the upper parts of these Heliopolite canals (p 19) ran alongside the Pelusiac arm of the Nile & upon the same plane, till $1\frac{1}{2}$ joined the Wadi Sumilat canal proper.

The "off-take" of the Wadi Sumilat Canals: p 19

It has been shown that these were Bubastis & Phacusa, on the Tanitic & the Pelusiac arms of the Nile respectively, joining each other by a cross branch & on the same parallel of latitude or thereby. It is therefore of necessity to deal with the Phacusan "off-take" of these Wadi Sumilat canals. That has been shown to be in the region of Sapt el-Kenna (pp. 60.61), & it is desirable to discover both the zero of this "off-take" and its high water levels. These can only be ascertained theoretically & yet with a fair amount of precision; for the regimen of the Nile (regimen)

Survey Dept.

Jissot: Statistique de l'Égypte (1873)

and its deposit of Nile alluvium are really fixed quantities throughout the ages. Cf pp. 98-99. We may, therefore set up a theoretical zero and a theoretical inundation level for a theoretical nilometer at Phacusa or Saft el Kenna thus: -

- (1) The zero of the Roda nilometer is a theoretical figure
The new survey of the Irrigation Department of Egypt has slightly raised its level compared with that of 1906; & now it is taken at 12.5 metres above mean sea-level of the Mediterranean. Cf sym. Nil p 321. Let it be put at 41 ft above ~~that~~ datum-level.
- (2) The slope of the Nile in the Delta at Low Water is $= 1/20,000$
 $= 3.17$ inches per mile: The slope for High Water $= 1/13,000$
 $= 4.87$ inches per mile (Willcocks)
- (3) The distance of Saft el Kenna from the Roda nilometer is 50 miles
- (4) The zero of our theoretical nilometer at Saft el Kenna, being 50 miles down stream on a slope $= 3.17$ inches per mile is 50 x 3.17 inches $= 158.2$ ft below the zero of the Roda Nilometer. Its height, therefore, above mean sea-level of the Mediterranean is 410 - 158.2 = 251.8 ft

Similarly we may discover High Water (inundation) for our Theoretical Nilometer at Tolacasa (Saff el Kenna) thus:-

(1) High water at Roda nilometer is = zero level $\pm$ inundation rise = $41.0 + 23.5 = 64.5$ ft above mean sea-level of the Mediterranean

(2) The High Water level of our Theoretical nilometer at Saff el Kenna, being 50 miles down stream on a slope of 4.87 inches = $50 \times 4.87 \text{ inches} = 20.3 \text{ ft}$. Its height, therefore above mean sea-level of the Mediterranean is $64.5 - 20.3 = 44.2 \text{ ft}$

Hence, from Theoretical nilometer at Saff el-Kenna:-

(1) Zero = 27.8 ft above mean sea level (Med)
 (2) High water = 44.2 ft above mean sea level (Med)

Hence (3) Rise of the Nile at Saff el-Kenna is = $44.2 - 27.8 = \underline{\underline{16.4 \text{ feet}}}$

The use of the Wadi Jumilat Canals during the inundation was thus on an average = 16.4 ft.

*N. B. The cause of the difference between the two seas in this respect is, doubtless, the attraction of the mighty Jebel Ataka in the region of Suez. The Indian Survey showed that the sea-surface is 300 ft. nearer the centre of the earth at Ceylon than at the Indus Delta, owing to the attraction of the Himalayas. Prof. Hull calculated that the sea-surface is 2000 ft. nearer the centre of the earth at the Sandwich Islands than on the west coast of South America owing to the attraction of the Andes. When Nero was engaging himself in the project of cutting thro' the Isthmus of Corinth, Egyptian engineers declared that the seas on each side were at different levels.

Alleged Difference of Level between the Mediterranean & the Red Sea.

There are introduced to our notice by Aristotle (p. 12) in connection with the Isthmian Canals (p. 13) of Sesostris & Darius. This point has received little attention hitherto. No explanation of it has hitherto been attempted, tho' Pliny gives us precisely the value of this difference alleged of level as three cubits (p. 17). The particular cubit used here is not mentioned, but presumably it is the common Egyptian cubit - i.e. "the public or carpenter's cubit" = 0.450 metre = 1.476 ft. Hence three cubits = 4.43 ft. The difference in the levels of the Mediterranean & the Red Sea is a fact. Linant Bey's repeated surveys, & the rectification of these by the international commission of engineers leave no doubt about it. Linant's figures are these:-

Low water in Mediterranean	0.00 ft	} of Jackson:
High water in Mediterranean	1.25 ft	
Low water in Red Sea at Suez	2.43 ft	} Hydraulic Works
High water in Red Sea at Suez	7.94 ft	

p. 184

Hence mean sea-level of Mediterranean = 0.62 ft

Hence also mean sea-level of Red Sea = 5.18 ft

Hence mean difference of levels between the two seas becomes } = 4.56 ft
 = 3 cubits +

* At 4.4 inches per mile as against 4.6 inches per mile:
i.e. a difference of 20 inches in a 100 miles!

* of new marvellous drainage works in the oasis
of Kharga

This is a very surprising agreement; yet it is one, no doubt, based upon an accurate survey. Prof. Breasted shows that Amenemhat iii (1849-1801 B.C.) made a cadastral survey of Egypt. Captain Lyons shows that the ancient Egyptians had instruments of precision for taking land-levels - the instrument used being a right-angled isosceles triangle of wood with a plumb-line, used on a long wooden straight-edge resting on pickets. He also quotes Borchardt as showing that the Egyptians carried out levelling from the head of the Delta to the first cataract in connection with Nilometers which were built at very important towns. The average slope deduced from scales on these Nilometer works being $\frac{1}{14,400}$ as against $\frac{1}{13,700}$ of the Longford Service of to-day. Cf Lyons: Cadastral Survey of Egypt pp 51. 52. The engineers of Sesostris were therefore quite likely to find out a difference of three cubits between the mean levels of the two seas. In the engineers of Samsar & in his own engineers, Darius was, no doubt, equally fortunate. The further bearing of this difference of level between the two seas will soon become manifest (p). Much more remains to be said here, did space permit.

The 'ΕΥΡΩΠΙΟΣ of the Phoenician Canal

* Here sides & counter-sides prevailed against
each other many times a day. Of Austali, Shabo,
Shing, Cicew, Mela.

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Strabo relates that the Ptolemaic Kings made close
the ἑρπίπυς of their canal (cf p 15). Writers,
almost invariably, translate this term ἑρπίπυς as
sluice or lock. But Diodorus gives as precise
equivalents for these the words ὀΐρα and διαγγρα-
μα. The ἑρπίπυς must therefore bear a different
meaning. The original ἑρπίπυς was the channel
between the island of Euboea & the mainland of
Boeotia. The foregoing term then came to denote a
tidal channel, or a strait beset with tides. Such
precisely was the outlet of the Wadi Sumilat Canal
or rather the Nile-arm through the Wadi Sumilat
before Ahmedy ii undertook to canalize it afresh.
Some two centuries & a half intervened between
his work & that of Darius i. No doubt, the Red Sea,
which still extended so far, had studded the mouth
of the old Canal of Darius, making it perilous:
the tides themselves penetrating far up the Wadi
Sumilat "at full & change of moon". The first
thing to be done was to shut out the sea by em-
bankments, so as to form a channel of the di-
mensions of a ship-canal at the mouth of
the Wadi Sumilat. This is what Strabo means by
making the ἑρπίπυς .. κασιόπυς of p 15a

It is possible to go further & ascertain the slope of this

Canal lying between Phacusa = Sift el Henra and
Arsinoe - Cleopatra = Magfar

- (1) Rise of alluvium of Wadi Jumilat = 4.5 inches or $3/8$ ft
per century. Cf p103
- (2) Interval between to-day & day of Ptolemy ii = 21.5 cent
- (3) Rise of alluvium of Wadi Jumilat in 21.5 centuries (miles)
= $21.5 \times 3/8 \text{ ft} = 8.1 \text{ ft}$.
- (4) Zero of theoretical nilometer at Phacusa ut supra is
 - (a) To-day = 27.8 ft above the Mediterranean
 - (b) In Ptolemy's time = $27.8 - 8.1 = 19.7 \text{ ft}$ " " "
- (5) But this height of 19.7 ft is to be referred now to the
Red Sea at high water, which is 7.0 ft higher than the
Mediterranean ut supra
- (6) Thus this height of 19.7 ft referred to high water of the
Red Sea becomes = $19.7 - 7.0 = 12.7 \text{ ft}$.
- (7) This height of 12.7 ft is spread over the whole length
of the Wadi Jumilat Canal between Phacusa &
Arsinoe - Cleopatra ut supra
- (8) Slope therefore of the Wadi Jumilat Canal, referred
as above to the Red Sea = $12.7 \times 12/38 \text{ inches} = 4 \text{ inches}$
per mile.

Similarly it can be shown that with high water of theoretical
nilometer at Phacusa, ut supra, = 44.2 ft above the
Mediterranean (p108), this referred to high water of
the Red Sea ut supra gives a slope for the Wadi

Jumilat Canal = 9.2 inches per mile.

The current on a slope of 4.0 inches per mile would be about 4 miles per hour; & the current on a slope of 9.2 inches per mile would be about 10 miles per hour. Such a current would make navigation difficult for Nile boats & larger vessels.

The *Sia Gpayua* & *Pidotexrov* of Divdorus almost certainly denotes a lock-gate. Two of them arranged to open outwards towards the sea would permit free egress of the canalised river at the inundation & would offer little difficulty to the passage of vessels either way.

When the 'εοριππος was left unprotected by a *Sia-Gpayua*, as above, the tidal waters must have penetrated the channel of the Wadi Jumilat to a very considerable distance. Take the extreme case of zero at Phacusa & low water at Arsinoe, then it can be shown that the slope of the Wadi Jumilat becomes 6.2 inches per mile. When therefore the high water at Arsinoe rose to its full extent of 7 ft., the tidal waters of the Red Sea must have penetrated the channel of the Wadi Jumilat some 13 miles. Rozière & Leperier's maps show that the waters of the Red Sea could penetrate as far

as far as possible, the Red Sea waters would penetrate far beyond Maffar. Lepsius admits so much. Cf

Dimensions of the old Wadi Sumdat Canals.

Strabo gives 100 cubits as the breadth of Ptolemy's Canal & Pliny makes it 100 ft, with a depth of 30 ft. ^{15.17} Cf pp. Both probably think of the breadth at the water-line; but the foregoing figures are worthless, or almost so; as the breadth & depth of the old Canals must have varied with the ground thro' which they passed & with their different exposures to sand-dept at different places. Herodotus tells how Necho aimed at constructing a canal sufficient in breadth for two Biremes to be rowed abreast (p 10) The dimensions of an Attic Bireme, after Boeckh & Graser, are:- Length ≈ 140 ft; Breadth at water-line ≈ 14 ft; oars 6 of 14 ft in uppermost tier, 5 of 10 ft in middle tier, 5 of 7.5 ft in lowest tier; draught ≈ 7 & 8 ft. One Bireme with such a spread of oars would require at least a space of $(6 + 14 + 6 =) 26$ ft. Two Biremes when rowed abreast would require at least 3×26 or 78 ft. The estimate of Pliny sums just, & that of Strabo is not far astray.

The French Engineers of the Expedition found traces of the old Canals (Amar's or Hakem's) in the Wadi Sumdat, showing a breadth of 60 & 80

Cf Macdaren, 50 m; Jalabir 40-50 m;
Captain Newbold, 64-70 paces (=160-175 ft)

* G. Rankine's Civil Engineering.

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meters (Maccaren) or 90 meters (Talabot). Over the
Chalouf, the remains of the old Canal, probably
Hakimis, showed a breadth of some 50 meters. All
observations were greatly improved by the exceedingly
fresh appearance of the banks & bottom of the old
Canal in this region. Talabot remarks upon its
irregular outlines & compares it with the regular
works of the old canal in the region of the Wadi Rum
lat; declaring that the former was purely Arabic, whilst the
remains of the latter possessed the appearance & regularity
characteristic of the ancient Pharaohs. Cf
Revue des Deux Mondes: Vol V (1855): p 487. This
point is of further interest. Cf p.

The engineering formulae proper to an ordinary canal are
these: -

- i Least breadth at bottom = $2 \times$ greatest breadth of boat
- ii Least depth of water = $1.5 \text{ ft} +$ greatest draught of boat
- iii Least area of water-way = $6 \times$ greatest midship section of boat

But it is evident that these formulae are not really applicable;
in the old Wadi Rumlat Canal was essentially
a river, subject to a periodic rise of some 16
feet at least (p 108) & the depth of the canal must
have been such as to keep the Nile Flood flowing through
it, within the limits of its channel

N.B. The Khaliph Harun er Raschid wished to
unite the two seas by an Isthmian canal &
be supplied with water from the Nile, but
gave up the idea, as this (impracticable)
scheme would involve too great a loss of
Nile water. Cf. Dabryère i. 176

Were the Wade Sumilat Canals Perennial or Seasonal?

No history exists on the subject, but certain considerations would indicate that these canals were navigable for some four months only - two on each side of the maximum rise of the canal:-

- (1) A canal which would be navigable for sea-going vessels would require a supply of water little less than that of any of the ~~main~~ branches of the Nile flowing into the Delta & the Mediterranean. Such a supply would mean the cutting off of the Pelusiac arm of the Nile, as happened at the opening of Lemais Canal. Cf p.
- (2) Even if a supply of water were available, problems about sluices, locks, &c present themselves here, which would probably have been beyond the skill & the resources^{ces} of Egyptian, Persian, & Greek engineers; not to mention the Arabic ones.
- (3) Even if such skill & resources had been at hand, the gains accruing from such a perennial canal would have found been poor compensation for the vast expenditure involved in repairs, working, &c.
- (4) The Wade Sumilat Canals were always of secondary importance to Egyptian commerce foreign, which usually preferred to use the Nile route to upper parts of Egypt, one of the wadis between the Nile, & some Red Sea port. The later canals were used

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almost entirely, if not altogether, for the import of elephants
& stones.

With considerable assurance, therefore, we may dismiss the
idea that the Trade Sumilat Canals were available
for navigation for more than four months in the
year. Navigation of the Trade Sumilat Canal, at
or about the time of the inundation, is indicated by
the return of the fleet of Sathmes iii about October,
as already mentioned. Cf p. 52a

History of the Four Ancient Canals.

It is enough to deal slightly with this part of our subject,
as detailed history is clearly out of the question in
this regard, tho' the historical situation always re-
quires close attention:—

1 The so-called Canal of Sesosthis.

The name of Seti i has been associated with this Canal
on the authority of Brugsch, who interpreted on this
wall scene 9 on the northern wall of the Hypostyle
Hall of Karnak. There Seti is depicted as
returning from the fortress town of Zaku from

the first campaign in Syria. He crowns "the cutting" - "Ta
denat", which separates Egypt from the desert, by
a bridge. The stream underneath swarms with fishes
& crocodiles. Brugsch, Meypre, regarded the stream
as the canal uniting the Red Sea & the Mediterranean.
This view has gained wide acceptance & appears in Prof.
Petrie's History of Egypt: vol iii p 13. But the for-
tress town called Zadi - the Sile of the Antonine
Itinerary - has now been identified by excavation &
inscriptions, - as Kantarah, "the Bridge", at
the 45th kilometre of the Suez Canal of Naville:
Archaeology pp 38-39. Even this bridge have surged
invading & conquering hosts from the times of Ramses
iii of the 18th dynasty down to the ^{attempted} incursion of
the Turks in February 1915. The canal of Seki
so-called thus turns out to be the Pelusiac arm of
the Nile which ran this Zadi-side. It has nothing
whatever to do with a marine canal between the
Mediterranean & the Red Sea. That would have been,
as now, a salt-water canal. As such it would
have contained no crocodiles, which are anything
but salt-water animals. Among reptiles of
this order, only the Croc. biporcatus ventures at
Ainass into the sea. That fact alone should
have prevented the idea of the canal at Zadi being
a canal between the two seas. This canal

or "cutting" may be the Siche of Scripture - the
Horus - Sei a Horus Lake of the ancient Egyptians.
G. Rouge La Bane Eg. pp 93. 95. 101

The foregoing, however, settles nothing about the Canal of Sesostus.
Herodotus does not mention his name in connection with any
Canal in particular, ~~that~~ he has much ~~that~~ is fabulous to
say about him otherwise. Many regard the "Sesostus
tradition" of the Wade Jumilat canal as post-
Herodotean & probably it is so. But who is this
Sesostus of Aristotle, Diodore, Strabo, & others?

