XIII. *Contributions to the Fossil Flora of North Greenland, being a Description of the Plants collected by Mr.* EDWARD WHYMPER *during the Summer of* 1867. *By Professor* OSWALD HEER. *Communicated by Professor* STOKES, *Sec. R.S.*

Received February 16,—Read March 11, 1869.

General Remarks.

I. THE greater part of the fossil plants which have been brought from Arctic regions have come from North Greenland. Atanekerdluk (lat. 70° N.) is the principal locality, and there the remains of vegetable organisms are found in such profusion, that we are able, to some extent, to restore the ancient flora of North Greenland, and deduce most important conclusions as to the former physiognomy and the climate of this high northern region. The fossil plants which were brought home by M'CLINTOCK, INGLEFIELD, and COLOMB, and deposited in Dublin and London, were found at this locality, as well as the very rich collection made by Mr. OLRIK, formerly Inspector of North Greenland, which is now to be found at Copenhagen. These materials, on examination, were found to contain 105 species of plants. Of some, the leaves, fruits, and seeds were observed, so that an absolute determination of their species was rendered possible; while of others merely the leaves, and of these at times only fragments, were discoverable. Of these latter accordingly the identification cannot be considered as final. It became therefore a matter of great importance to procure additional specimens from this locality, so as to increase our knowledge of the Arctic Fossil Flora, and also to ascertain whether similar fossils were of universal occurrence in the various lignite deposits of North Greenland. It was hoped, too, that remains of Mammalia might be found in the coal.

The interest attached to these questions induced Mr. ROBERT H. SCOTT to propose the plan of an Expedition to North Greenland, to be carried out by means of funds furnished by the British Association. That body at the Nottingham Meeting voted a sum of money for the purpose, which was subsequently most liberally augmented by the Government-Grant Committee of the Royal Society. Circumstances rendered it impossible for Mr. SCOTT to carry out his idea of visiting Greenland himself, and Mr. EDWARD WHYMPER, who had previously made arrangements for travelling in North Greenland, undertook to obtain as good a collection of fossils from Atanekerdluk as possible, and to examine as many other localities as his time might permit. Mr. WHYMPER took with him Mr. ROBERT BROWN, F.R.G.S., as collector. Mr. W YMPER passed some time at Copenhagen, preparing himself for his undertaking, and sailed from that port in the spring of 1867. He arrived at the Colony of Jakobshavn in Greenland on the 16th of June, and on the morning of the 20th of August he arrived at Ritenbenk with Mr. Brown, and with a number of natives who were engaged as workmen. I quote from Mr. Whymper's Report, presented to the British Association at Norwich*, the portions which relate to the Geology of the district.

"We started [from Ritenbenk] at 10.30 P.M., and our course soon took us into the midst of the Tossukatek ice-stream, a great assemblage of icebergs large and small, which were given off from a glacier whose summit we could just see on the horizon. This ice-stream was remarkable for the enormous number of icebergs it contained, and was also notable for the small amount of moraine matter upon them. Really large blocks of rock we did not see, and those of a yard in diameter were rare; but there was abundance of small stones, of grit, and of sand upon the bergs. There is no doubt that beneath the course of the Tossukatek ice-stream, as below all others†, there are conglomerate strata in course of formation, which cannot now be seen, but which may possibly be presented to the view of future travellers.

"Shortly after passing through this ice-stream we arrived at the small settlement of Sakkak‡. This place stands by the water's edge at the entrance of a great valley running into the heart of the Noursoak peninsula. A considerable river that flows down this valley falls into the sea a little to the north of the settlement, and appears to form the boundary line of the granite districts which we were just quitting, and the trap formation upon which we were just entering.

"A solitary Danish man lives at this place, and has done so for twenty-four years. He says that the glaciers which can be seen from his house, both on the Noursoak peninsula and upon Disco Island, are steadily increasing; so much so that their progress can be noted every year. This statement coincides with the observation of Sir C. Giesecke nearly sixty years ago. The latter says§, speaking of the route to Umenak, 'formerly they drove generally over Gamle Ritenbenk||, but for several years the road has become impassable in consequence of the 'iceblink'¶ by which the whole continent there is covered. The same will take place with the new road at present in use.' The glaciers to the south were, however, as far as I observed them, decidedly shrinking.

* This Report was accidentally omitted from the volume of British Association Report for 1868. It will appear in that for 1869.

† "On the voyage up Davis' Straits we were becalmed off Rifkol, a noted landmark, and anchored on some banks in eighteen fathoms. These banks have certainly been greatly increased, if not originated, by the deposition of matter from the icebergs of the Jakobshavn ice-stream. At the time we were anchored a number of small bergs were aground upon them, breaking up and revolving all around. We took the opportunity to put down the dredge, and although we only worked from the ship side, and consequently over a very limited amount of bottom, we brought up in two or three hauls fragments of granite, gneiss (some with garnets), syenite, quartz, hornblende, greenstone, and mica-slate. The sounding-lead showed a fine sand bottom, and the anchor flukes brought fetid mud.

‡ "The word Sakkak means, according to Giesecke, 'sunside,' *i. e.* southerly aspect.

§ "Giesecke's MS. Journal, year 1811.

|| "The Danish name for the settlement of Sakkak.

¶ "The term is used in Greenland to signify a glacier.

"At Sakkak we were joined by a native guide for Atanekerdluk, named GUDEMANN, and also by two others who volunteered their services. We continued our journey after a brief halt, and arrived at our destination shortly after 1 A.M. on August the 22nd.

"The name Atanekerdluk is applied by the natives to a basaltic peninsula about half a mile in length, connected with the mainland by a sandy neck which is apparently covered by the sea at spring-tides. A bay with a sandy beach stretches about two miles to the south, and at its further extremity there is another promontory, of columnar basalt, named Imnarsoit. Between these two promontories, and indeed along the whole of the shore from the above-mentioned valley at Sakkak to the most northern point of the Noursoak peninsula, mountains rise from the water's edge, and attain in some places a height of 5000 to 6000 feet. Behind the peninsula of Atanekerdluk they do not, however, attain a height greater than 3600 or 3800 feet. They are cut up by numerous small valleys and ravines.

"The position of Atanekerdluk is indicated at a great distance by means of three mountain-peaks of symmetrical form. The fossil bed is one-third way up the most northern of these, and between it and the central one. Under the guidance of GUDEMANN we started for it at mid-day on the 22nd. The sides of the hill on which it is situate (an outlying buttress of the mountain already mentioned) were of considerable steepness, and channelled in many places by small streams. It was mainly composed of sand and of shales, and was strewn with disintegrated fragments of hardened clays, sandstones, and basalt. The most prominent features were the dykes of trap which appeared in numerous places; sometimes as regular in form as built walls, and in others as picturesque as Rhine castles. Five, if not six, of these dykes appeared at different places in the section of the coast between the headlands of Atanekerdluk and Imnarsoit.

"It has been already mentioned that this locality had been frequently visited* before 1867 for the sake of its fossil deposit. This was evident by numerous fragments that we found in the course of our ascent, which had been dropped by others in descending, and it seemed at first as if the deposit was very extensive. We found it in fact to be confined within narrow limits. It did not appear to extend a greater length than 400 feet, with a maximum depth of 150 feet. In most places the portion exposed was nothing more than a seam a few feet in depth. It was on a shelf of the hill at the height of 1175 feet†; the southern end was exposed on the north side of the most prominent of the ravines already referred to. The length of the deposit, that is to say the face of the hill on which it was found, fronted the Waigat, due west (magnetic).

"I took from England, besides hammers, picks, and shovels, all the necessaries for blasting; but these latter were unnecessary. The seam was for the most part enclosed by sand, and specimens were obtained with ease. After a hard day's work we returned to our camp, in a ruined native house by the shore. It froze sharply during the night.

* "By Danes, or by natives collecting for Danes.

† "The mean of eight observations by aneroid. Captain INGLEFIELD gives the height 1084 feet.

"On the 23rd we resumed work, and by the close of the day had made a large collection of good specimens. It was my endeavour to select, as far as possible, perfect specimens of individual species, rather than fine slabs containing numerous species. Unfortunately a large number of the finest specimens were irremediably smashed in transit down the hill; this was due much more to the brittleness of the specimens and the steepness of the descent than to carelessness. The natives indeed worked admirably.

"On the 24th we finished our work at this locality. A trench had been dug by this time twenty feet in length, to a depth of five feet, completely through the seam, and the section showed:—

	Feet.	In.
1. Stratum of fine sand, light grey colour	1	7 deep
2. ,, ,, similar to No. 1, darker colour	–	8 ,,
3. ,, ,, fine white sand	–	8 ,,
4. ,, ,, similar to No. 2	–	9 ,,
5. ,, ,, ,, ,, No. 3	–	6 ,,
6. ,, ,, yellow sand.		