There are three kings of this name belonging to the XIIth
dynasty - each of them great as conqueror, ruler, &
organizer of the resources of Egypt. They all carry on
important works on Lake Moeris in the Fayum. Amen-
emhat iii brings there a highly successful enclosure &
sets up the earliest nilometer at Semna by the
second cataract. Prof Petrie shows that kings of the 12th
dynasty had relations with establishments on the side
of Tell el Retabeh. Lieblein has gone so far as to
assert that Amenemhat iii canalized the Wade
Jumilat. (But this may well be doubted), as the
earliest nome-lists - those of the reign of Sesi i -
show that the nomes of Lower Egypt end with
the Heliopolite nome. The Wade Jumilat,

* The late Sir George Maspero has shown how Ramesses
II becomes the Sesotris of the Persian Period
and the Cosmambyses of the Ptolemaic Period
of Popular Stories of Ancient Egypt pp 180...

was not organized as a nome in the time of Seti I. But his son Ramses II builds both Raamses-Town & Pi-Thomas in the Wadi Sumilat. The poem of Pantusa shows that the former is a garden-city, the seat of government, and a sea-port (p.). These things agree well with the canalizing of the Wadi Sumilat of Ramses II, whose name is otherwise Sesostriis - a name of Semitic origin, after his popular name Sesusraya, found on several monuments.

Whilst there is good reason for connecting the name of Ramses II as Sesostriis with the Wadi Sumilat Canal, Aristotle connects this name with what is distinctly an Isthmian Canal, & connects the two seas. There is excellent reason for supposing that this Sesostriis is again Ramses II. After making peace with the Greeks in his 22nd year, he had the leisure, the man-power, & other resources for accomplishing such a scheme, which [which would give direct access] would greatly benefit his kingdom, both from the military & the commercial point of view. The excavation offered no insuperable difficulty. The line of the proposed canal would run mostly ~~through~~ the Nile-alluvium. But the survey showed the Red Sea to be higher than the Mediterranean, higher than the low-lying areas of the Delta. The project thus went no further.

The Northern or Isthmian Canal failed to materialise

ii The Canal of Necho II (610-594 BC)

Very much could easily be written about him, were this the place for it. He was an ambitious son of an ambitious father. Both had developed the naval & military forces of Egypt with the aid of the Greeks. At Niniveh, the capital of the Assyrian kingdom, was now threatening to fall, Necho lost no time in fitting out his expedition to Syria, 609 BC. Sweeping, Sennacherib, King of Judah, from his path, he over-ran Northern Syria as far as the Euphrates & returns to Egypt in triumph after a few months absence. There are many & strong reasons for believing that Necho went to Syria by sea & not by land, but these cannot be advanced here. It is almost certain, as a sequel to such a course, that Necho took Suez on his return from his northern campaign. Be that, however, as it may, Necho must have returned with a vast multitude of captives, & it is altogether likely that the digging of his canal began upon his return, with the help of these numerous prisoners of war. The canalisation of the Nile-arm thro' the Isthmus of Suez was thus probably quite a small matter & soon accomplished.

* The invasion took place in the 37th year of Nebuchad-
nezzar: attested by Prof. Sayce's cylinder:
cf Academy XXV (1884) p 51 Nesutur,
governor in Upper Egypt, under Merneptah^{who} quells a
revolt of Egyptian troops there has nothing to do
with Nebuchadnezzar

Cf Alexander of Macedonia lays the bones of Sennacherib in
a temple or pavilion called Tetrapylon at Hama.

Necho's connection with an Isthmian or Northern Canal remains a matter of speculation. ~~Q~~ Herodotus couples his name with such an enterprise, making him attempt a water-way from the Pelusiac mouth of the Nile to the Arabian Gulf or Red Sea. (p. 13) Herodotus speaks of him as building fleets upon both the Mediterranean & the Red Sea. Necho had evidently great commercial schemes on hand & a canal between the two seas is not unlikely. But its execution is arrested: by an oracle, according to Herodotus: by his defeat at the hands of Nebuchadnezzar in the battle of Carchemish on the Euphrates, 605 B.C., according to Wiedemann & many others. Nevertheless, there seems to be much truth in the version of Herodotus; for the oracle is, in all likelihood, the oracle of the prophet Jeremiah, who twice prophesied the invasion of Egypt by Nebuchadnezzar. Cf. Jer. xl.iii. 8-13: ~~XVI~~ 14-16. This may seem an adventurous proposition, unless we bear in mind the fact that Jeremiah's personality had assumed an international importance during the siege of Jerusalem & at its fall in 586 B.C. He was held in highest esteem by Nebuchadnezzar & his subsequent prophesying in Egypt (at Tel Defenneh: Cf.) against Egypt seems to have been well remembered in Egypt itself. But in this supposed relation of Jeremiah to the "oracle" of Herodotus, no stress is here laid.

+ The Hyksos at Avaris number 240,000 ^{90. c. ap. i f 14} do do
the Asmat (Numd. ii. 30; whilst the empire
Israelites number 250,000 c/90. c. ap. i f 32

The "nacli" would have great efficacy, if Necho was at the time of its delivery engaged in an Isthmian or Northern Canal; in its completion would have been of great advantage to Nebuchadnezzar, as further laying Egypt open to attack from the Northern or the Southern Sea.

The testimony of Herodotus as to the death of 120,000 men in digging a canal is probably an exaggeration in point of numbers. Indeed 240,000 is rather a conventional figure in the history of ancient Egypt, & this 120,000 is a submultiple of it. In 1819 Mehemet Ali set 250,000 peasants to work on the Mahmudiyah Canal. Its length was about 50 miles, its average breadth about 100 ft. The work continued about a year & the people who perished of accident, hunger, & plague numbered not less than 20,000. Necho might have 120,000 working on the Northern or Isthmian Canal. The work then done is nearly equal to that done on Ali's Canal & the number, who might have perished under conditions, ut supra, should not have been more than some 10,000. If anything, like the number mentioned by Herodotus, perished, then we might reasonably suppose an outbreak of Pestis fulminans. The region around about Lake Serbonis had a bad reputation in this respect & the Scythians who

* Something of this sort may underlie the report
of Herodotus regarding the smiting of the
Scythians by Euboeat Venus. i. 105. The
account of Hipparchus^{-ocrates} regarding the Enarets of
Herodotus may in part corroborate the foregoing
view. Cf

Cf Herod ii, 141 *Scythians*.

attempted an invasion of Egypt in the time of Pscho's father may have retired from the frontier plague-stricken*, without the gifts & prayers of Psammethichus, as Herodotus asserts (1105). The Herodotean account of the disaster which befell Sennacherib in the region of Pelusium may also point to plague, as indicated by the mouse in the hand of the priest of Vulcan so-called (ii. 141). All that one can conjecture here is, that if Pscho suffered the loss of even 10 per cent. of the number of men set down by Herodotus, an outbreak of plague may be suspected as the cause. Such a cause was likely to operate in the region of d. Serbonis or Pelusium & in this region Pscho may have been attempting an Isthmian Canal.

The Canal or Canals of Darius: 521-485 B.C.

i The Wade Humilat Canal. This is the one specially described by Herodotus. Remembering that the work here is simply the repairing of a canal^{river} which, in the dry season, such repair was a simple matter. There need be no hesitation whatever in accepting the statement of Herodotus as to its completion; all the more that he visited Egypt some 30 years after the death of Darius, during the inundation $\approx$ 455 B.C.

- ii) The Southern Canal. It was marked out by imposing stelae, bearing the figure of Darius with inscriptions in four languages - Egyptian on one side, with Persian, Median, & Assyrian on the other. The detailed history of the discovery of these monuments cannot be given here. Suffice it to say that they were found more or less along the line of the present Fresh-water Canal going from the Nile to Suez. Their relative positions are those, so far as yet ascertained:
- (1) The Tell el Maskoutah (Pithon) monument, one kilometre south of Tell el Maskoutah
 - (2) The Serapeum monument, at the 14th kilometre on the Fresh-water Canal
 - (3) The Tehaluf monument, at the 61st kilometre on the Fresh-water Canal. (12 kms from Tehaluf)
 - (4) The Suez monument, at the 83rd kilometre on the Fresh-water Canal. (7 kms north of Suez)

No one has hitherto noticed that these monuments are symmetrically disposed. Thus:-

- (1) Distance between the Tell el Maskoutah monument & that of the Serapeum ≤ 23 kms
- (2) Distance between the Suez monument and that of the Tehaluf ≤ 23 kms
- (3) Distance between the Tehaluf & the Serapeum monuments $\approx 2 \times 23$ kms

Tell el Maschoutah Stele

Serapeum Stele 14 km on the Fresh-water Canal

Dumhuir Stele (?) 37 km " " " "

Chaluf Stele 60 km " " " "

Suez Stele 83 km " " " "

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* The form the Tell el Maschoutah monument

The last stem points to the probable or certain existence formerly of a monument half way between the Chalcoph & the Serapeum Monument. This becomes even so much more probable when we remember that 23 kilometres closely represents the average distance between the post-houses on the great highway from Sais, past Sardin, to Ephesus, is between 14 & 15 miles. Cf. Rundt IV. 52. These represent some four parasangs. The symmetry of the distribution thus calls for a stile. Now Rozzière discovered & in part deciphered a stile, now lost, which once stood at 6.5 hrs north of Suez. But this 6.5 hours' journey on camel-back is again between 14 & 15 miles or 23 kilometres. Here, therefore, near the Fresh-water Canal may this last monument still be recovered: this being apparently that which was seen & also lost by Devilliers during the time of the French Survey here.

Of the four monuments, whose sites are known, that near Suez has long been reduced to fragments, that of ^{the Serapeum} Chalcoph has been reduced to powder; that of the Chalcoph & that of Tell el Masakhat are in fragments, from which only the sublimest patience & genius have been able to exhaust any information about the Southern Canal. The Chalcoph Stile, such as it is, has been carefully studied. It was inscribed in four languages - Egyptian, (hieroglyphic), Persian, Media, & Assyrian. The Egyptian occupied one

side, the other three languages the other. The Egyptian was translated by Maspero, the Persian of Effert, the last lines of the Medes lost are defective, & ~~those of the Assyrian~~ ~~lost~~ is altogether wanting. Effert's translation denied outright the completion of this canal. Its crucial part thus runs: "Darius the King says" I am a Persian, with the aid of Persia, I conquered Egypt. I ordered this canal to be dug, from the River named Pirava (Nile), which flows in Egypt, until the sea which is in communication with Persia. Then this canal was dug there as I ordered it. But I said thus: Now go & destroy the half of the canal from the town of Bira, until the sea, for thus is my will."

Cf Records of the Past: IX pp 80-81 (1st series)

The whole subject has been studied afresh with the most excellent results in the "Recueil des Travaux..."

- (1) S. Maspero: VII. pp 1-8 (1886)
- (2) J. Méisant: IX. pp 131-157 (1887)
- (3) S. Dariusy: XI. pp 160-171 (1889)
- (4) W. Solimischeff: XII. pp 99-109 (1890)

Without entering into particulars, it is now well known that Effert simply inserted the letters which, in the crucial part, denote - destroy - & the word Bira

Ayâtâ	kaca	[Bira]ya	[na:]mami
He	inde a	Bira	dimidium

y u v i y a m a b i y p â [ram. vika] t a
 canalem usque ad littus dirvite

Maspero, Naville, & others could find nothing like Bira in
 the debris of the text. Maspero could find only the ending
 of a mutilated phrase - "When they reached Piri ... water"
 He regarded Piri as uncertain but was tempted to read
 Piris, Pirs, Pirst - which might be Persia. Efforts
 simply introduced the critical term [vika] t a =
 "destruy": the cuneiform text having here a lacuna
 followed by the letter ta. Minant, after many
 forceful remarks upon Efforts' venture here - [vika] t a
 - shows that Efforts intruded either vika - do not
 even fulfil the space requirements of the text. Dis-
 missing Efforts' embellishments, he would read the
 the disputed line simply "Hé! à partir de ...
 ce canal jusqu' au littoral, telle est ma volonté."
 In conclusion, he applies to the line under consideration
 the soaring words - Parcourez la Astaliti de
 ce canal jusqu' au la mer: telle est ma volonté

Dariusy in his "Révision des textes de la Stèle de
 Behistun", after some interesting suggestions, holds
 the completion of the Canal of Darius as proven:
 founding in line 3 of Fragment No. 9: - Ils ar-
 rivèrent en Perse en prenant (?) l'eau"; which

formula Darius understands, as denoting a voyage to Persia"
 In any case, he finds nothing in the hieroglyphs ~~and~~ to
 suppose a check upon the undertaking of Darius

Solémarschkeff deals with the last discovered Stela - that
 at Tell el Maskhousah. He finds twice on the Stela
 a reference to Shaba - land of the Sabaeans in South
 Arabia & finds Darius despatching a fleet to
 reconnoitre the sea. He too believes in the completion
 of the Canal of Darius

Conclusion. There can now be no reasonable doubt about
 the completion of what we have, for convenience, called
 the Southern Canal of Darius. The contents of the
 Stelae, thus far, agree well with the fact related by
 Herodotus, viz - the voyage from Caspatyrus (Cabal)
 in India to the Heluspote Gulf - & return there. This
 Southern Canal seems indicated by Herodotus in
 two things: (1) its turning south & south east into the
 Arabian Gulf (2) its length as equal to a four days'
 voyage (cf p 10). His account otherwise refers to
 the Wade Sumdat Canal

iii The Isthmian or Northern Canal. Such a canal
 would readily ^{commend} ~~commend~~ itself to one of the most
 successful rulers known to history. He had at his

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disposal abundance of men for such an enterprise, with
skilful engineers - Egyptian, Persian, & Greek (from Samos).
The excavation was not great in amount; but the dis-
covery of the difference of level between the two Seas put
an end to the project. Aristotle, in the most explicit
& exclusive manner, deals with this Isthmian Canal alone.

The Canals of Ptolemy II: 285-247. B.C.

- (1) The Wadi Sumilat Canal. Its completion is beyond
doubt. Its Administration at Arsinoe (Magfar) is
certain according to the testimony of classical writers.
There is also the testimony of the Pitheum-Stele, or, as
Naville, its discoverer calls it - the Stone of Pitheum
(p 18. ed. 3rd). Since his translation of this document, we
have the translation of Brugsch; & now the revised
version of the latter by Erman of *Zeitschrift für
Sprache: Bd xxxii. (1894)*. It attests the opening &
repairing of the Wadi Sumilat Canal by Ptolemy II in his
Sixth Year (pp 78. 79); followed by an expedition to
Persia for bringing back the lost gods of Egypt. It is,
however, in his Sixteenth Year that he digs his
Helio-polite Canal which ends in the Scorpion Lake.
In this same year he founds the city of Arsinoe
in honour of Arsinoe, his sister & wife; she having
died in the previous year. Now comes the fitting out

of a fleet of kamports from Kemverma (= Magfar
port) for hunting elephants. Bruché-Declercq has,
with rare insight, disclosed the secret of this movement.
Antiochus was preparing war against Ptolemy II, but
dissimulated his preparation. In the course of the year
275-274 BC, Antiochus got 20 elephants from Babylon
& Seleucia, & other things. In the spring of the year 273
he sets out with his army to Egypt. The Pithom-Stele
says that on his 11th year, Ptolemy, with his sister Arsinoe,
came to Heropolis & took after the defences of Egypt in
that quarter, also to inspect & hasten on the canal
for the fleet upon the two seas, if need should arise.
War was not yet declared. In the year 273 Ptolemy
sends an embassy to Rome & receives one in return from
Rome. At this juncture war was declared [^{between} the Romans]
against the Kings of Syria & Egypt. Now comes the
expedition to the land of the Sargolytes for elephants &
he hurried for war: Ptolemy being cut off from a
supply from India. The Pithom Stele evinces a
certain anxiety about the supply of these elephants.
The King tried to persuade them Sargolytes to give up
their taking of elephants that he might have more for
war; but the Elephantophagi refused to change
their habits, even for all the good things of Egypt. The
history of the war-Elephants, both before & after Ptolemy's
day, is an interesting story, which must here remain

cf Hist. Roman: Proem 10.