"The impressions of leaves were found for the most part in stratum No. 1, or upon the surface. They were also obtained from Nos. 2, 3, 4, but I believe not lower. Those found in the uppermost and upon the surface were ordinarily in hard clay, red in colour, due to oxide of iron. These did not suffer much by transportation; but the surface had apparently undergone a careful scrutiny, and few very perfect specimens were obtained from it. The impressions in the softer and more brittle shales were obtained some depth below the surface; these yielded the best specimens, but they suffered greatly in transit. Those found at the greatest depth were almost invariably in lumps of hard clay that fractured irregularly; these differed from the others in being of an iron-grey colour. They have reddened since they have been exposed to the atmosphere. The trench was dug about mid-way between the extremes of the deposit, and examination at other points showed a similar arrangement. The hill at this part was mainly composed of sand, enclosing numerous thin seams of brittle indurated clay, red in colour, containing a good deal of iron, and of moderately fine-grained sandstones.

"We were unable to find the 'perfect stem, standing 4 feet out of the side of the hill,' spoken of by Captain INGLEFIELD*, and it was unknown to the natives. It was said to have stood on the edge of a precipice in the ravine on the south of the hill, and it has probably been buried in a fall that appears to have taken place not very long ago. In the sides of this ravine, both above and below the leaf-deposit, numerous beds of lignite are exposed, at least one being of considerable thickness. I brought home from this bed a block 1 foot 9 inches in thickness, a portion of which has been analyzed in the laboratory of Mr. T. W. KEATES of Chatham Place, with the following results:—

* Private Journal of Captain E. A. INGLEFIELD, quoted in "A Report on the Miocene Flora of North Greenland, by Professor O. HEER," 1866. Journ. Royal Dublin Soc. vol. v. p. 81.

'Specific gravity	1·369		
Gaseous and volatile matter		45·45	
Moisture		·75	46·20
Sulphur			·55
Coke { Fixed carbon		47·75	
Coke { Ash		5·50	53·25
			100·00

The lignite contains a trace of bitumen; the coke is non-caking, and of little use.'

"In this lignite we found small pieces of amber, the largest being about the size of a common pea. We also found amber, but in still smaller fragments, in the leaf-deposit itself. It was nowhere abundant.

"The scantiness of the living vegetation at Atanekerdluk offered a marked contrast to the luxuriance displayed in the leaf-deposit. Although this was the sunny side of the Waigat Strait and the hills were completely free from snow, vegetation was as meagre as upon Disco Island itself. The drifting of the sand accounts for this doubtless to some extent. The largest dead wood measured less than an inch and a half in diameter, and the largest growing wood less than an inch.

"The most remarkable natural object at Atanekerdluk is a trap pinnacle*. The surrounding soil has been removed, leaving this portion of a former dyke standing perfectly isolated. Its height is about eighty feet."

Mr. Brown furnishes the following particulars as to the stratification of the rocks†.

"*General stratification of the beds at Atanekerdluk.*—A stream called Ekadluk (probably connected with the name of the place) flows into the Waigat Strait here and exposes a section nearly to the summit of the cliff. This shows a series of beds *dipping* at an acute angle at various degrees to S., with a general *strike* E., all lying in general conformably on each other. These strata are divided into many distinct beds of sandstone, conglomerate gritty sandstone, shales (clayey, splintery, and fissile), and all alternating with each other, and containing various seams of lignitic coal; and towards the summit of the section thin cherty ironstone, with which you are most familiar as the matrix of the fossils. This 'ironstone' I look upon merely as of the nature of a shale, but owing its hardness and cuboidal fracture to being so impregnated with oxide (?) of iron; accordingly we find it taking the place of a shale and alternating with the sandstones and shales topping, and underlying the coal-beds shown in this section.

"All of these beds (sandstones, shales, &c.) contain vegetable fossil impressions to a greater or less extent, but owing to their softness none of them here have retained them except the ironstone shales already referred to, and these impressions are only seen as indistinct *charred* looking blackenings. The greatest thickness of these sandstones is about 20 feet, and the beds of splintery shales occasionally reach that thickness, down to a thinness of a few inches. The fossil layers (the ironstone shale) never exceed from

* A photograph of which, from a drawing taken on the spot, was exhibited.

† In MS. notes furnished by Professor Heer.

a few inches to 2 feet in thickness. The coal, in general, rested on and was overtopped by shales, but sometimes on shales, and was overtopped by sandstone, and *vice versâ*, indeed as in our Carboniferous formation, and in the Pliocene coal-fields which I examined in Washington Territory, U.S. It varied in thickness from a few inches to 2 feet, though sometimes I found shaly slaty beds partaking of a lignitic character which reached to the thickness of 4 feet. These beds consisted of a great number; I have enumerated between one and two hundred layers and beds, one alternating with another, and reaching to the height of some 1200 feet above the sea.

"Intersecting these beds, and crossing the bed of the stream, and running about N.W. and S.E., are three trap 'dykes' which may be styled A, B, and C. Where they come in contact with the strata I did not notice much contortion and scarcely any metamorphosis, from which we might perhaps infer that the traps here and the sedimentary beds are not of the same geological age. (?) However, it ought to be mentioned that though these dykes in some cases cut diagonally through the sandstones, they did not seem to be metamorphosed; and as confirmatory of the query I have advanced, I noticed that the sandstone lying in juxtaposition had contained fragments of trap. Further to the southward along the shore, about 200 yards from the mouth of the stream before mentioned, is exposed a section:—

"1. Brown sandstone 2 feet, dip 33°.

"2. Seam of clay, slate, and shaly coal; irregular thickness, average 8 inches.

"3. Seam of coal, 2 inches.

"4. Splintery shales, 6 inches.

"5. Whitish sandstone, stained brown in some places with oxide of iron, 2 feet exposed, but obscured by trap débris from above.

"In this shale (or clayey slate) and in the sandstone where it joined the slate were faint impressions of vegetable structure, but so imperfect as only to be distinguishable as charred spots.

"After proceeding along the beach for 1½ mile the trap dyke A appears, coming down perpendicularly through the strata, and sending a longitudinal vein to interstratify between a seam of sandstone and a sandy description of shale. The spur of trap runs almost horizontally until it ends in a protuberant 'knob.' The strata are slightly tilted at the line where the dyke cuts through them on the north side, which also gives them a slight northerly dip: the *strike* of all the strata is, however, the same, viz. *circiter* N.E. magnetic. These strata, however, resume their former southerly dip on the other side of the dyke, from which they had an opposite dip as from an anticlinal axis. This sandstone is of a coarse gritty character, and, as formerly remarked where it comes into contact with the igneous rock, does not seem to have suffered much metamorphosis though directly in contact; indeed this was of such a small extent as to render the tracing of it a matter of difficulty. In some places on the line of contact between the sandstone and the trap, the trap seems (if the term may be allowed) to take the characters of the sandstone, being soft, crystalline in structure, and easily broken with the hand.

On the other hand, the grit in contact with the trap does not seem to differ from that in the normal condition, but in some cases the sandstone (*i. e.* the grit) seems to have been melted by the heat, forming a glaze on the surface. (B.) *The trap dykes* I have spoken of as intersecting the sedimentary rock, are three in number, and run in three regular lines cutting the strata obliquely. They often stand out in bare weathered wall-like structures which have survived the action of frost and snow, arctic winter cold and summer heat, and the torrents of melting snow in the spring. One of these weathered masses is quite picturesque, and a good landmark coming to Atanekerdluk from sea.

"The disintegrating causes I have spoken of have worn down the sedimentary strata on either side of these dykes into a mere soil, and you for the most part (as being the most accessible way to get at them) dig the pieces of cherty ironstone out of a clay composed of the remains of these disintegrated rocks, and which in their downward sweep by the torrents, have been arrested on a flat or hollow halfway down the mountain, or perhaps 1100 feet above the sea."

These statements confirm the accounts of RINK and INGLEFIELD respecting the stratification of the coal-deposits and plant-beds of Atanekerdluk (conf. Flora Foss. Arctica, p. 7). They show us that there is a considerable succession of sedimentary strata, pierced by volcanic rocks which form the summits of the mountains. Fossil plants occur in all the beds, but the siderite and limonite contain them in the greatest abundance and in the best state of preservation. In fact the slabs from these beds are quite covered with specimens, lying in every direction (*l. c.* p. 10).

Among the leaves I found two insects, a beetle and one of the Hemiptera. These must have been inhabitants of dry land, as well as the plants. However, amongst the latter we find several species which must have grown in marshy or moory ground, viz. *Phragmites*, *Sparganium*, *Taxodium*, and *Menyanthes*. These plants indicate a freshwater formation, as does also a *Cyclas* (Plate LII. fig. 10), the shell of which occurs in the siderite, and which is undoubtedly a freshwater mollusk. These facts, combined with the entire absence of marine plants and animals, prove to us that the siderite of Atanekerdluk is most certainly a freshwater deposit—probably similar in its origin to the limonite of our own woods and marshes.

Mr. WHYMPER'S collection contains fossil plants from two localities on Disco Island, viz. Ujararsusuk and Kudliset, which is opposite Atanekerdluk and nearly on the same parallel of latitude. As before, I shall extract from his report and the notes of Mr. BROWN the portions which bear on the geology of the place.

"Coal-seams are exposed at a number of points both along the Waigat and on the coast between Flakkerhuk and Godhavn. Dr. RINK mentions* five places at which it is found along these shores; there are at least three others,—one spoken of by GIESECKE; another near to Issungoak Ness, from which I obtained amber through the natives; and a third nearer to Godhavn. At the time of our visit fossil wood had been found:—1st,

* Grönland geographisk og statistisk beskrevet, vol. i. pp. 172, &c.

at Iglutsiak, near Godhavn; 2nd, at Signifik, between the last-named place and Flakkerhuk; 3rd, at Ujarasusuk (Ujarasuksumitok); and 4th, at Kulfelden (Kudliset). Specimens from these places are in the University Museum at Copenhagen, and on my return I obtained, through the courtesy of Professor JOHNSTRUP, duplicate specimens from the first two named. Until the time of our visit leaves had not, however, been found, with the exception of a few specimens by Dr. LYALL. Amber had, however, been found at several places, and from this fact, and from the statement by GIESECKE, that he had himself observed impressions of leaves, there was little doubt but that a more careful search would yield results. It was most important to find the place spoken of by GIESECKE as Ritenbenk's Kulbrund. There was difficulty in doing so: the natives differed among themselves; but we now know that this name is applied equally to all the places along the Waigat coast of Disco from which coal has been taken for Ritenbenk. At the present time coal for that colony is only taken from one place on Disco, namely, Ujarasuksumitok; but it has been taken from several others, and hence we were much puzzled to determine the precise point to which GIESECKE referred.

"On arrival at Ujarasuksumitok it was found that the coal was exposed in the cliff by the shore, at a height of about 50 feet above the sea. It had been worked a length of 50 feet to a depth of $4\frac{1}{2}$: one could not say what was the entire depth of the seam, as the lower part was covered up by débris*. All the natives were put to work, but for some hours we failed to find anything more than wood (up to 5 inches diameter), charred stems, doubtful impressions, and a few grains of amber. I then went along the coast towards, the north, and was at length rewarded by finding a fair specimen, containing leaves, in the bed of a small stream. It was in hardened, warm-coloured clay, similar to those obtained at Atanekerdluk. I followed the stream to its source, a height of about 1000 feet, without finding anything more. Then returning, I went to the south, and in another and larger torrent-bed found several others. The natives, now put on the right track, soon brought in a fair collection. GUDEMANN was the fortunate discoverer of the *Magnolia* cone, to which Professor HEER refers, and he was greatly surprised at the reward it produced him.

"All the specimens collected at this place were obtained from these two torrent-beds: Mr. BROWN, who followed the fossils up to their source, reported that they came from a thin seam difficult to get at. As it was becoming a question whether the boats would carry all the specimens we had already collected, I decided to push onwards the same night to Kudliset, which, from reports received, seemed a more promising place for investigation."

Mr. BROWN says, "A few days before our arrival coal had been taken out. The place where the mining had been done was a cliff facing the sea. It exhibited shales resting (?) on trap, topped again by medium-grained white sandstone, this apparently covered by

* "The Danish man at Sakkak informed me that the coal was got out easily enough during the summer time, but that at a depth of 12 feet it remained frozen throughout the year. On arriving at the frozen coal they commonly wait two or three days to allow it to thaw, before continuing to work it.

coal; for further along the beach there was a face of 3 feet of lignite exposed, this covered again by 1½ foot shale, then 10 feet coarse brownish gritty sandstone, then 2 feet of hard brownish sandstone, finally 4 feet of hard grey sandstone discoloured in some places by iron. On this the alluvial soil rested; some strata, or a stratum, having, however, to all appearance been denuded. The dip 33°. Strike easterly across the Waigat. Both the shales and sandstone grit contained innumerable impressions of stems interlaced in every direction, but more particularly in the shales, but, as at Atanekerdluk, (nearly directly opposite) there were no leaves, and most of the stems &c. in the shale appeared only like lines of charred wood. The coal, though of a poor quality, is yet perfectly fit to burn, and some of the exploring ships (McClintock's and Inglefield's) have taken it.

"Much débris has been brought down by the stream here as it dashes from the mountain, and bursts through the sedimentary strata which lie in its way. Among this débris were found fair impressions of leaves. I followed these up, and found them to be *from the little stratum of hard brown sandstone formerly mentioned.* It was, however, difficult in our limited time to obtain specimens of the rock on account of the mass of deposits above them. The place where these are found *in situ* is about 100 feet above the sea."

Mr. Whymper's Report goes on to say, "At this place (Kudliset) coal (lignite) was exposed in a cliff on the south side of the bed of a small stream in two seams, 4 feet apart, for a length of about 30 feet, difficult to get at. They were 105 feet (by aneroid) above the sea, and distant from it about 300 yards. The lowest seam, 2 feet thick, was resting on a bed of indurated clay, and between the seams was a coarse and very loose, crumbly sandstone. The uppermost seam, 1 foot thick, was capped by a finer and harder sandstone which I could not measure. The whole, above and below, was enclosed by sand.

"In the torrent-bed we found some considerable masses of apparently fossilized wood, and I followed the stream upwards in hopes of finding leaves. At a height of about 800 feet I obtained agates in basalt, and following the stream to its source (about 1000 feet above the sea), came nearly to the foot of the great basaltic cliffs. The specimens collected here include hardened clays which have taken form in cavities in the basalt. Returning to my party, I found that they had in the mean time obtained some indifferent and fair specimens from the torrent-bed and from the sandstone above the coal. We afterwards added to their number, but the coarseness of the stone prevented any very good specimens from being obtained. Nodules of argillaceous oxide of iron, having usually in the centre kernels of the same, were abundant in the stream and in the soil at its sides.

"After a half-day's work we had apparently exhausted this locality. The specimens obtained were again chiefly taken from the torrent-bed. It was a matter of difficulty, if not of danger, to get any from the sandstone above the coal; and as the natives were murmuring frequently at being taken further away than they had agreed, I sent Mr. Brown to the south with one boat to examine the coast and then proceed to Ritenbenk, *viâ*

Atanekerdluk, while I went with the other boat as far north on the Disco shore as the natives would go. A little further along the coast I found some doubtful impressions of leaves in a great wilderness of stones brought down by a glacier-torrent, and about three miles still further north came to the magnificent gorge in the sandstone cliffs by the shore to which I have vainly endeavoured to do justice in a view exhibited at the Meeting*. One mile after this the cliffs by the shore came to an end, and the coast apparently continued quite flat until opposite Hare Island†. The natives agreed that no coal was visible along the whole of this shore; and we crossed to Mannik, on the opposite side of the Waigat. Here there was a small thin seam of coal exposed in a cliff not far from the shore; but I obtained nothing from it, and we continued our course to Atanekerdluk, arriving shortly after midnight; here we passed the night of the 27th August. The next day was occupied in loading the boat with the specimens we had left there, in sketching, and in completing the examination of the locality. At 4 P.M. we started for Sakkak, and left it at 8.30, arriving at Ritenbenk on the morning of the 29th August. Mr. BROWN had arrived about twelve hours before, but, like ourselves, had failed to make any fresh discoveries.

"At Ritenbenk we remained three days, with foul weather. During this time the collections, including many hundred specimens, amounting to considerably more than half a ton in weight, were repacked. We were then favoured, by the kindness of Mr. ANDERSON, with a passage in a blubber-boat to Godhavn, at which place we arrived on September the 4th, after a most disagreeable voyage. On the 10th we sailed on board the brig 'Hoalfisken,' and arrived at Copenhagen on October the 22nd."

Mr. WHYMPER concludes his Report by saying, "It is right to observe that these collections could not have been made excepting by means of the facilities afforded by the Danish authorities. We may feel a natural satisfaction that so many as 80 species should have been discovered by the labours of Professor HEER, but it should be remembered that they are primarily due to the invaluable information given by

* "At this part some boulders of granite, probably transported by sea-ice, were lying on the shore.

† It is to be regretted that Mr. WHYMPER could not extend his excursion as far as Hare Island, where General SABINE collected brown coal and amber fifty years ago, and where it is probable that fossil plants occur. General SABINE has had the kindness to send me an extract from his Journal, containing information respecting this discovery, and I cannot but let it find a place here.