* Roughly 208-206 BC. *Classical Review* XII (1898).

untouched. African makes Ptolemy ii the possessor of 300 war-elephants - an obvious exaggeration. The import of elephants from the south continued until at least the reign of Ptolemy Philopater, as Hall has shown. Cf Classical Review: pp 274-276. Strabo gives a long list of places where elephants were hunted by the Ptolemies, even from Ptolemais Theron, just founded for this purpose, almost up to Cape Guardafui. Strabo. xvi. iv. 5-15.

ii The Helioptake Canal. This is the old Egyptian canal of the Helioptake nome called A-ti or A-i or Mui, which was the part of the Arabian nome. Cf Rougé: la Base - Égypte pp 4. 82. 140. It joined the Wadi Jumilat Canal in the neighbourhood of Belbeis.

The Canals of Ptolemy proved of little worth for general commerce & at a later date he filled up Berenice on the coast of the Red Sea as a port joined to Egypt on the Nile by a good road, well supplied with water. Cf Strabo. xvii. i. 45. The Canals were a necessity for the importation of elephants, & Diodorus shows how the elephant-transports often came to grief through stormy seas. Cf Diodore. iii ch 40.

Trajan's Canal: 98-117 A.D.

cf Revue des deux Mondes: xxvii. pp 215-235 (1842)
cf Recueil vol i pp 136-197 (1842)

This, as noted, is Ptolemy's Heliospolite Canal, joined in
 to the Wade Sumilat Canal. Ptolemy's statement
 concerning it is most concise, yet most meagre.
 Makrizi ascribes the construction, i.e. the repairing
 of this Canal with the name of Hadrian. That Trajan
 had a plan on hand, & that Hadrian executed that
 plan, is the idea of Makrizi & very likely in itself.
 Anyhow, there is good reason for refusing to accept the view
 of Gregorovius, based ultimately on Humboldt's Kosmos
 (ii p 204) that Trajan had before 106 A.D., not only
 restored the canal from Boubastis to Arsinoe, but
 had also made a branch to Babylon. Cf Gregorovius:
 "The Emperor Hadrian" i. p 131. His reign ended in the
 disaster of defeat at Alesyphum & his death followed close
 upon it. Cf Dio Cassius: Bk 68 ch 32. The canal was
 probably constructed shortly after the death of Trajan
 (in 117 A.D.). How this water-way was used for the im-
 portation of Porphyry & Granite from the Nile has
 been already noted & reasons have been given against
 the view that this Canal was picked up, or at least
 defunct, by the time of Septimius Severus, c. 205 to
 211 A.D. Schumme has dealt very fully with these
 quarries for porphyry & granite at Jebel Dokhan
 & Jebel Fokeerah respectively. These quarries for porphyry
 continued in use till the time of Diocletian, as
 Eusebius shows. The Augustan poem of Paulus

Silentiarius describing the building of the Church of St Sophia in Constantinople might be taken to indicate the closing of Trajan's Canal at a before ~~that~~ time, as porphyry is now described as being imported of the Nile

Ὀὐς ποτε οὐβὺς νείδωνς ἐδοχενσαρ ἐοκνμίδες
'ερίτρα. Description: i. vv 379. 380

ποδὺς δ' ἐυπαχεὶ νείδων γορτίδα πιδνοας
ποταμνίδα δαας ἀνισχων πορφυρεὺς V. 625-627

Yet the porphyry used was not all directly brought from the Hebrard. Gibbon shows ~~that~~ eight columns of it were taken from a temple of the sun dedicated by Aurelianus. It is impossible here to relate the journey of Wilkinson & Burton to these quarries (cf Jo. Roy. Geogr. Soc ii p 42...) nor the recent survey of these by the members of the Egyptian Survey Department. There is excellent reason for believing that Trajan's Canal continued in use, till closed by the Coptic Christians as a defence against invasion from Arabia, at the time of the rise of Islamism. Cf p. 90.

The Canal of Omar: 634-644 A.D.

This may be very lightly dealt with, as having been already described: -

i. Omar's Canal is Trajan's Canal restored.

This is the statement of all the responsible Arabic geographers

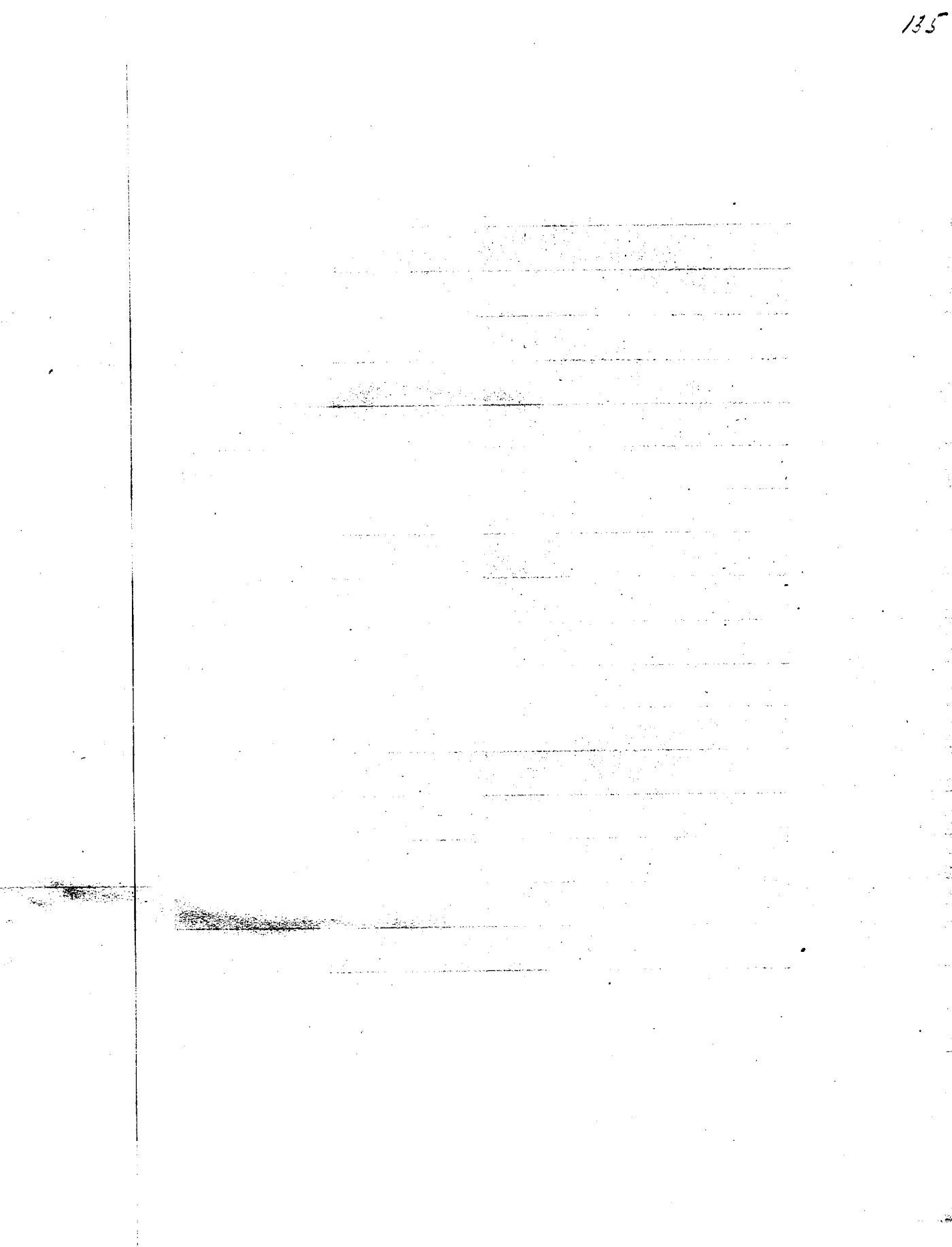
ii) This Canal ends in the region of the Wade Sumlat:—

(1) It ends at the place called the Soul of the Crocodile. So
 Al-Kundi & Ibn al ^{Abdul Hakim} Khayr. This, as already noted,
 is the western extremity of Lake Timsah up the Wade
 Sumlat. (2) Ibn al Khayr makes Qanari

Canal begin at the Sea of Sweet Water (Nile) & end
 at the Sea of Salt Water, at Kulzim, which, as shown,
 already recalls the more ancient Northern Telysma.

So also Na'rizi & Schems Eddin.

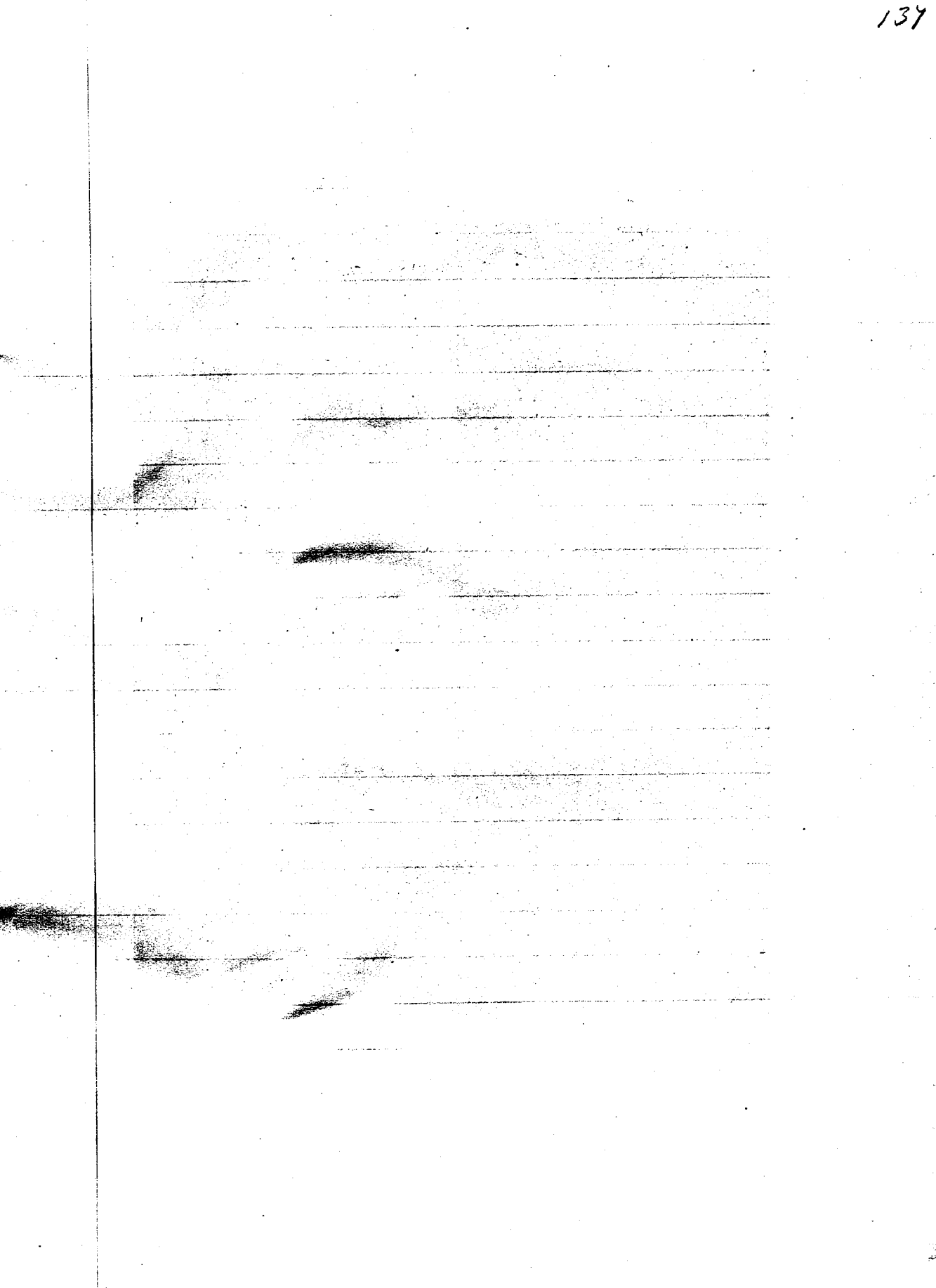
The continuance of this Canal until about 1350 ^{A.D.} has
 been already indicated. Cf p 93.

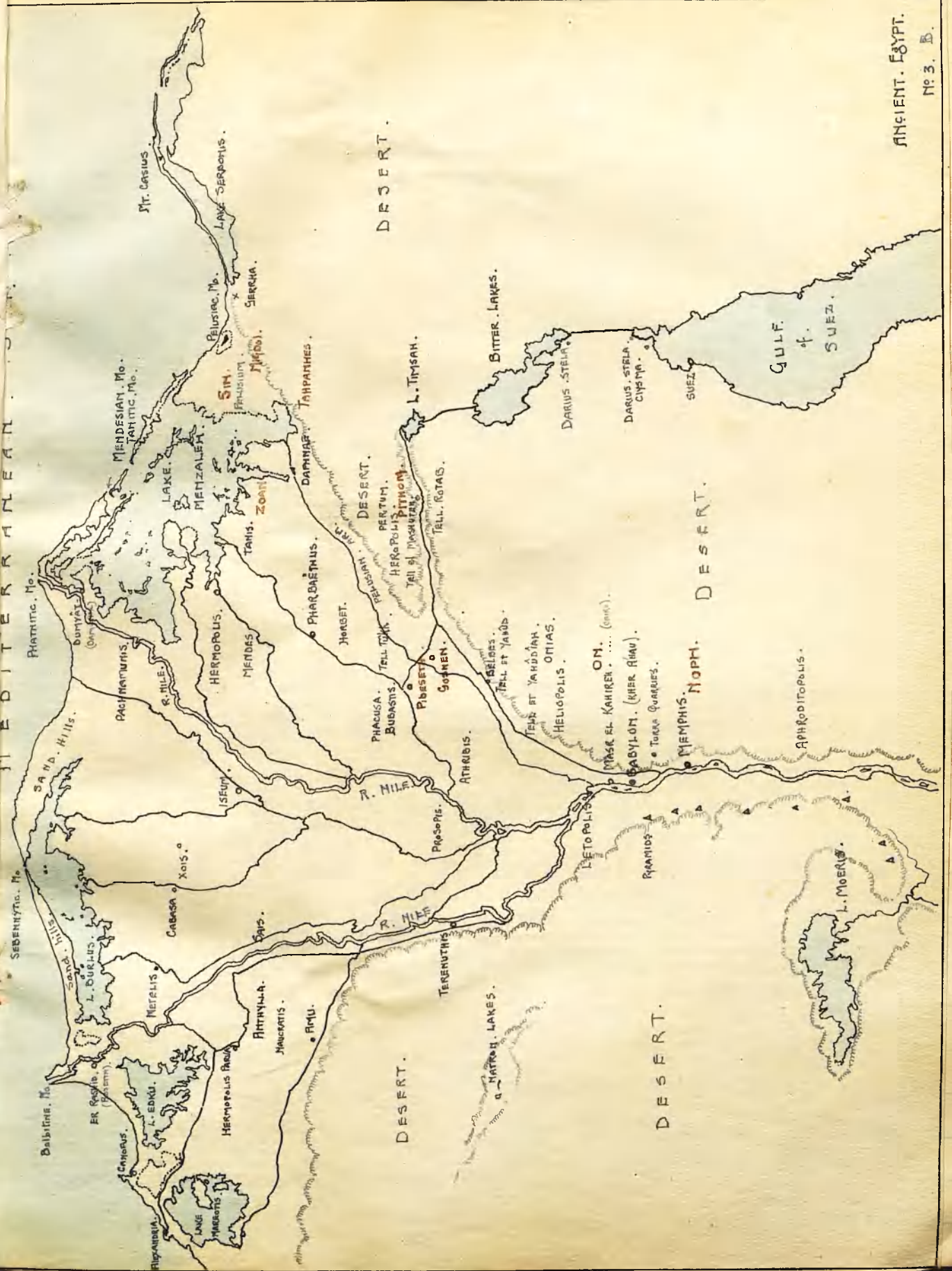




ANCIENT. EGYPT. No 1.