"1818, June 19th.—Sergeant MARTIN and my servant [JOHN SMITH] have been on a shooting excursion for twenty-four hours, but have seen no other land birds than Ptarmigan and Snow Buntings. They have brought with them from a hill near the middle of the island, several pieces of a curious specimen, apparently the trunk of a fir tree, fossilized. Our party walked this evening in search of the bed of Hare Island Coal, but the direction we had received from the surgeon of a whaler did not enable us to find it; we procured, however, specimens of the most interesting mineralogy of the island, particularly a remarkable variety of brown coal passing into bituminous wood, which is mentioned by GIESECKE.

"I may add that we collected from the vicinity of the spot near the sea where our clocks and transit were placed, many specimens of a shaly coal, many of which had on their surface a deposit of amber; these were given to Mr. KONIG at the British Museum, and were described by him in the mineralogy of the voyage. The hill was under 1000 feet in height."

Herr C. S. M. Olrik, the Director of the Greenland Trade. Scarcely less are our thanks due to Herr K. Smith, the present Inspector of North Greenland, and to Herr Anderson, of Ritenbenk; both of these gentlemen gave much assistance at considerable personal trouble, which was of the greatest service."

Mr. Brown says, "*Kudliset*. This locality is backed by great cliffs of basalt giving the place its name. Walking south along the beach the following section is exposed, from top to bottom:—

"1. 20 feet alluvium of earth, débris of rocks from cliffs behind.

"2. 5 feet coarse gritty brown sandstone.

"3. $1\frac{1}{2}$ foot hard grey sandstone.

"4. 1 foot hard sandy shales with the faint vegetable impressions, &c.

"5. 14 inches of coal exposed by the men attempting to work it at the place where a stream breaks through the strata. The coal is of the same nature as the others.

"6. 2 to 3 feet of shales.

"7. 3 feet hard sandstone.

"8. 2 feet shales, sandstones &c. in irregularly laminated seam.

"9. 1 foot hard sandstone.

"10. 2 feet shales.

"11. Hard grey sandstone with pieces of coal contained in its mass. Of this 14 feet were exposed at the level of the beach.

"The dip of these strata is north 45°, strike easterly (across the Waigat). Scattered along the beach are great blocks of *conglomerate of primary rocks* which have rolled from the mountains.

"(*a*) *Fossil stem locality*.—North of the last-named place a stream flows in. This stream flows in a general course, easterly from the mountains or the interior of the island (which seems only to be a small edition of the mainland in its physical features). Many of the stems were lying in the stream in fragments, but the dicotyledonous character of them was quite apparent. The bark, knots &c. were quite characteristic—the outside brownish or whitish, the interior of a blackish character. They might be passed over by any one not acquainted with the appearance of fossil stones as mere blocks of stone. A perpendicular section facing the stream where these stones had rolled down (as it afterwards appeared out of the level) showed from the level of the creeks the following:—

"1. (Bottom) 4 feet splintery shales.

"2. 1 foot hard gritty sandstone.

"3. 4 feet mixed shales and sandstone.

Not very distinct from each other. {

"4. 1 foot coal.

"5. $1\frac{1}{2}$ foot shale, with faint impressions of leaves, stems &c. (*ut antea*).

"6. $2\frac{1}{2}$ feet coal.

}

"In this coal are the stems referred to previously. They lie apparently horizontally N. and S., and the *transverse* section of them is exhibited in the cliff. The direction of all the stems is not constant, and more difficult to satisfy oneself regarding than might be supposed. At all events there is no doubt they lie *horizontally*. Coal is, according to my observations, *invariably* all around the stems, and the shales do not come in contact with them. I would also beg of you to notice there is no 'dirt bed' inferiorly—strong presumptive evidence (I venture to think) that under whatever condition the plants to which the leaves, &c. belong grew (and there can be no doubt but that *they* were *never* water-floated), the stems grew not *in situ*, but were probably floated there in much the same way as the drift wood is now, and accumulates in great mass in certain places about Disco Bay and other portions of the Arctic regions*. I pray you, however, to look upon this as merely a *theory*, not a *fact*, and as such only do I state it, with every respect for your opinion, to which I wish entirely to yield.

"7. Shales, 18 inches.

"8. Sandstone with leaves, &c. (as per specimen), 3 feet.

"9. Small seam of soft shale.

"10. One foot of coal.

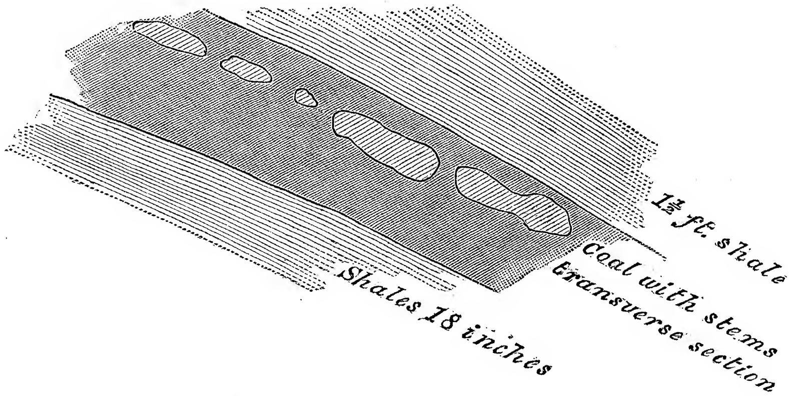
"11. 4 feet of shales, soft and splintery.

"12. 1 foot of coal.

"13. 3 feet soft splintery brownish shales.

"? 14. Whitish sandstone, gritty?

"15. Alluvial soil with recent vegetation.



Rough sketch showing position of stems in coal at Kudliset.

"Close to this place I found the face of a bare slope scattered with fragments of fossil wood, twigs, and portions of stems out of strata."

If we take a general view of the geological relations of this part of Greenland, as described in the foregoing extracts, we find that on both sides of the Waigat the crystalline rocks are covered by a succession of Miocene deposits pierced by volcanic rocks

* It may be so, but as no marine miocene animals and plants were found either at Disco or at Atanekerdluk, it is more probable that the fossil stems were drifted by a river, and that the lignites of the brown coal issued from trees of the moors, in which they sank. At present times this occurs frequently on the moors. The fact that they are lying in every direction and enveloped by coal accounts for it.—Oswald Heer.

which appear in places as thick beds of basalt and trap. Most unfortunately there was no opportunity afforded to this expedition of visiting the cretaceous strata on the north side of Noursoak (near Kome) which have revealed to us the existence of the interesting chalk flora, described in my 'Flora Arctica.'

I shall now proceed to give some particulars respecting the plants brought home by Mr. Whymper.

I. *Fossil Plants from Disco.*

The collection contains fourteen species from this island; six are from Ujararsusuk, and twelve from Kudliset, four are common to both localities, viz. *Aspidium Meyeri*, *Sequoia Couttsiæ*, *Platanus Guillelmæ*, and *Magnolia Inglefieldi*. The plane and the *Sequoia* are the commonest trees at both places. Plane leaves of various sizes and of great beauty have been found (cf. Plate XLVII. & XLVIII.), and prove to us that two species of this tree occurred in the Miocene deposits of North Greenland. Both of them have been found at Atanekerdluk, but only one (*P. Guillelmæ*, Göpp.) occurred at Disco. The *Sequoia* exhibits not only long twigs in a good state of preservation, but also the cones (Plate XLI. & XLII.). It appears therefore that at the Miocene epoch the woods of this part of Disco Island were chiefly composed of planes and *Sequoias*. In addition there were a *Widdringtonia*, a *Liquidambar*, and a *Magnolia* with very large evergreen leaves. The leaves of this *Magnolia* have been found at Kudliset and Atanekerdluk, the fruit at Ujararsusuk. I had previously known only the leaves of this remarkable tree, which were described in my 'Flora Arctica' (p. 120, pls. iii., xvi., xviii.). The two cones found at Ujararsusuk are accordingly among the most important results obtained by this expedition; they corroborate the determination of the tree effected by means of the leaves alone, and they prove to us that this splendid evergreen ripened its fruits so far north as on the parallel of 70°. A *Dryandra*, an *Aralia* and a *Paliurus* probably constituted the brushwood of the forest, while several ferns (*Aspidium Meyeri*, *A. Heerii*, Ett., *A. ursinum*) covered the ground. The *Phragmites* and the *Sparganium* point to the existence of a river or a lake.

Seven out of these fourteen species occur also at Atanekerdluk. Eight of them agree with those of the Lower Miocene of Europe. The flora belongs therefore to that epoch.

II. *Fossil Plants from Atanekerdluk.*

In the sandstone and ironstone of Kudliset and Ujararsusuk, the fossil plants are rather rare, but at Atanekerdluk they are found in the greatest profusion, at times occurring in dense conglomerated masses. The collection contains 73 species from this locality; 48 of these are described in my 'Flora Arctica,' and 25 are new. Of these latter 5 are found in the Miocene Flora of Europe, viz. *Poacites Mengeanus*, *Smilax grandifolia*, *Quercus Laharpii*, *Corylus insignis*, and *Sassafras Ferretianum*. Of these the *Smilax* and *Sassafras* present points of peculiar interest. The *Smilax grandifolia* represents the *Smilax Mauritania* of the present Mediterranean flora, and at the lower Miocene epoch was distributed over the whole of Europe. It is found in Italy, Switzerland,

and Germany up to the coasts of the Baltic, and we now know that it occurred even in Greenland, hanging probably in festoons from the trees. The *Sassafras* has hitherto only been found at a few localities, which are however are so far apart (Menat in France, and Senegaglia in Italy) that it is very probable that the plant ranged over a large part of Europe. This type of plants must have had a very large distribution as to time and space, for we find it in the Cretaceous formation of the United States (*Sassafras cretaceum*, Newb.) as well as in the Eocene of Europe (*S. primigenia*, Sap.). At present it is only found in America.

As interesting new species we have to notice a *Viburnum* (*V. Whymperi*) resembling the *V. Lantana* of Europe and the *V. dentatum* of America; an *Aralia* with leathery leaves, a *Cornus*, an *Ilex* with very large leaves, two *Rhus*, a *Sorbus*, a *Nyssa*, and two *Pterospermites*.

The collection gives us also much information about species already known. It contains many fine leaves of *M'Clintockia* which extend our knowledge of this remarkable genus. It is true that even now its systematic position cannot be determined with certainty, but it probably belongs to the family of Menispermaceæ. The appearance of a fruit from Atanekerdluk confirms this opinion, which can also be based on the leaves. Of the *Sequoia Langsdorfii* I found the male and female flowers, and the ripe and opened cones are not rare. They and the long shoots which are occasionally found, show us that the climate and soil must have been very favourable for the growth of this tree. Of the *Salisburea* we knew formerly merely the form with entire leaves. This collection contains a portion of a leaf which shows us that the fossil species had at times bilobate leaves like the living ones. It is therefore probable that the Miocene tree belongs to the same species as the living *S. Adiantifolia* of Japan.

The oaks appear very frequently at Atanekerdluk. To the eight species which we knew formerly, a new one (*Quercus Laharpii*, Gaud.) has been added, while among the former ones we obtained more perfect leaves of *Q. Lyellii* and *Q. platania*. The same is the case with *Juglans*, *Planera*, and two remarkable ferns (*Hemitelites Torelli* and *Woodwardites*), differing very widely from all species both of the temperate and frigid zones.

The discovery of the fruit and flowers of the chestnut (cf. Plate XLV. figs. 1, 2) lying beside a leaf of *Fagus castaneæfolia*, Ung., confirms the opinion which I expressed in my 'Flora Arctica' (p. 106) of its identity with *Castanea*. They prove to us that the deposits of Atanekerdluk were formed at different seasons; in spring when the chestnut is in flower, as well as in autumn. The discovery of the fruit of *Menyanthes* (Plate L. fig. 16) is a further confirmation of a species founded only on the leaves.

Mr. WHYMPER's collection contains on the whole 80 species of plants from North Greenland; 32 of these are new for this flora, and 20 are quite new. The Miocene plants of North Greenland have thereby reached the number of 137 species, and those of the Arctic Miocene flora 194. Of these 137 species from Greenland 46 species agree with those of the Miocene of Europe. Of these the following species have their Southern limits determined.

On the coasts of the Baltic, 6, viz.:—

Sequoia brevifolia, Poacites Mengeanus, Populus Zaddachi, Salix Raeana, Andromeda Saportana, and Fraxinus denticulata.

In Switzerland, 10, viz.:—

Aspidium Meyeri, A. Heerii, Osmunda Heerii, Pteris Œningensis, Sparganium stygium, Widdringtonia helvetica, Platanus Guillelmæ, Corylus insignis, Rhamnus Gaudini, and Colutea Salteri.

In Austria, 7, viz.:—

Lastræa Stiriaca, Quercus Lyellii, Fagus macrophylla, Alnus nostratum, Cornus ferox, Myrica acuminata, and Dryandra acutiloba.

In France (Armissan and Menat), 4, viz.:—

Thujopsis massiliensis, Sequoia Couttsiæ, Populus sclerophylla, and Corylus M'Quarrii.

In Italy, 17, viz.:—

Salisburea adiantoides, Taxodium, Smilax grandifolia, Phragmites Œningensis, Liquidambar europæum, Platanus aceroides, Fagus Deucalionis, Castanea Ungeri, Quercus Drymeia, Q. Laharpii, Carpinus grandis, Diospyros brachysepala, Ilex longifolia, Juglans acuminata, J. Strozziana, Rhamnus Eridani, Sassafras Ferretianum.

In Greece (Kumi), 6, viz.:—

Sequoia Langsdorfii, Glyptostrobus europæus, Planera Ungeri, Quercus furcinervis, Andromeda protogæa, and Rhamnus brevifolia.

We find 4 species common to North Greenland and Bovey Tracey in Devonshire. It is remarkable that among these is the tree most common at the latter locality, *Sequoia Couttsiæ*, while the fern most frequently found at Bovey (*Hemitelites lignitum*) is represented in Greenland by a species (*H. Torelli*) very closely related to it.

It is certainly very interesting that so many species extend to Italy and Greece. Almost all of these may be referred to the country situated between these two extreme limits, and we thereby see that our knowledge respecting the Miocene Flora of Europe, at least the forest plants, is no longer so imperfect as heretofore.

This review proves to us the extensive distribution of the Miocene plants, and also that the same types have ranged over a wider area than the homologous living species. These indeed reach as far southwards as the Miocene ones, but do not advance so far in a northerly direction.

Amber has been brought by Mr. WHYMPER from Atanekerdluk and from Ujararsusuk. At Atanekerdluk it is found in the brown coal, and also in the fossil plant-beds. In some stones grains of amber are seen beside twigs of *Taxodium* (Plate XLIII. figs. 4, 6). It is, however, much more abundant in the brown coal of Hare Island (cf. Flora Arctica, p. 7). The *Sequoias* and the *Taxodium* being the commonest conifers of Greenland, it seems likely that the amber was produced by them.

I pointed out in my 'Flora Fossilis Arctica' (p. 13), that the formation containing the Tertiary plants of Greenland is Lower Miocene in age. The species which have been newly discovered do not affect the truth of this statement. *Platanus Guillelmæ* and *Quercus Laharpii* have certainly been only found in the Upper Miocene of Europe; while *Smilax grandifolia*, *Widdringtonia helvetica*, *Dryandra acutiloba*, *Aspidium Heerii*, and *Corylus insignis* occur only in the Lower Miocene; and *Sassafras Ferretianum*, with *Aspidium Meyeri* and *Liquidambar Europæum*, have been met with in both divisions.

In conclusion I beg to offer a few remarks as to the amount of certainty in identification which the determination of fossil plants is able to afford us. We know that the flowers, fruit, and seeds are more important as characteristics than the leaves. There are many genera of which the leaves are very variable, and would consequently be likely to lead us astray if we trusted to them alone. However, many peculiarities as to the form and nervation of leaves are well known to be characteristic of certain genera, and can therefore afford us indications of great value for their recognition. Most fortunately in the case of fossil plants we are not always dependent on the leaves alone for purposes of identification. Of many plants we know other organs which, taken in connexion with the leaves, justify a determination as absolute as that of a living plant. If a species has been once thoroughly identified in this manner we are able to recognize it in other localities where the leaves alone are found. The same is true of living plants in many cases. We recognize at first glance a fir, a beech, a maple, &c. if we see the leaves only, without looking to the flowers or fruit.

On the whole, then, the following are the grounds on which the determination of the plants belonging to the Miocene Flora of Greenland has been based respectively.

I. Species identified by means of leaves, flowers, fruit, and seeds.

Sequoia Langsdorfii, Castanea Ungeri, and Diospyros brachysepala.

II. Species identified by means of leaves and fruit.

Taxodium, Sequoia Couttsiæ, Sparganium, Myrica, Populus Richardsoni, P. Arctica, Ostrya, Corylus M'Quarrii, Menyanthes, Magnolia, and Paliurus.

III. Species identified by means of leaves and seeds.

Vitis and Prunus.

Accordingly the leaves and organs of fructification of 17 species have been described*.

IV. Ten species are only represented in Greenland by their leaves, while their fruit, and in some cases their flowers and seeds, have been found elsewhere.