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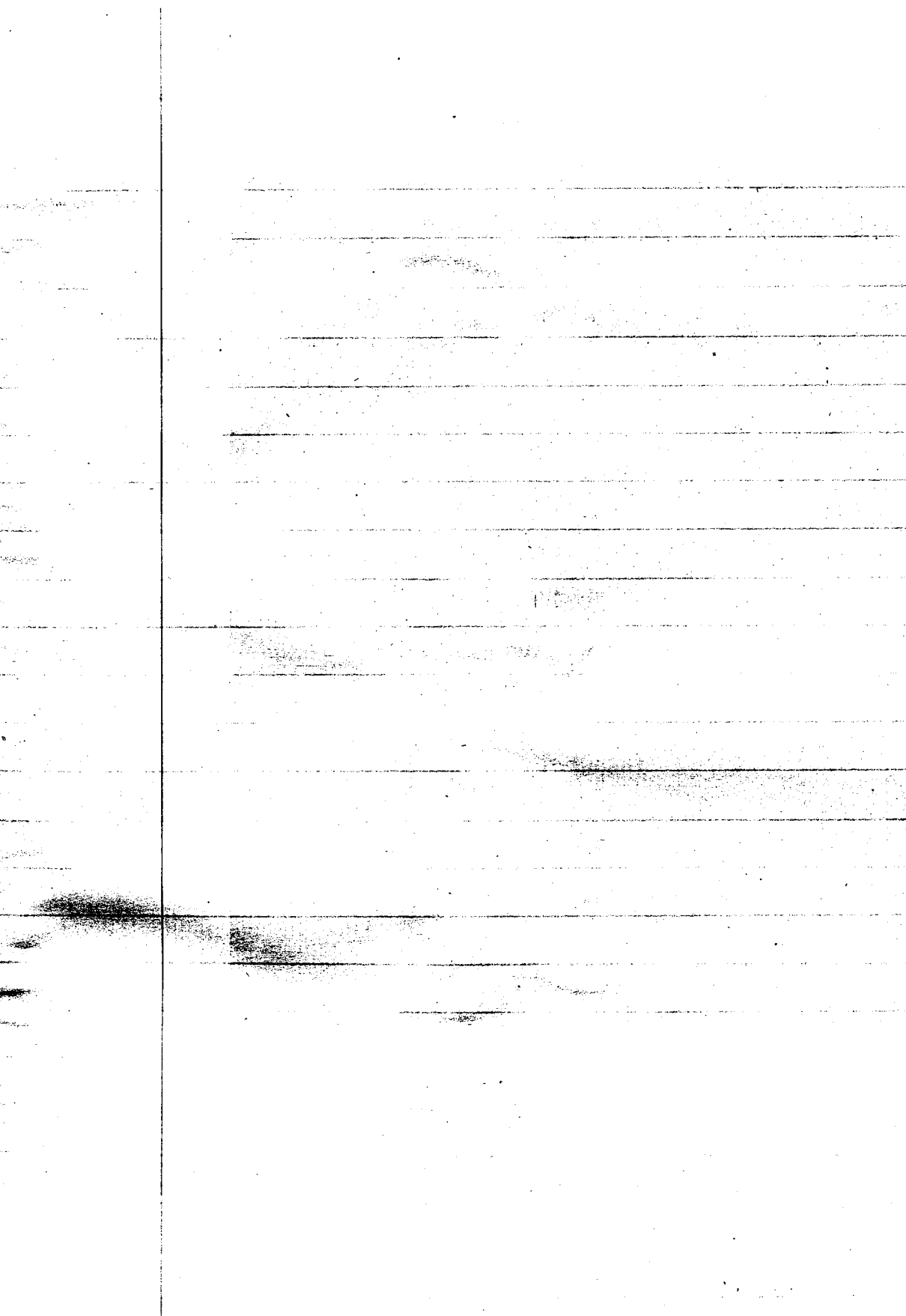
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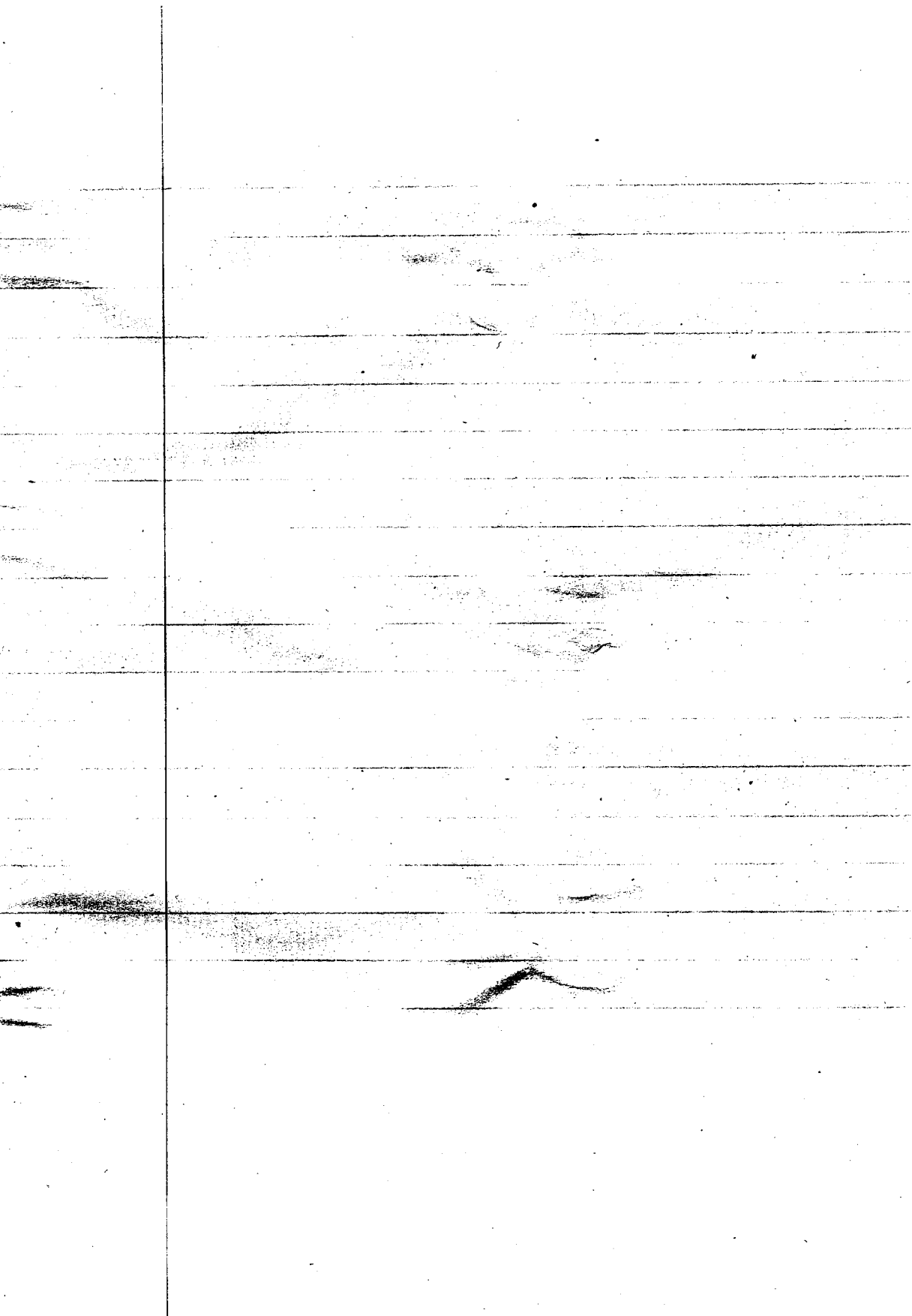
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G. M. Paulin Talabot.

Revue des Deux Mondes: X: 1855

ISTHME DE SUEZ.

Echelle de 1/1,000,000. B.

20,000 m

100,000M

longitudinal Section of the Nile:
 (diagrammatic after W. Meade)

Horizontal scale 1/12,000,000

Vertical scale 1/20,000

Victoria Lake
 Fowcira

Albert Lake
 Maganga

Sudds

6" cat.

5" cat.

4" cat.

3" cat.

2" cat.

3312

3472

miles 0 Ripon Falls 3628 ft

2060 ft

242 Gola Rapids 2034 ft

496 Jado 1761 ft

962 Jado

1101 Fashoda 1447 ft

1560 Khartoum 1256 ft

Solima
 Abu Nemed 1034 ft

2234 Dongola

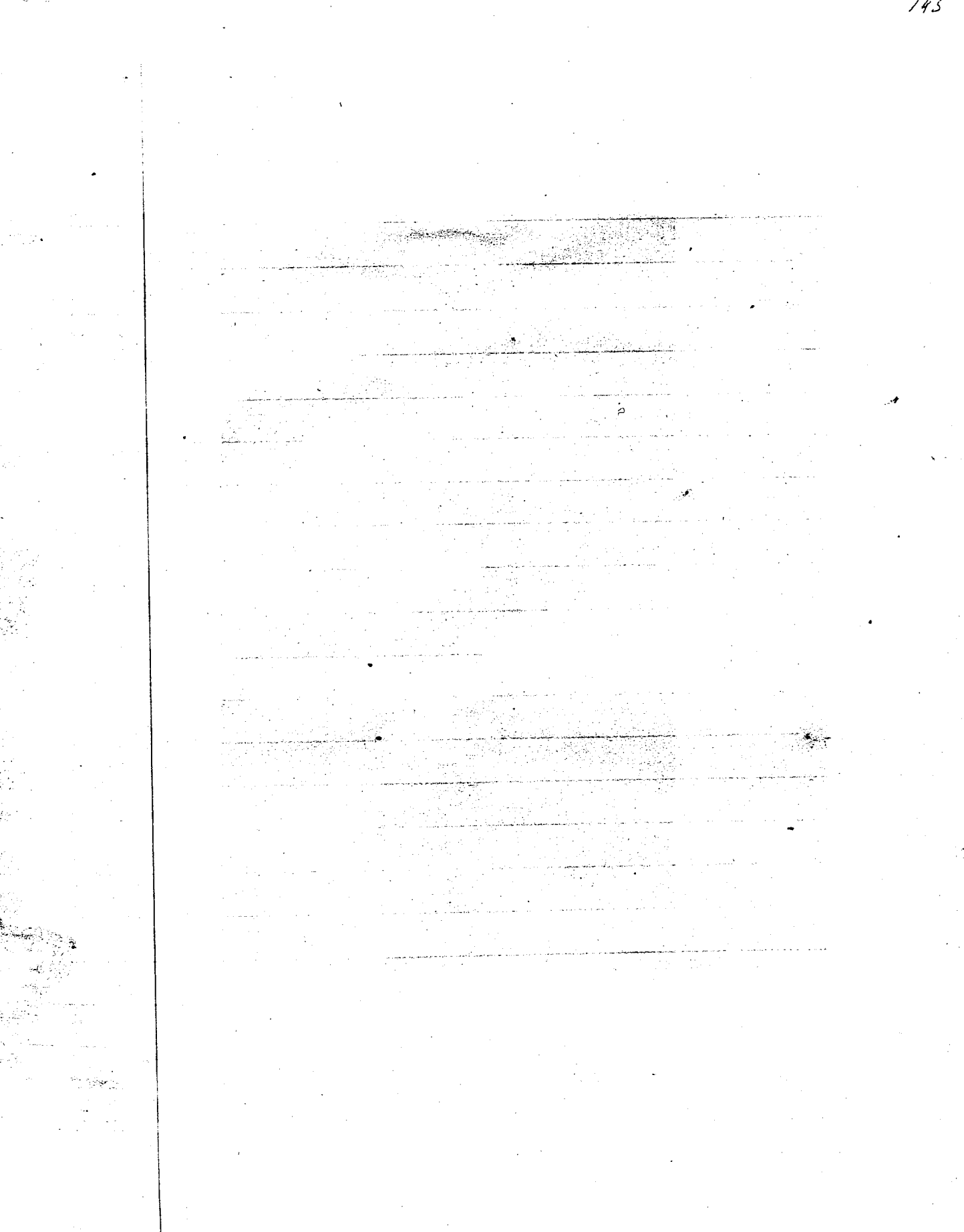
Amara

2510 Wadi Halfa 420 ft

2785 Aswan

Calix

Fasetta North

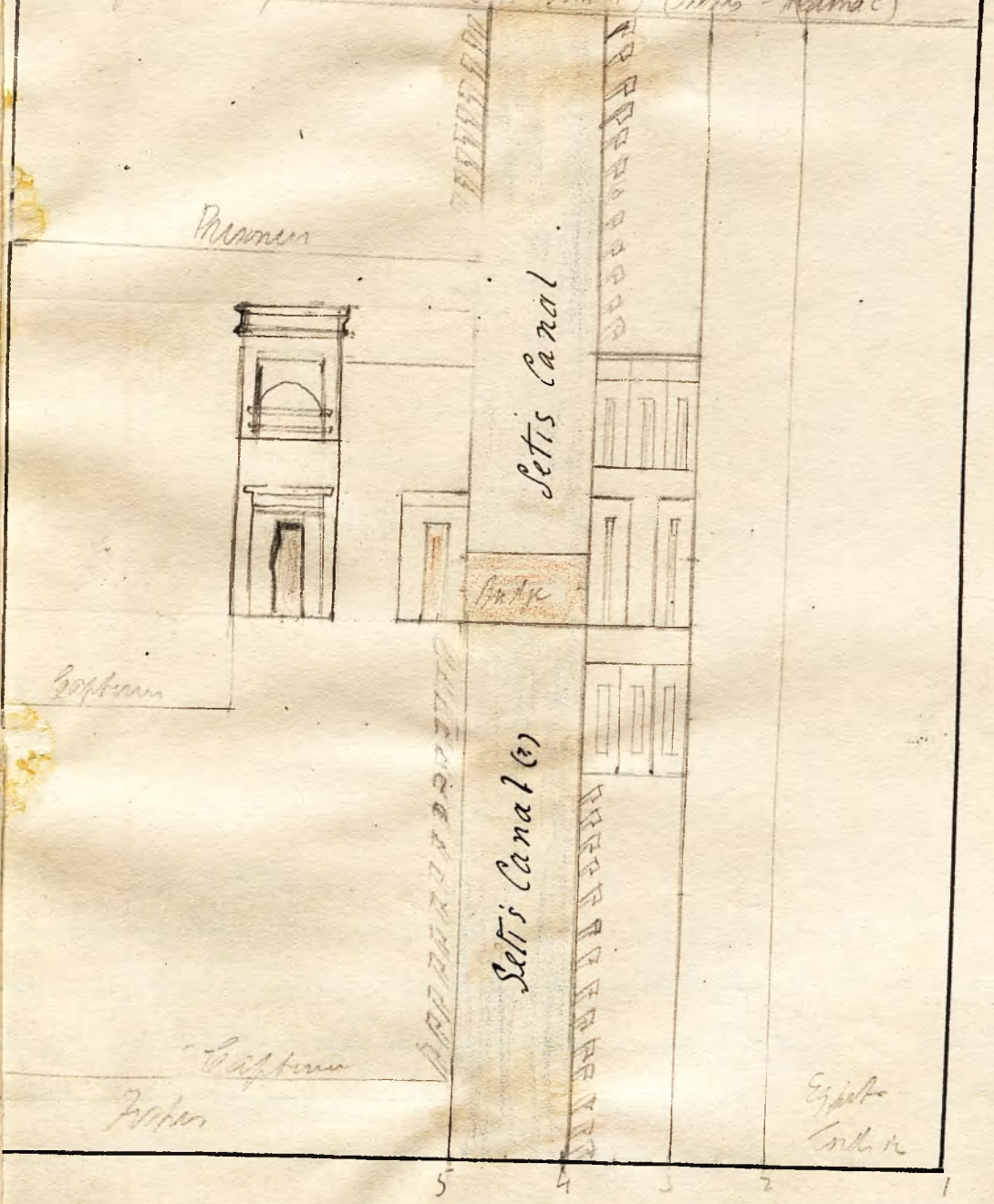




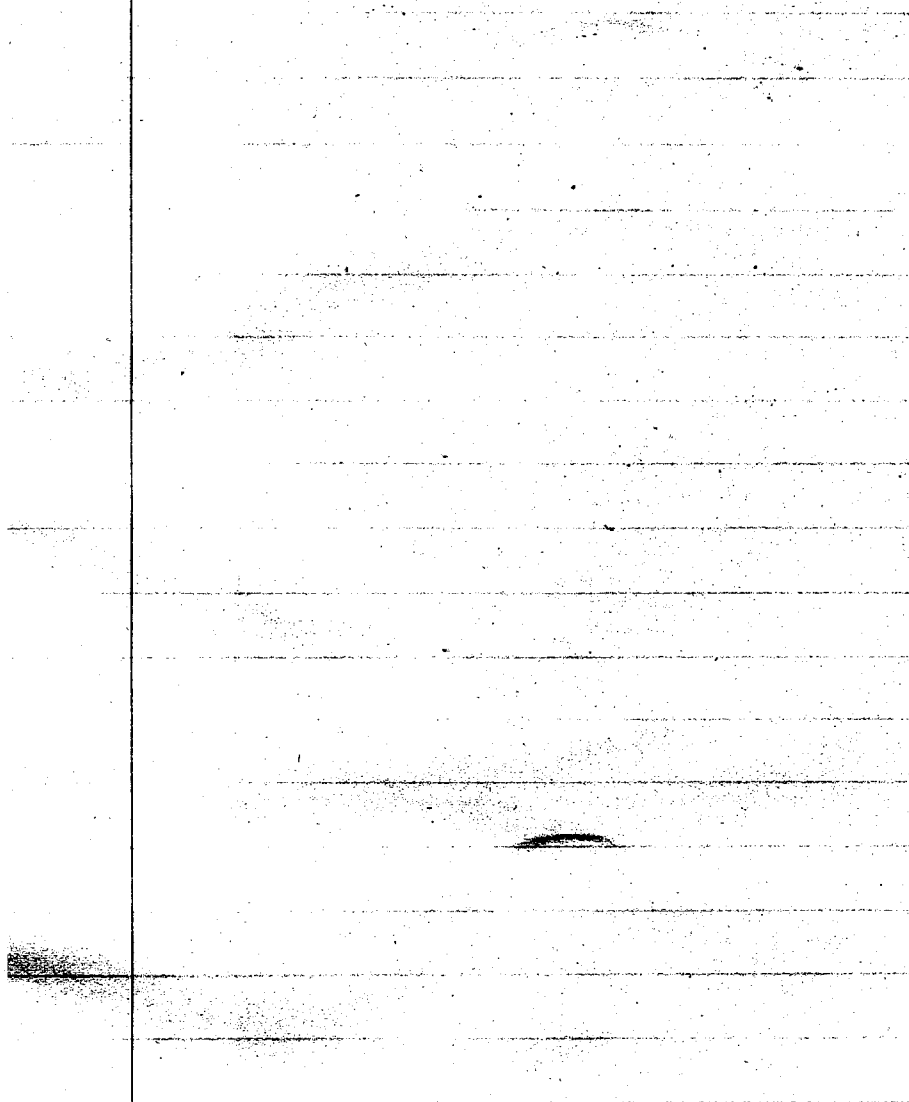
Peutingero's Map: Segmentum VI A Bruxelles. 1728