Glyptostrobus europæus, Pinus polaris, Widdringtonia helvetica, Liquidambar europæum, Planera Ungeri, Platanus aceroides, Andromeda protogæa, Carpinus grandis, Juglans acuminata, Populus Zaddachi, and Quercus furcinervis.

V. The remainder of the Phanerograms is only known to us by means of their leaves. The leaves of many of the species have, however, such well-marked characteristics, that their generic determination may be considered as complete. These are

Salisburea adiantoides, Smilax grandifolia, Salix Ræana, S. Grönlandica, Alnus nostratum, Fagus Deucalionis, Quercus Greenlandica, Q. Olafseni, Q. Lyellii, Q.

* Notice of the fruits of *Quercus* and *Fagus* is omitted in default of complete identification.

Drymeia, Platanus Guillelmæ, Sassafras Ferretianum, Hedera MacClurii, Viburnum Whymperi, Cornus hyperboreus, Rhamnus Eridani, Cratægus antiqua.

VI. To these may be added 5 Cryptogams, of which the position in the vegetable kingdom is quite certain, viz.:—

Aspidium Meyeri, Lastræa Stiriaca, Pteris Œningensis, Osmunda Heerii (Gaud.), and Equisetum arcticum.

It must be allowed that the systematic position of a number of plants from North Greenland is as yet uncertain. The families to which *Daphnogene Kanii*, the *M[c]Clintockias*, and *Pterospermites* are to be assigned are not satisfactorily determined, while the remains of the plants described by me as *Dryandra*, *Ficus*, *Ilex*, *Aralia*, *Rhus*, and *Nyssa* are questionable. However, the number of species which have been positively identified is so large, that it enables us to give a sketch of the Miocene Flora of North Greenland.

II. List of the Plants, and descriptions of the New Species.

I. Filices.

1. *Aspidium Meyeri*, Heer, Plate XXXIX. figs. 1–3. Fronde pinnata, pinnis patentibus, lanceolato-linearibus, profunde pinnati-partitis vel pinnatisectis, laciniis oblongis, apice rotundatis, integerrimis, nervis tertiariis furcatis; soris biseriatis, indusio orbiculato. Hr. Fl. Tert. Helv. i. p. 36, pl. xi. fig. 2. *Hab.* Ujararsusuk (figs. 1, 2). Kudliset (fig. 3).

This remarkable fern seems to have been very common in Disco. The best specimens (Plate XXXIX. fig. 1) are from Ujararsusuk. Rachis pretty thick, leaflets numerous, lying in all directions. On most of the pinnules are traces of sori, sometimes very well preserved. Pinnules pretty close-set, of considerable length (fig. 1 *c*), deeply pinnately lobed, the lobes contiguous at the base or remote. Pinnules of the largest leaves are $5\frac{1}{2}$ millims. broad, and 12 long; shorter, smaller, and somewhat bent upwards at the apex; near the base they spring from the rachis almost at a right angle. Lower pinnules oblong, rounded at the apex, which is not the case with the upper ones. Secondary nerves contiguous, and mostly forked (fig. 1, magnified). Sori in two lines of 3–5 each along the principal nerve (fig. 1 *a a*, magn.) halfway between the midrib and the margin. Fig. 1 *f* (1 *f f*, magn.) shows two ranges of sori. With the lens we perceive in them a great many small round impressions left by the capsules. Fig. 1 *a* (magn. *a*, *a*) represents a fine portion of a leaf with the indusia, which are circular, and seem not to be emarginate. In fig. 2 the pinnules are united higher up at the base; nevertheless this specimen from Ujararsusuk probably belongs to the same species; the pinnules being also obtusely rounded.

These Greenland leaves agree with the molasse plant from Lausanne and Ruppen. It differs from *Aspidium Escheri*, Hr., in the obtuse pinnules and forked secondary nerves.

2. *Aspidium Heerii*, Ett., Plate XXXIX. figs. 4, 5. K. von Ettingshausen, die Farrn kräuter der Jetzwelt, p. 199. *A. elongatum*, Hr. Fl. Tert. Helv. i. p. 36, pl. xi. fig. 3. *Hab.* Kudliset, Ujararsusuk.

Fragments of pinnules, agreeing well with the fern of the Hohe Rhone. It differs from the preceding species in the pinnules, which taper at the apex, and the secondary nerves, which are apparently not forked. Figs. 5 & 5 *b* represent the pinnatisect ends of the pinnules. The pinnules are bent upwards, and the secondary nerves spring at acute angles. Fig. 5 *b* shows traces of sori.

3. *Aspidium ursinum*, Hr., Plate XXXIX. fig. 6 *a*. Foliis bipinnatis (?) pinnulis oblongis, subpinnatifidis, lobis rotundatis. *Hab.* Kudliset.

A portion of a pinna. Rachis slender, bearing alternate, oblong-oval, and on the upper part obtusely rounded pinnules. Margin with large teeth, or rather short obtuse lobes, separated by shallow sinuses. Nervation obliterated, but only one undivided secondary nerve seems to run to each lobe (fig. 1 *a a*, magn.).

4. *Woodwardites arcticus*, Hr., Plate XL. fig. 6. Hr. Fl. Foss. Arct. p. 86, pl. i. fig. 16. *Hab.* Atanekerdluk.

Fig. 6. Fragments of pinnatifid pinnules, lobes obtuse. Nervation well preserved, agreeing with pl. i. fig. 16 of my 'Flora Arctica.'

5. *Hemitelites Torelli*, Hr., Plates XL. figs. 1–5 *a*; LV. 2. Fronde bipinnata, pinnis pinnatifidis vel pinnatipartitis, apice attenuatis, lobis integerrimis, apice obtusiusculis, nervis tertiariis furcatis, inferioribus sinum attingentibus. *Pecopteris Torellii*, Hr. Fl. Foss. Arct. p. 88, pl. ii. fig. 15. *Hab.* Atanekerdluk.

Formerly I had but a small fragment of this species. Mr. WHYMPER'S specimens are much better, and give a good idea of this interesting species, but the sori are wanting.

Stipes furrowed, pinnules alternate, tapered downwards and decurrent (Plate XL. figs. 1, 2), long, deeply cut, entire, lobes rounded or obtuse, midrib pretty stout. Secondary nerves forming acute angles more or less curved, and bearing on each side 4–6 tertiary nerves; lowest strongly curved, always entering the sinus between two lobes. The lowest tertiary nerves do not generally join those of the neighbouring pinnules (figs. 2, 3), but this is the case in fig. 4.

Fig. 5 *a*. Portion of a very large pinnule, which belongs, I believe, to the same species.

In the collection at Copenhagen is a remnant of this species showing that the leaf is bipinnate; the rachis communis is large (11 millims. diam.), the pinnæ approximate. (Plate LV. fig. 2.)

This must have been a very large and luxuriant fern. It is very near *Pecopteris* (*Hemitelia*?) *lignitum*, cf. Lignites of Bovey Tracey, p. 29, pls. iv. figs. 4–6; v. 1–11; vi., which is very common in the lignites of Bovey, but the pinnules are more deeply cut, and have not acuminate lobes.

The genus is still doubtful. In my Bovey paper I have compared the *Pecopteris lignitum* with the *Hemitelia Karsteniana* (Mettenius, Icon. Filic. pl. xxix. fig. 2), the nervation of which is very similar. The Greenland species belongs to the same genus as *P. lignitum*. Count SAPORTA has described some species of fern of the same type as *Hemitelites* (*H. longævus* and *H. proximus*, Prodrome d'une Flore Fossile des Travertins anciens de Sezanne, p. 334, pl. xxiv. figs. 9–11), and I believe that *Pecopteris lignitum* and *P. Torelli* belong to the same genus.

6. *Osmunda Heerii*, Gaudin, Plate XLIII. fig. 2 *d*. Fl. Arct. p. 88, pl. i. figs. 6–11 viii. 15 *b*. *Hab*. Atanekerdluk.

Some leaflets.

II. EQUISETACEÆ.

7. *Equisetum boreale*, Hr., Plate XLIII. fig. 16. Fl. Arct. p. 89, pls. i. fig. 17; xlv. 10, 13 *e*, *f*.

I have represented in my 'Flora Arctica' different parts of this species. WHYMPER'S collection contains only some fragments. Plate XLIII. fig. 16 is probably a rhizome; it is articulated and striated.

III. CUPRESSINEÆ.

8. *Widdringtonia helvetica*, Hr., Plate XLI. figs. 10, 11; 10 *b*, *c*, magn. Hr. Fl. Tert. Helv. i. p. 48, pl. xvi. figs. 2–18. Ettingshausen, Fl. von Bilin, p. 34.

Besides the branches of *Sequoia Couttsiæ* there are on the large slab from Kudliset some thinner and more delicate-branched twigs, provided with very small imbricated leaves. These certainly belong to another coniferous tree, and closely resemble *Widdringtonia helvetica*; but the determination is doubtful, in the absence of cones, and from the leaves being so much compressed that it is difficult to determine their form. These twigs differ from *Glyptostrobus*, which they resemble, in the much smaller leaves. The branchlets are bent upwards, and the leaves are alternate, imbricate, acuminate, and almost cover the twigs (Plate XLI. fig. 10 *b*, *c*).

9. *Taxodium distichum miocenum*, Plate XLIII. figs. 4, 5. *Taxodium dubium*, Sternb. sp., Hr. Fl. Foss. Arct. p. 89, pls. ii. figs. 24–27; xii. 1 *c*; xxv. 11 *a–d*, 12.

I have tried to show in my 'Miocene Baltic Flora' that the *Taxodium* abounding everywhere in the Miocene formation agreed so closely with the living species, that it must be united to it. The new collection contains a great number of associated twigs from Atanekerdluk, several of which are very well preserved (Plate XLIII. fig. 4 *a*, *c*). Associated with these were some small pieces of amber (figs. 4, 6). Fig. 5 is the transverse section of the cone (from the Museum of Copenhagen).

IV. Abietineæ.

10. *Sequoia Langsdorfii*, Brongn., Plates XL. fig. 5 *b*; XLIII. 1–3; XLIV. 2–4; XLVI. 1 *a*, 7 *b*; LV. 3 *a*. Hr. Fl. Foss. Arct. pp. 91, 132, 136, pls. ii. figs. 2–22; xiv. 13 *a*, *c*, 14–18; xlvii. 3 *b*.

The collection from Atanekerdluk contains in almost every slab, amidst very numerous annual twigs, several which are very large (Plate LV. fig. 3 *a*) or of considerable length (one of 100 millims. in length), indicating a luxuriant growth. Some twigs with imbricate leaves had female flowers (Plate XLIV. figs. 2, 3).

Plate XLIV. fig. 4 represents a small oval catkin, probably male; fig. 3 *b*, a seed.

In the large slabs I found several ripe cones, the scales of which are spread open and separated. Plate XLIII. fig. 2 *a*, and Plate XLVI. fig. 7 *b* represent the transverse section of a cone, and Plate XLIII. fig. 1 a longitudinal section; fig. 2 *b* are leaves, and fig. 2 *c* a branch.

A scale of *Sequoia* was found in a nodule from Atanekerdluk (Plate XLIII. fig. 3).

11. *Sequoia brevifolia*, Hr., Fl. Arct. p. 93, pl. ii. fig. 23.

A small twig with short leaves rounded at the apex.

12. *Sequoia Couttsiæ*, Hr., Plates XLI. figs. 1–9; XLII. 1; XLVIII. 4 *d*, *e*. Pengelly and Heer, Lignite of Bovey Tracey, p. 33, pls. viii., ix., x. Quart. Journ. of Geol. Soc. 1861. Hr. Foss. Fl. der Polarländer, p. 94, pls. iii. fig. 1; viii. 14; xlv. 19. Saporta, Ann. des Sc. Nat. 1866, p. 193.

This appears to have been the commonest coniferous tree on Disco. Its twigs and fragments of cones are frequent in the sandstone and the siderite of Kudliset and Ujararsusuk. The finest specimen from Kudliset is represented in Plate XLI. On the older twigs are broad, scale-like imbricate scars (Plates XLI. fig. 1; XLII. 1 *a*) as on the biennial twigs from Bovey (Bovey Tracey, pl. viii. fig. 10). The lower parts of the branches are nearly smooth. Leaves of the young shoots falcately curved, acuminate, decurrent, and covering the twigs, sometimes very close together (Plate XLI. fig. 5), as in *S. Sternbergi*, at others, perhaps on young, lengthened shoots, more distant (fig. 3). The leaves in Plate XLI. fig. 4, and Plate XLII. fig. 1 *c* are not falcately curved, and are less acuminate, but appear to belong to this species. Plate XLI. fig. 9 represents a ramified twig, with scale-like adhering leaves, and bearing an oval body, probably a male catkin, such as I have described from Bovey Tracey (Plate XLII. fig. 43); the cone of this species is on the large slab (Plate XLI. fig. 7). In consequence of pressure, the shape has been altered, still one recognizes the peltate scales, which are cuneate at the base. At the base of one of these scales is an indistinct oval body, probably originating from the seed. The scales in Plate XLI. fig. 7 are in a lateral position. Plate XLII. fig. 1 *d* (from Ujararsusuk) represents their upper sides, and enables us better to determine their shape and size. They are 8 millims. broad and 7 long, polygonal, with a mucro in the midst, from which several wrinkles start. In shape and size these scales exactly tally with those of Bovey Tracey. Beside the scales are young twigs (fig. 1 *b*, *c*), and a pretty thick biennial shoot (fig. 1 *a*) closely covered with falcate leaves. This species agrees so well in its leaves and cones with the tree from Bovey, from Armissan, and from the lignite of Rixhöft, that its determination may be considered certain. At first sight the cone represented in Plate XLI. fig. 7 seems to be longer than those from Bovey; but this greater length certainly arises from the scales having partly separated from the axis.

The long, slender shoots, figured in Plate XLI., prove that the climate must have been very favourable to these trees.

13. *Pinus hyperborea*, Hr., Plates XLIV. figs. 5 *a*, *c*, *d*; LVI. 9 *c*. Hr. Fl. Foss. Arct. p. 94, pl. xvii. fig. 5 *f*.

Several leaves are better preserved than those represented in the 'Flora Arctica.' They are hard, leathery, gradually tapered to the pointed apex (Plate XLIV. fig. 6 *a*, *c*). When highly magnified there appear on each side of the strong medial nerve a number of very delicate longitudinal lines and transverse wrinkles. Fig. 5 *d* is much larger than the other leaves, but probably belongs to the same species; it is 9 millims. in breadth, with a strong midrib. The leaves differ from *Pinus* in their length and breadth, and recal *Podocarpus eocenica*, Ung., which possesses similar leaves.

14. *Pinus polaris*, Hr., Plate XLIII. fig. 6. Hr. Fl. Foss. Arct. p. 157.

Two partially preserved leaves (Plate XLIII. fig. 6) $1\frac{1}{2}$ millim. broad, flattened, midrib strong. They agree with the leaf discovered in Spitzbergen last year. Fig. 7 is a scale, probably of a *Pinus*, sectio *Picea*.

V. Taxineæ.

15. *Taxites Olriki*, Hr., Plate LV. fig. 7 *a*, *b*. Fl. Foss. Arct. p. 95, pls. i. figs. 21–240; xlv. 1 *a*, *b*, *c*.

Some leaves and a fine twig from Atanekerdluk. The leaves are rather obtuse at the apex, and not decurrent at the base. Beside this is a twig with small leaves, obtusely rounded at the apex. Belongs probably to *Cephalotaxus*.

16. *Salisburea adiantoides*, Ung., Plate XLIV. fig. 1. Fl. Foss. Arct. p. 95, pls. ii. fig. 1; xlvii. 4 *a*.

I have already tried to show in my 'Flora Arctica' that this species agrees in size and appearance with *S. adiantifolia* of Japan, although the fine leaf figured (Fl. Arct. pl. xlvii. fig. 16) is not lobed. The collection from Atanekerdluk contains a deeply bilobed leaf, only the upper part of which is preserved, but it corresponds so entirely with the living species, that it can scarcely be separated from it.

VI. Gramineæ.

17. *Phragmites Œningensis*, A. Br., Plates XLII. figs. 2, 3, 4 *a*; XLIII. 8, 9. Fl. Foss. Arct. p. 96, pls. iii. figs. 6–8; xlv. 6.

I have already described in my 'Flora Arctica' this species from Atanekerdluk. It is also found at Kudliset. Plate XLII. fig. 2 *a* represents a stout culm with knot, and fig. 2 *b* a fragment of a leaf. The numerous and equally strong longitudinal nerves are very distinct, while the slender secondary nerves are mostly obliterated. Fig. 2 *c* represents a deeply striated, more slender culm, probably of the same species. Fig. 4 is a shortly articulated rhizome from Kudliset, fig. 3 a more slender portion of a culm. Plate XLIII. fig. 8 represents a portion of a very large culm from Atanekerdluk, 24 millims. broad and 12 in diameter. The interior is filled with ironstone, the exterior striated. Fig. 9 are roots very much like those of *Phragmites Œningensis*, which I figured in my Fl. Tert. Helvet. i. pl. xxii. fig. 5. It therefore probably belongs to this species.