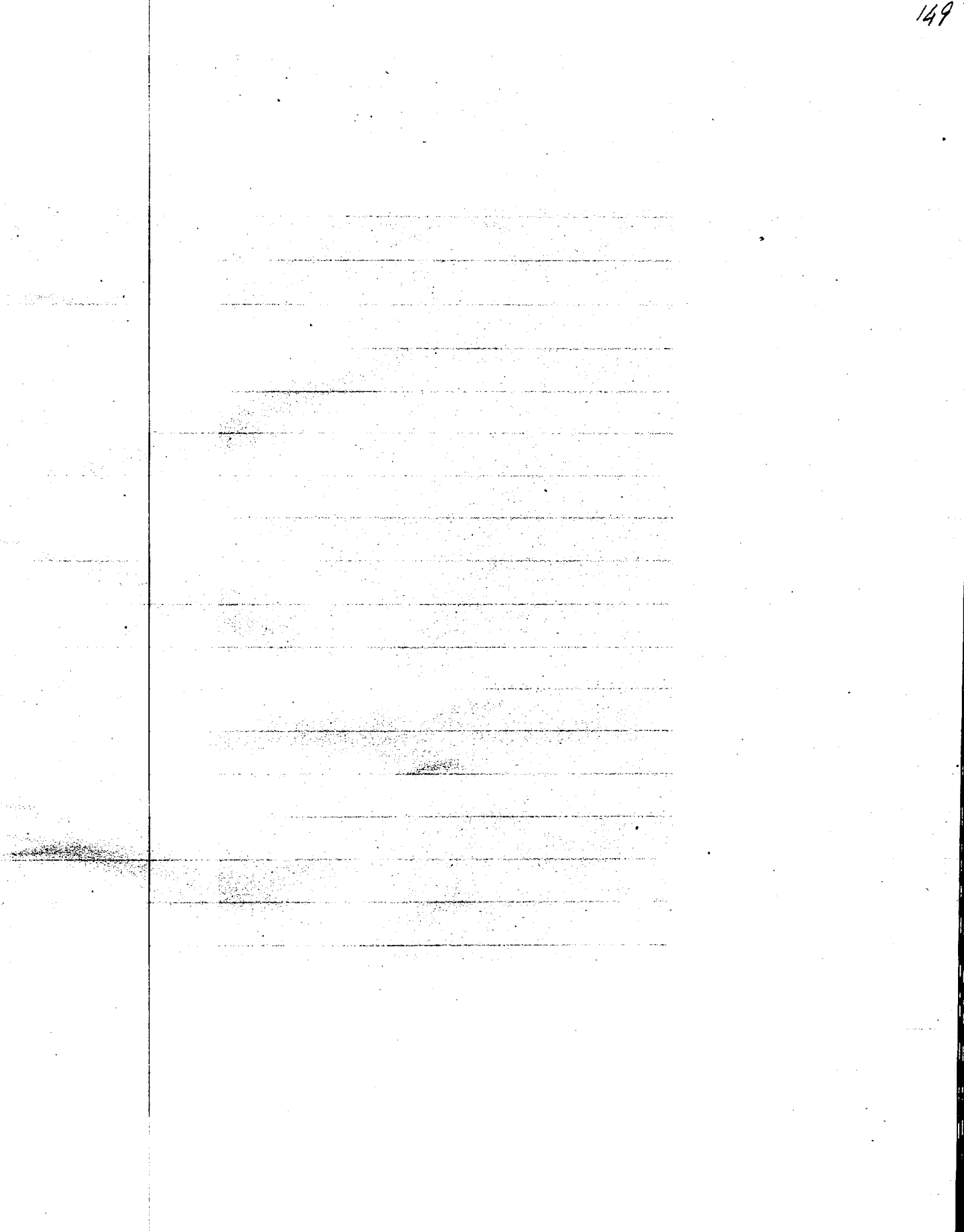
From Nicolas Bergier.

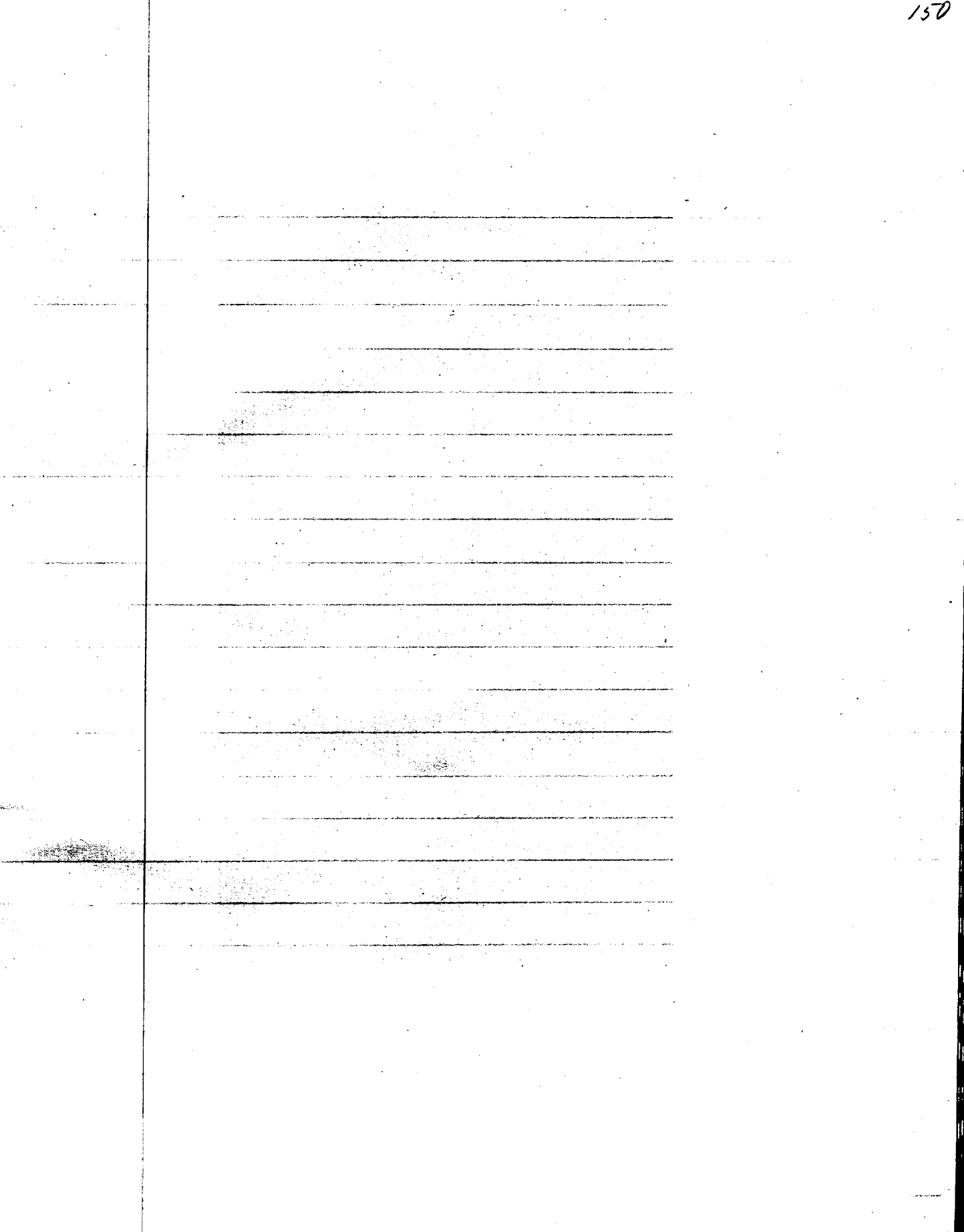
Bridge at 300 ft
After Colonization M.C.C. II (200 ft) (Hills = Kamae)

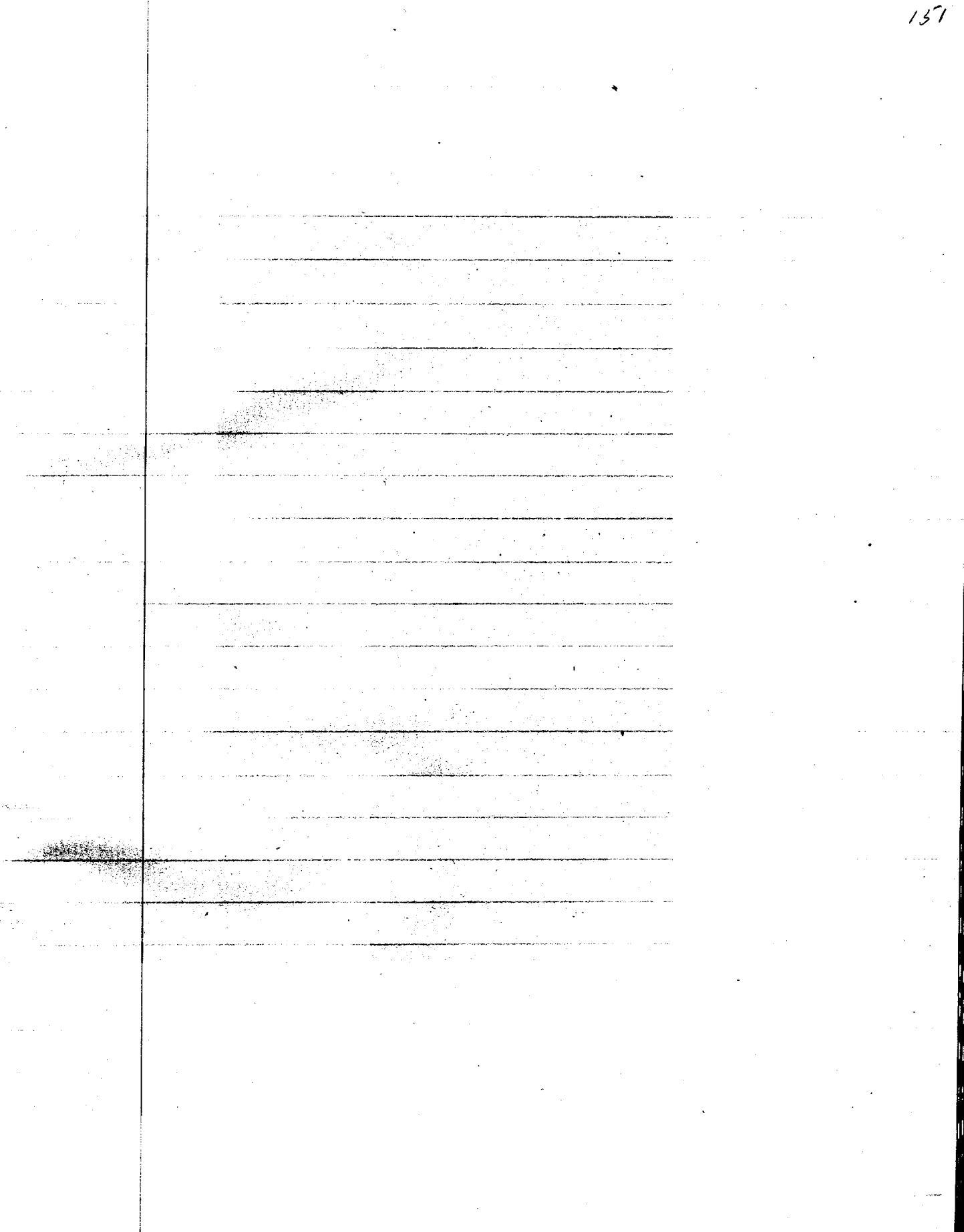


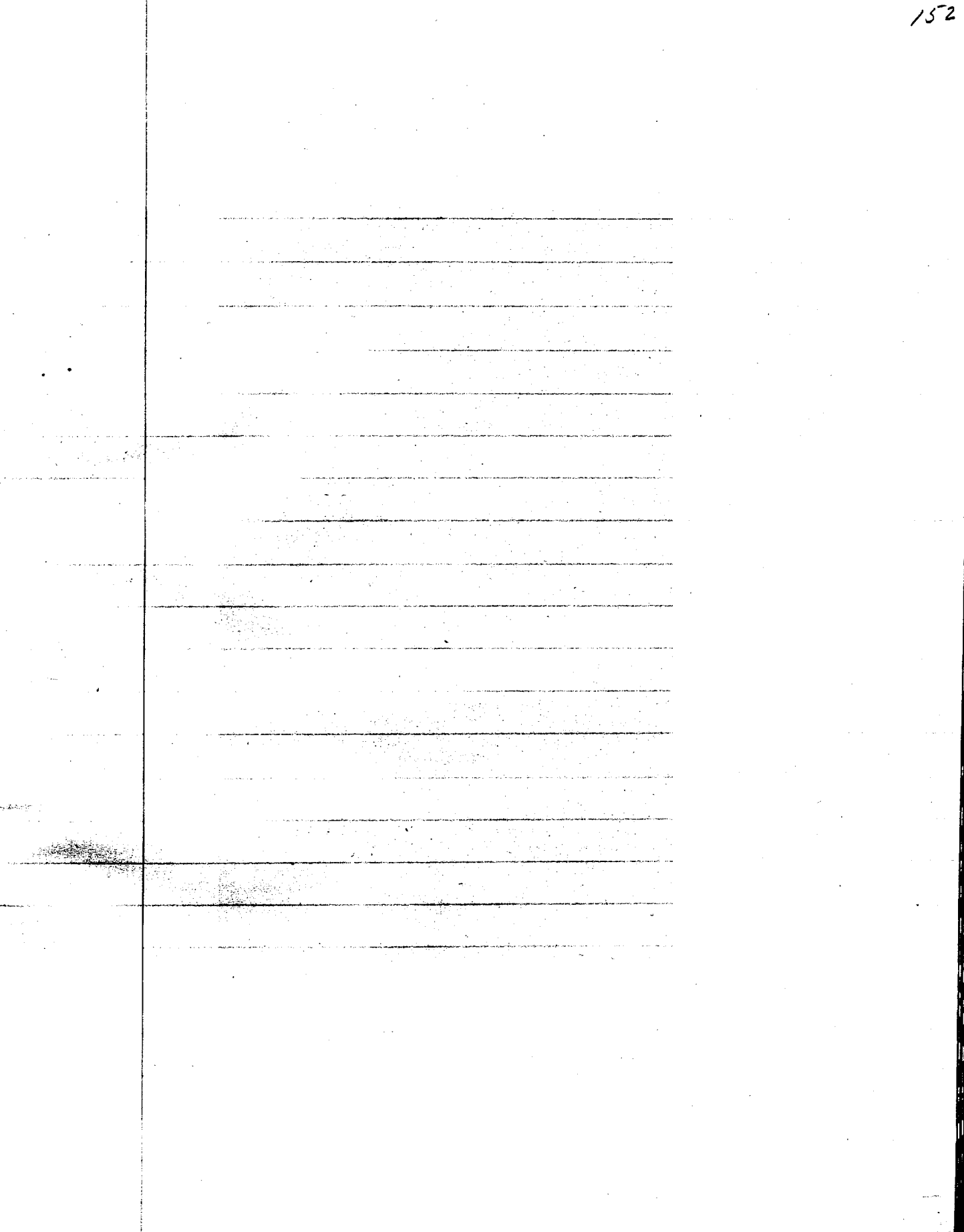
of Rome 123

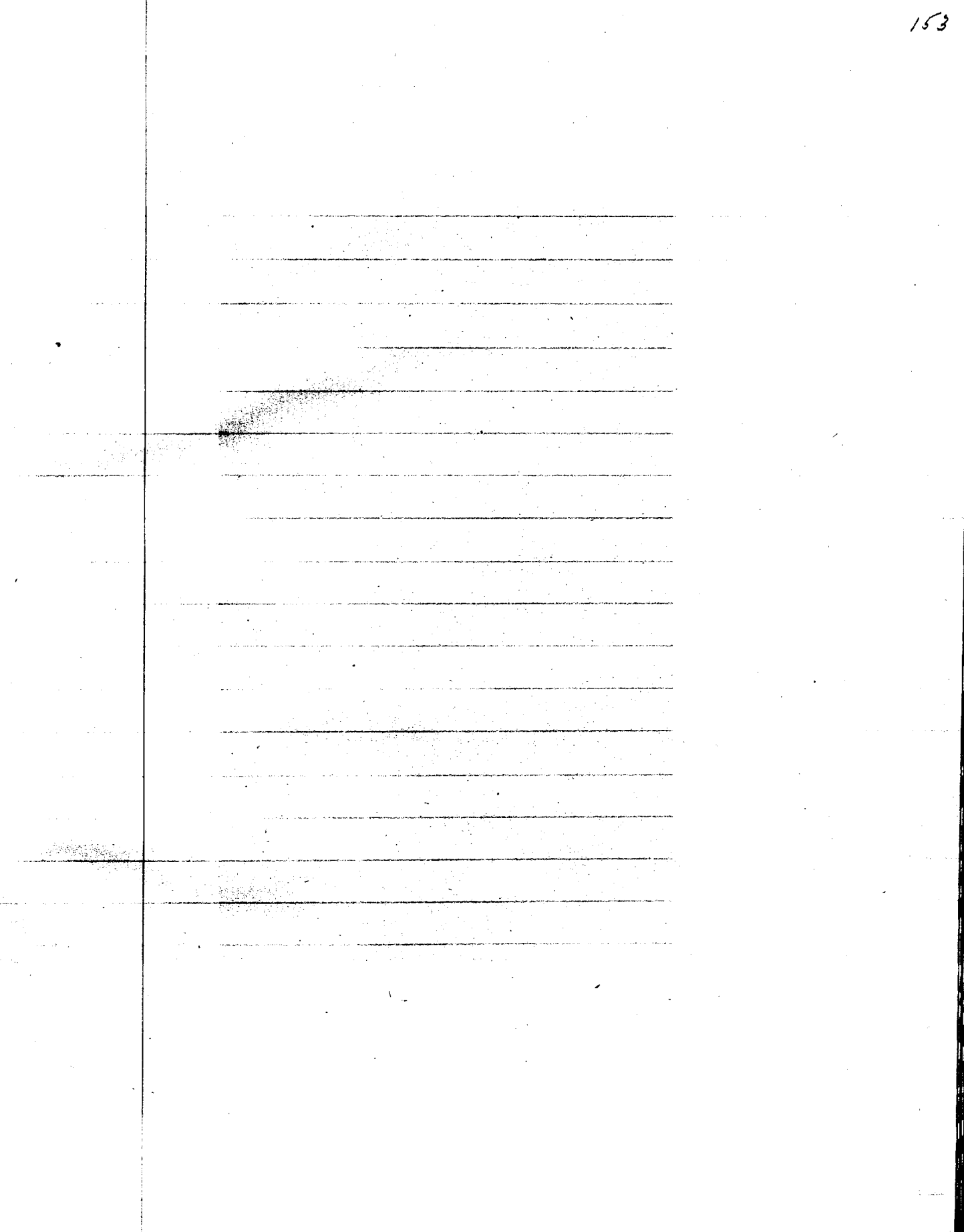


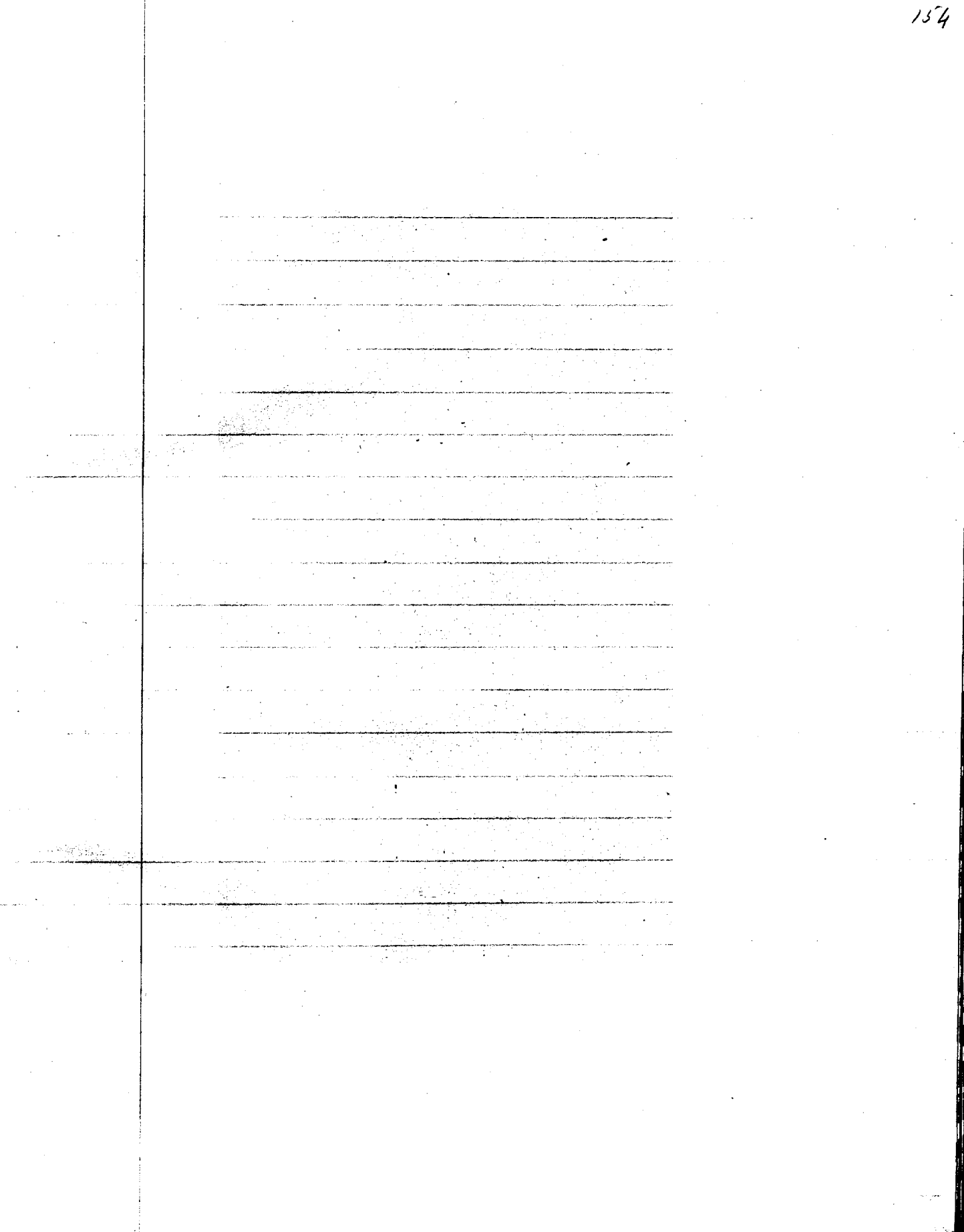


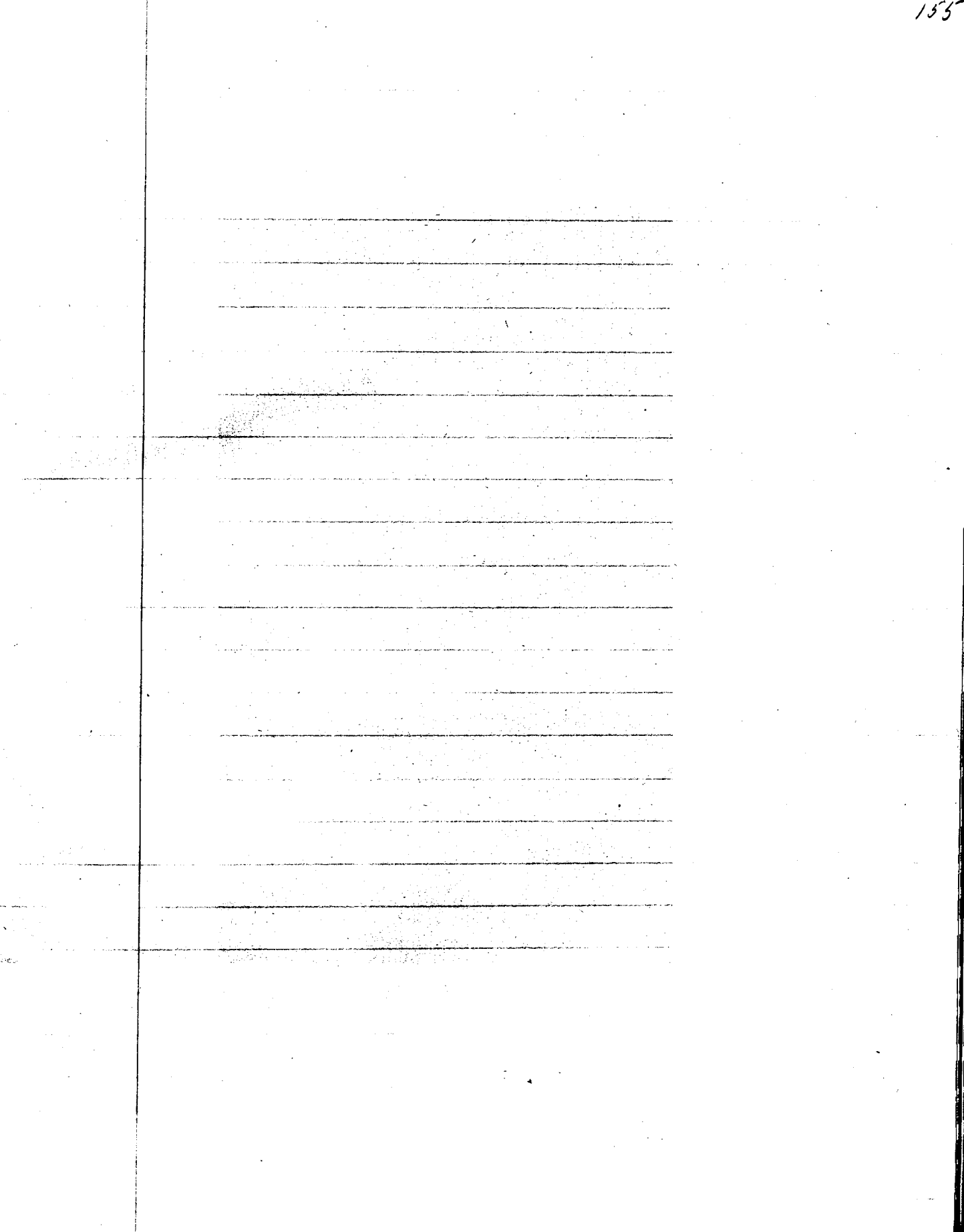






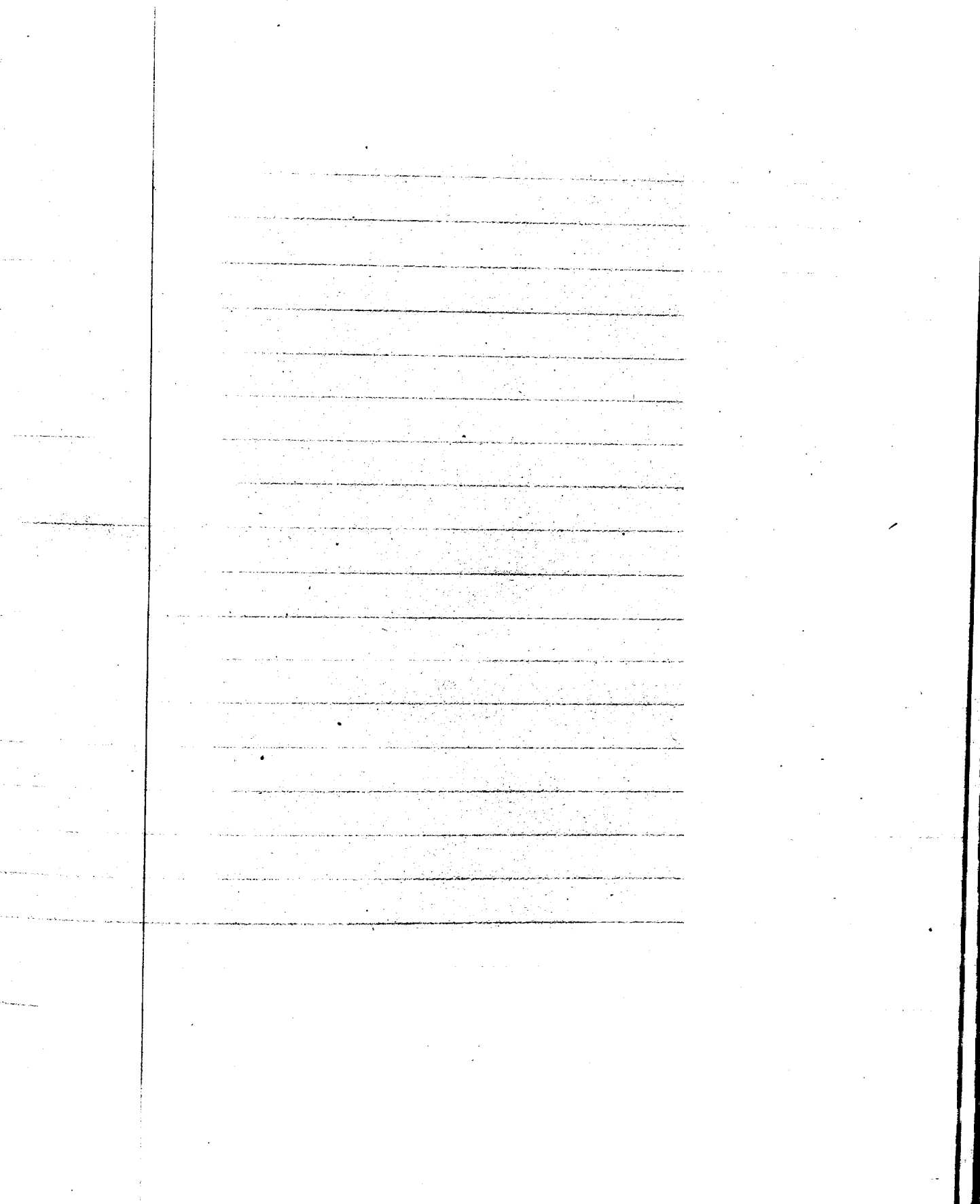


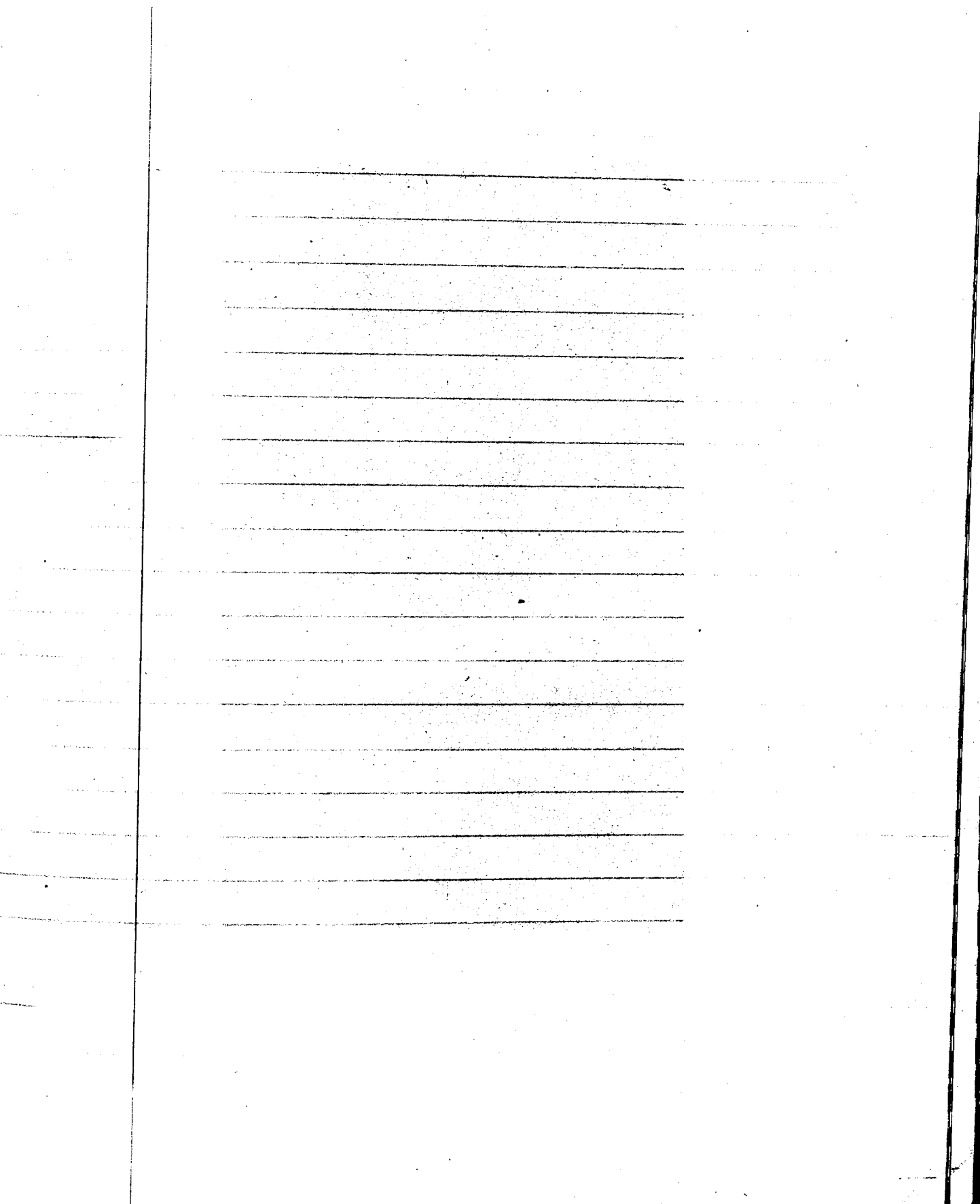


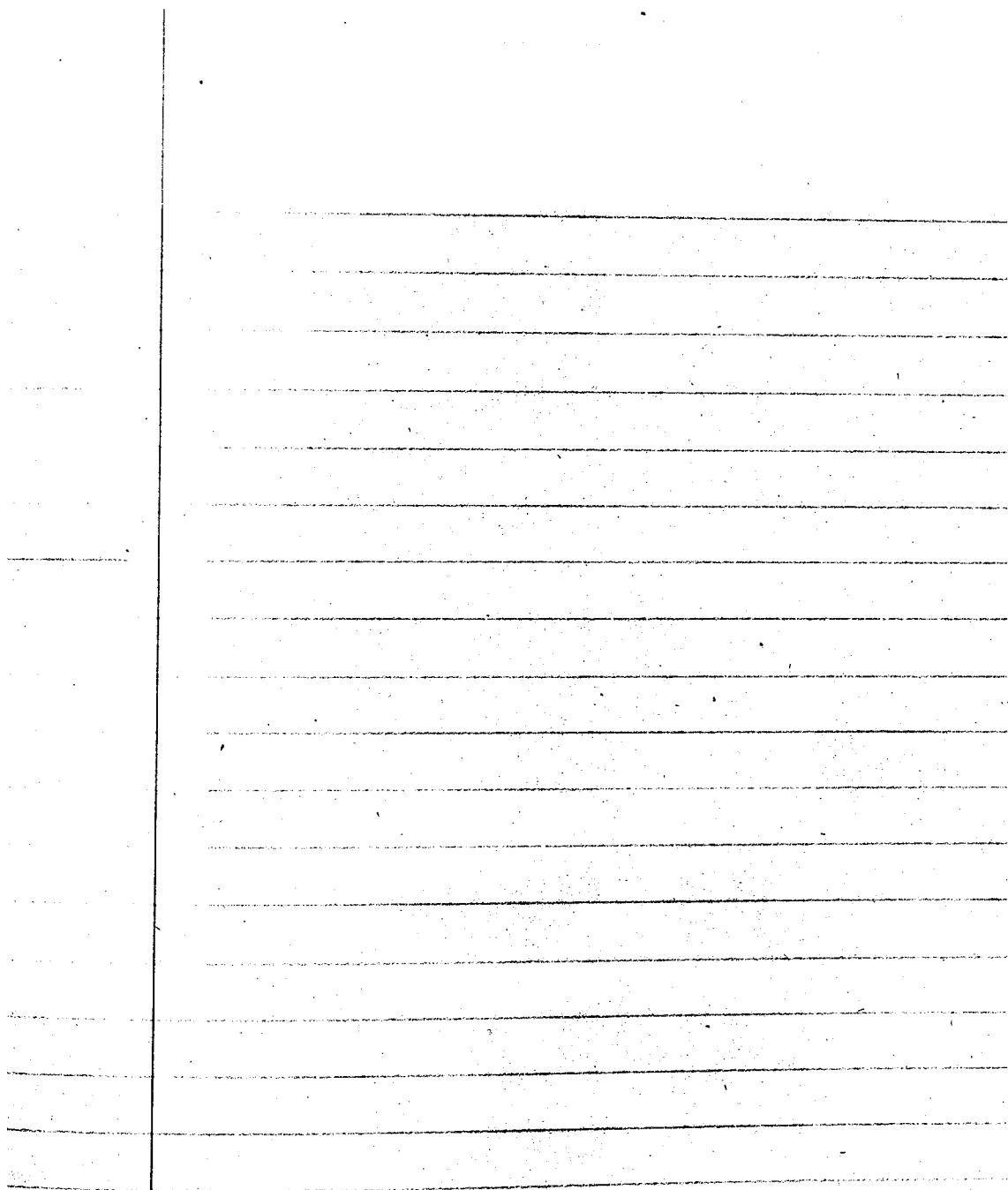


Vertical line of text or margin on the left side of the page.

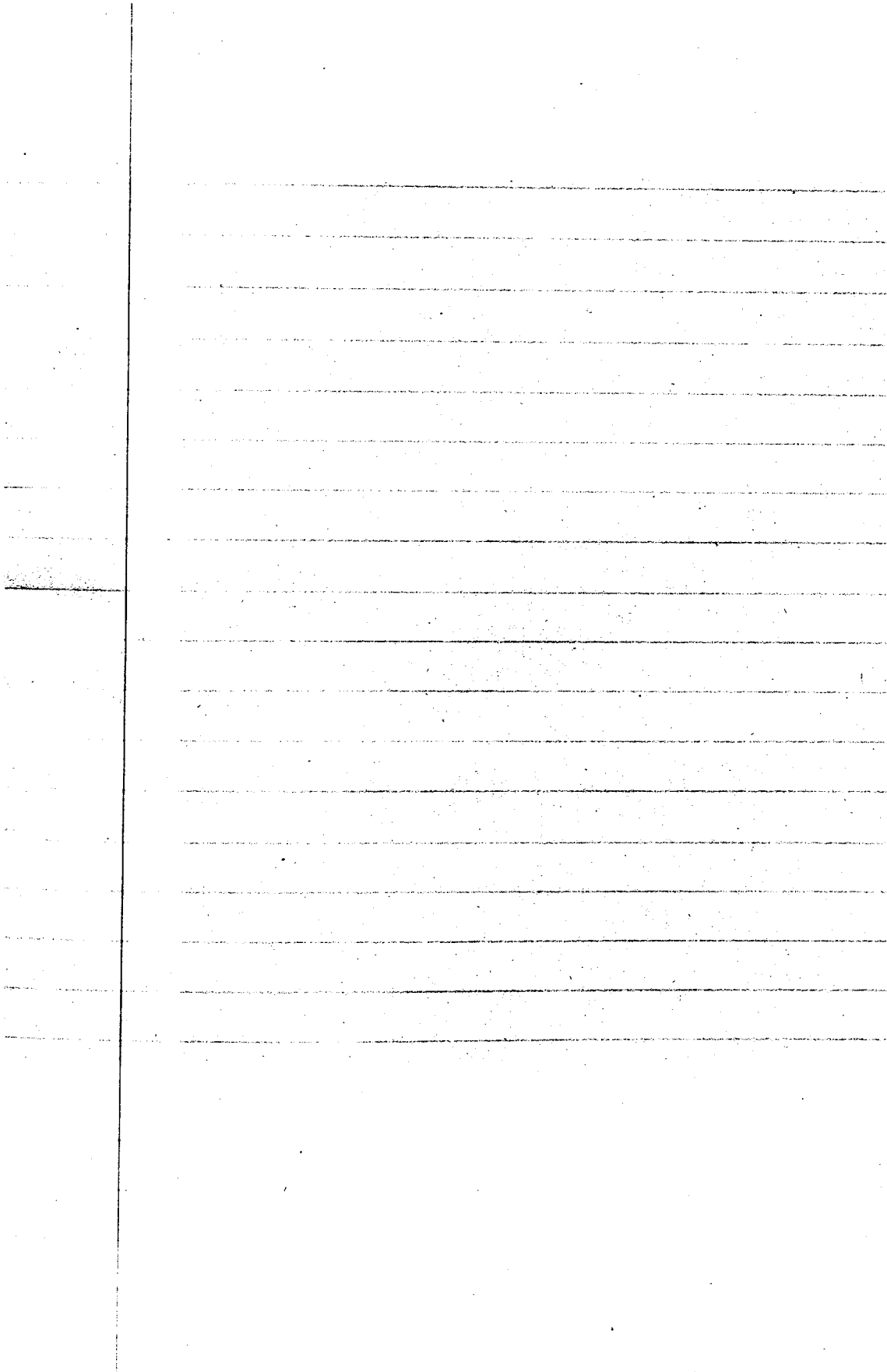
This image shows a single sheet of white paper with horizontal blue or grey ruling lines. A vertical margin line is present on the left side. The paper appears slightly aged or off-white. There are some faint smudges and a small dark mark near the center-left. The overall appearance is that of a clean but slightly worn piece of stationery.





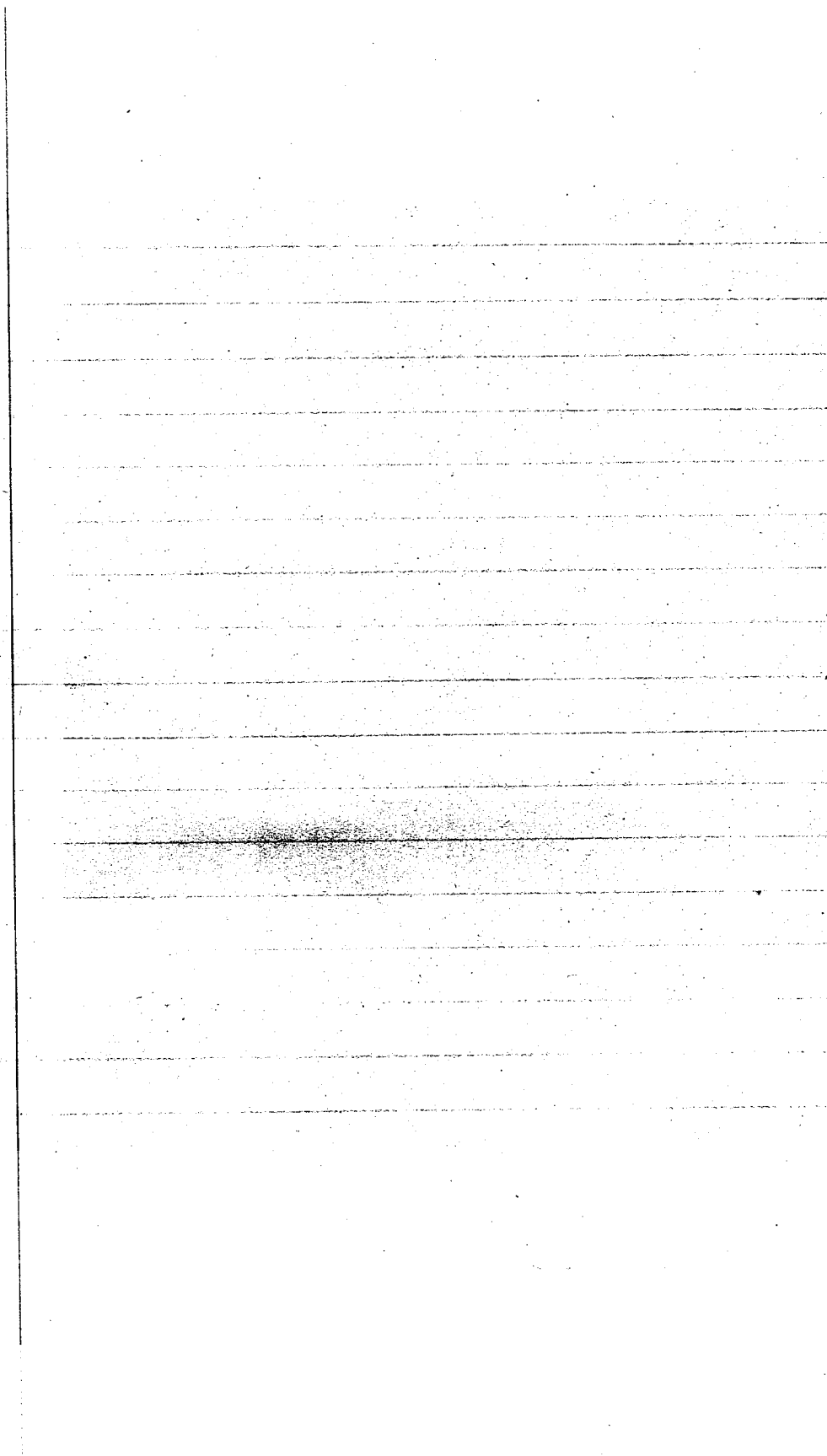


This image shows a single sheet of white paper with horizontal blue or grey ruling lines. A vertical margin line is present on the left side, creating a narrow left margin. The paper appears to be from a notebook or a set of legal pads. There are some minor dark specks and faint smudges scattered across the surface, particularly near the top and bottom edges, which might be dust or artifacts from the scanning process. The overall appearance is that of a clean but slightly used piece of stationery.



This image shows a single sheet of white paper with horizontal blue or grey ruling lines. A vertical line runs down the left side, creating a margin. The paper appears slightly aged or off-white. There are some faint smudges and marks on the surface, particularly near the bottom center where there's a small dark spot. The overall appearance is that of a clean but used piece of stationery.

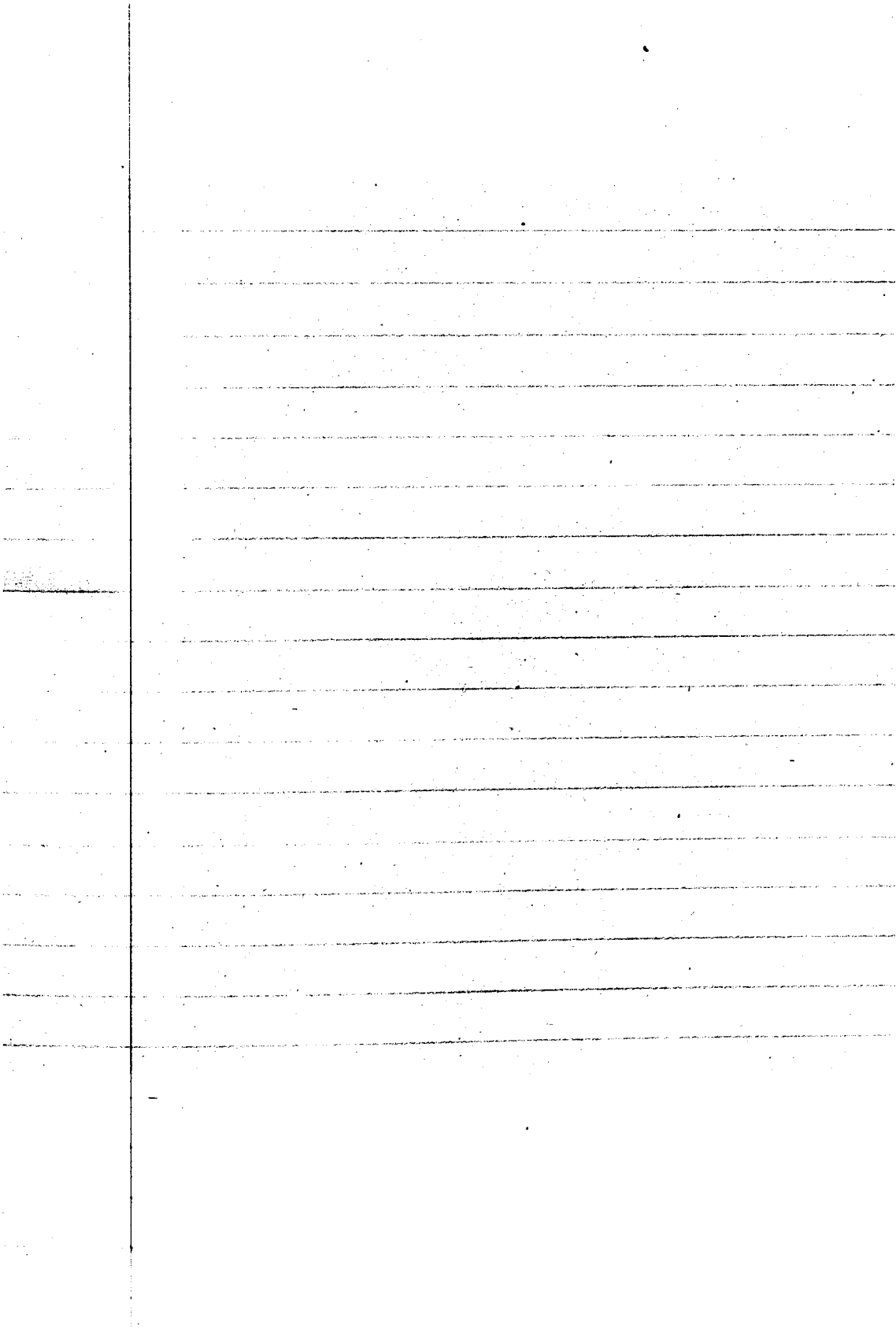
[The body of the page contains approximately 20 lines of extremely faint, illegible text. A vertical line is present on the left side of the page.]

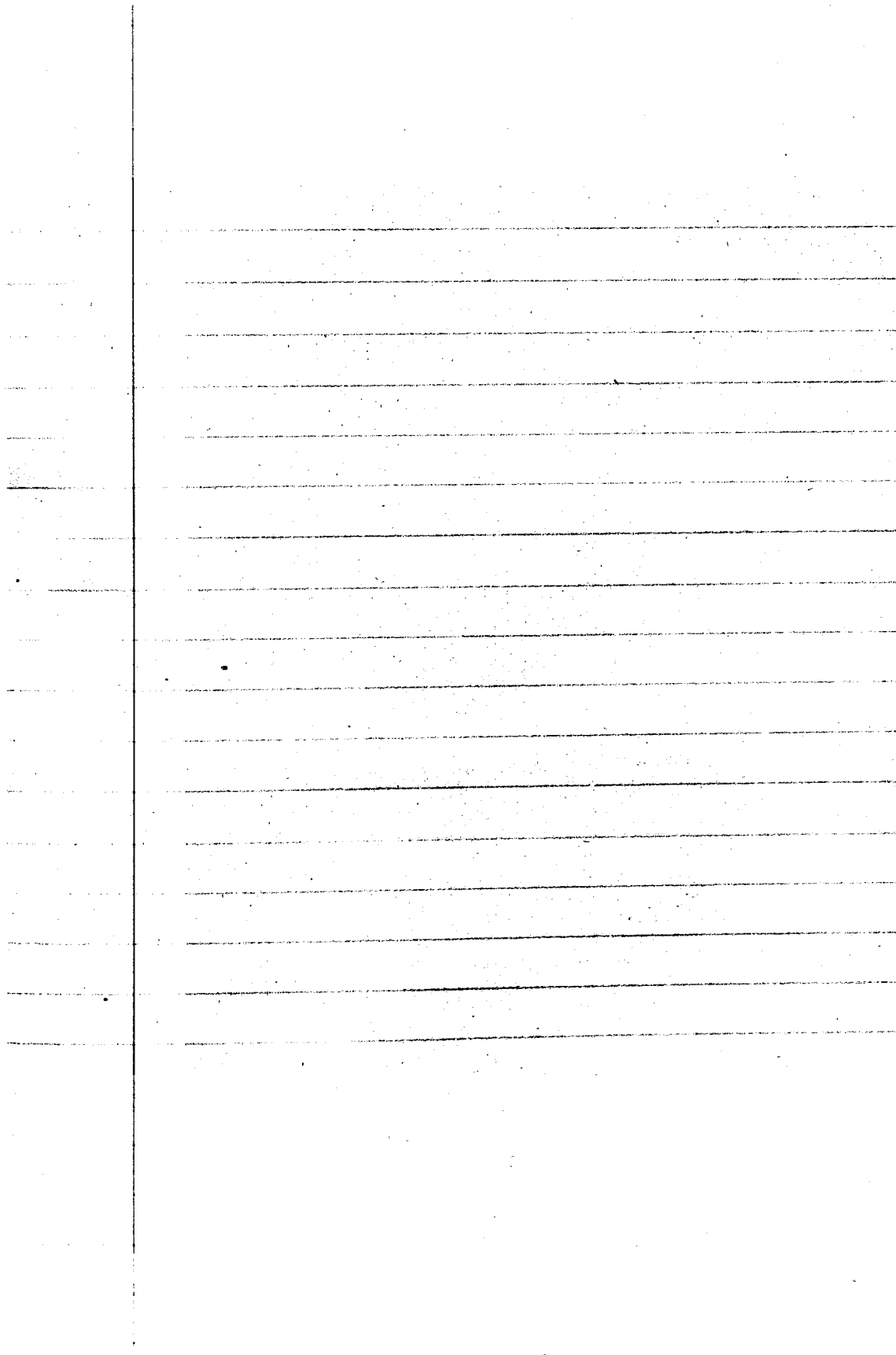


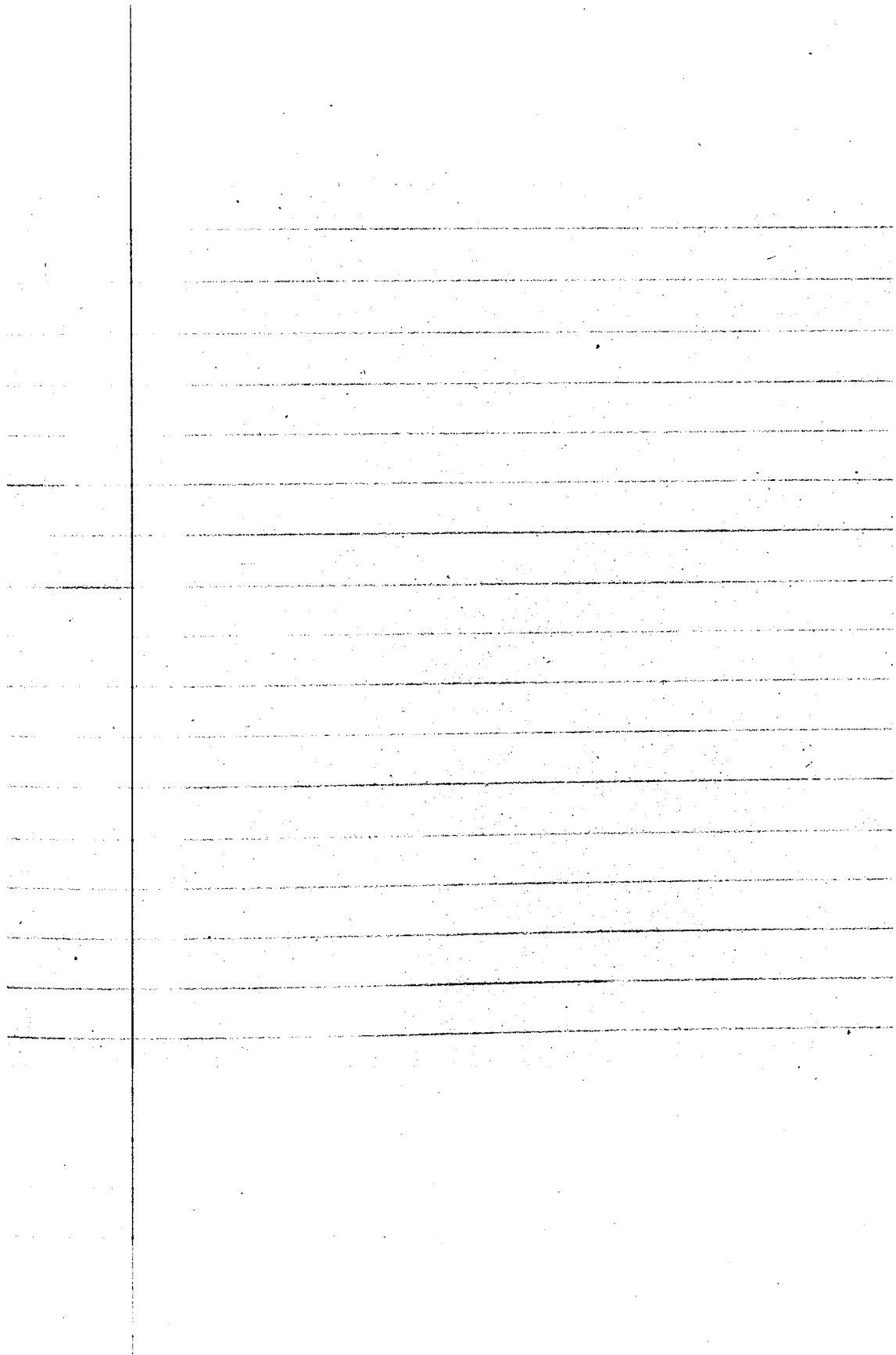
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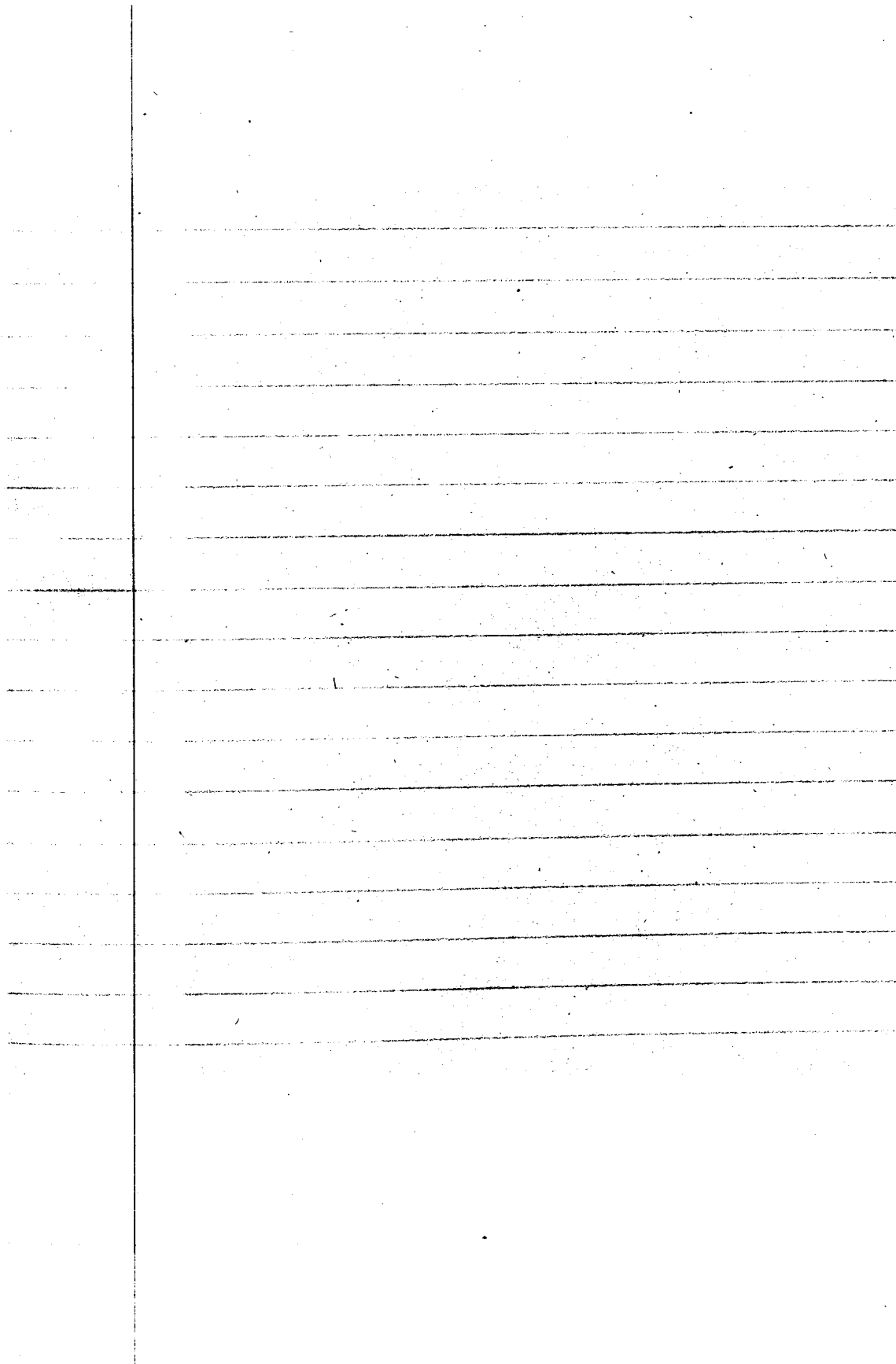
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1. The first part of the document is a list of names and addresses of the members of the committee. The names are listed in alphabetical order, and the addresses are given in full. The list is as follows:

Name	Address
Mr. A. B. C.	123 Main St., New York, N. Y.
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Mr. G. H. I.	789 Broadway, New York, N. Y.
Mr. J. K. L.	1010 Fifth Ave., New York, N. Y.
Mr. M. N. O.	1111 Third St., New York, N. Y.
Mr. P. Q. R.	1212 Second St., New York, N. Y.
Mr. S. T. U.	1313 First St., New York, N. Y.
Mr. V. W. X.	1414 West St., New York, N. Y.
Mr. Y. Z. A.	1515 East St., New York, N. Y.
Mr. B. C. D.	1616 North St., New York, N. Y.
Mr. E. F. G.	1717 South St., New York, N. Y.
Mr. H. I. J.	1818 Central St., New York, N. Y.
Mr. K. L. M.	1919 Union St., New York, N. Y.
Mr. N. O. P.	2020 Madison St., New York, N. Y.
Mr. Q. R. S.	2121 Park St., New York, N. Y.
Mr. T. U. V.	2222 Madison St., New York, N. Y.
Mr. W. X. Y.	2323 Park St., New York, N. Y.
Mr. Z. A. B.	2424 Madison St., New York, N. Y.
Mr. C. D. E.	2525 Park St., New York, N. Y.
Mr. F. G. H.	2626 Madison St., New York, N. Y.
Mr. I. J. K.	2727 Park St., New York, N. Y.
Mr. L. M. N.	2828 Madison St., New York, N. Y.
Mr. O. P. Q.	2929 Park St., New York, N. Y.
Mr. R. S. T.	3030 Madison St., New York, N. Y.
Mr. U. V. W.	3131 Park St., New York, N. Y.
Mr. X. Y. Z.	3232 Madison St., New York, N. Y.
Mr. A. B. C.	3333 Park St., New York, N. Y.
Mr. D. E. F.	3434 Madison St., New York, N. Y.
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Mr. W. X. Y.	4949 Park St., New York, N. Y.
Mr. Z. A. B.	5050 Madison St., New York, N. Y.

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