18. *Poacites Mengeanus*, Hr., Plate LV. figs. 9, 10. Foliis linearibus, 7–15 millims. latis, nervis fortioribus 8–15, interstitialibus 3–4, nervo medio ceteris paulo latiore. Hr. Fl. Mioc. Baltica, p. 59, pl. xv. figs. 2–11.

Several fragments of this species, which is not rare in the brown coal of the Baltic, are in a slab from Atanekerdluk. One specimen is 7 millims. broad (fig. 10 *b*), another 13 millims. (fig. 9). The midrib is flat, not much stronger than the longitudinal nerves, between which are 3–4 very slender and obsolete secondary nerves (fig. 10 *c*, magn.)

VII. Cyperaceæ.

19. *Cyperites microcarpus*, Hr., Plate LV. figs. 11, 12 magn. Hr. Fl. Foss. Arct. p. 97, pl. xlv. figs. 4, 5.

Plate LV. fig. 11. Transverse section of a spike. Several fruits surround an axis, each is 2 millims. long, oblong-oval, with a furrow near the margin; beside the fruit are small scales, probably bracts.

Similar to the *Cyperites Forbesi*, Hr. ("On certain Fossil Plants from the Hempstead Beds of the Isle of Wight," Quart. Journ. Geol. Soc. 1862, p. 373, pl. xviii. figs. 20, 21.)

VIII. Smilaceæ.

20. *Smilax grandifolia*, Ung., Plate XLV. figs. 6 *a*, 7. Fl. Tert. Helv. i. p. 82, pl. xxx. fig. 8. Ung. Sylloge Plant. i. p. 7. *Smilacites grandifolius*, Ung. *Chloris*, p. 129, pl. xl. fig. 3. *Hab.* Atanekerdluk.

The fragment of a leaf, figured in Plate XLV. fig. 6 *a*, from which I completed fig. 7, lies beside a leaf of *Corylus M^c^Quarrii* (fig. 6 *b*); it is rounded and emarginate at the base, gradually tapered and pointed towards the apex. Medial nerve a little stronger than the following principal nerves, which run in arches to the apex. The next following approaches the margin at $\frac{1}{3}$ up the leaf, and follows it towards the apex, but without reaching it. Beyond this is a delicate curved nerve, disappearing where the leaf begins to taper. The areas are filled up with nervules, forming a polygonal reticulation with large areoles, which project strongest at the margin. In the cordate base, the seven principal nerves, and their direction, this leaf agrees with *S. grandifolia*, but is relatively somewhat longer. On the other hand it is so near *S. Mauritanica*, and particularly the diluvial form from Lipari, which GAUDIN has represented (Contrib. à la Flore Fossile Italienne, v. pls. i. figs. 5, 6; ii. figs. 1, 2), that it is difficult to indicate differences, and its identification with the living *S. Mauritanica* appears probable. Certainly the leaves of *S. Mauritanica* are either entire or very slightly emarginate at the base; the principal nerves are more delicate, and the medial one not stronger than the others; but some leaves from Lipari are deeply cordate at the base, as in *S. grandifolia*, whilst others are slightly cordate, as in *S. Mauritanica*. The medial nerve of the Miocene *S. grandifolia* is sometimes much stronger than the lateral ones, and sometimes not (Ung. Syllog. fig. 7 with fig. 6), whereas the reticulation of the living species is more prominent than that of the Miocene one.

IX. TYPHACEÆ.

21. *Sparganium Stygium*, Hr., Plate XLII. figs. 4 *b*; 5; 5 *b*, magn. Fl. Foss. Arct. p. 97, pl. xlv. figs. 2, 13 *d*.

I have described (Fl. Arct.) the leaves and some indistinct fragments of fruits of this species. The collection of Mr. WHYMPER contains better preserved fruits, probably belonging to this species. On a slab from Atanekerdluk the heads of fruits are as closely placed as if they had been fixed on a common peduncle (fig. 5), which, however, is not preserved. The fruits are collected into a densely imbricated head; those in the middle are 10 millims. long and $2\frac{1}{2}$ broad. The base is tapered, and the upper part elongated into a pretty long beak (fig. 5 *b*, magn.). The inflorescence (fig. 4 *b*) from Kudliset, probably belonging to this species, and which I take to be a male catkin, presents a number of small scales round a receptaculum. It is very much like the *Sparganium* in my Flora Tert. Helvet. i. pl. xlvi. figs. 6 *d*, 7. The question whether the male catkin from Kudliset and the above described fruits from Atanekerdluk belong to *S. Stygium* cannot yet be decided. I referred them to it because the leaves from Atanekerdluk had been so called (cf. Flora Arct. p. 97), and we are justified in combining the flowers and fruits with these leaves.

X. NAIADEÆ.

22. *Caulinites costatus*, Hr., Plate XLIII. fig. 10. Caulibus profunde striatis, verrucis magnis rotundatis notatis. *Hab.* Atanekerdluk.

A portion of a stalk with deep striæ, which separate pretty strong projecting ribs.

The warts are round, and of different sizes. Very like *C. borealis*, Hr. (Fl. Foss. Arct. p. 145) and *C. dubius*, Hr., but much more deeply striated. The systematic position of *Caulinites* is still very doubtful.

XI. Styracifluæ.

23. *Liquidambar europæum*, A. Br., Plate XLI. fig. 13. Hr. Fl. Tert. Helv. ii. p. 6.

The large slab (Plate XLI.) contains a strongly compressed, though distinctly lobed leaf, agreeing with the 5-lobed leaf of *Liquidambar*, and resembling the leaf from Œningen, represented in my 'Flora' (Tert. Helv. pl. li. fig. 4.). The lower lobe is best preserved, the fine teeth are indicated at some places; it is tapered outwards. The margin of the other lobe is for the most part obliterated.

XII. Salicineæ.

24. *Populus Richardsoni*, Hr., Plates XLIV. figs. 7, 8, 9; LV. 3 *b*. Hr. Fl. Foss. Arct. p. 98, pls. iv. figs. 1–4; vi. 7, 8; xv. 1, *c*.

The collection contains many leaves of this common Miocene tree of North Greenland. Plate XLIV. fig. 8 *a* is a small one. All the teeth are rounded, as in *Populus tremula*, L. The nervation is very well preserved. Figs. 7 & 9 *a* show the long and slender petiole. A portion of a leaf, with a petiole 70 millims. long is beside the *Caulinites costatus*. Plate LV. fig. 3 *b* represents a very large leaf, 143 millims. long, and probably 130 broad, the base emarginate. Fig. 4 is probably the branch of a poplar; the bark shows transverse and longitudinal undulated stripes and ribs.

25. *Populus Zaddachi*, Hr., Plates XLIII. fig. 15 *a*; XLIV. 6. Hr. Fl. Foss. Arct. p. 98, pls. vi. figs. 1–4; xv. 1 *b*. *Hab.* Atanekerdluk.

Plate XLIV. fig. 6 is a fine leaf, with many small teeth. They are bent towards the apex, and every one has a small gland, exactly as in the leaves from Samland (pls. v. and vi. of my 'Miocene Baltic Flora'). Plate XLIV. fig. 6 agrees with pl. vi. fig. 5 of my Baltic Flora,' and Plate XLIII. fig. 15 *a* with pl. vi. fig. 4.

26. *Populus arctica*, Hr., Plates XLIII. figs. 14; LII. 8 *b*; LIII. 4 *b*. Hr. Fl. Foss. Arct. p. 100, pls. iv. figs. 6, 7; v., vi. 5 *b*; viii. 5 *b*; xvii. 5 *b*, *c*.

Common at Atanekerdluk. The collection contains various forms. Plate LIII. fig. 4 *b* is a leaf with an entire margin and an obtuse base.

I consider Plate XLIII. fig. 14 to be a young leaf of *Populus arctica*. It has a long petiole, dilated at the base. The margin is not toothed. Five almost equally strong principal nerves spring from the base of the leaf. The collection contains two such small leaves.

Populus pruinosa, Schrenk (Songorei), seems to be the nearest species.

27. *Salix Raeana*, Hr., Plate XLIII. fig. 11 *a*. Fl. Foss. Arct. p. 102, pls. iv. figs. 11–13; xlvii. 11.

The collection contains some fragments of this species, and an entire leaf, which agrees very well with the leaves from the Mackenzie (Fl. Foss. Arct. pl. xxi. fig. 13). It is oblong, with an entire margin; the secondary nerves approximate and are strongly curved.

28. *Salix varians*, Gœpp.? Plate XLIII. figs. 12, 13.

The margin being quite obliterated, an exact determination is not possible. The leaf is large, and lanceolate (?), the secondary nerves distant. From the midrib spring several short secondary nerves, which are united with each lower secondary nerve (a character peculiar to leaves of willows). Besides a leaf is a twig, also probably belonging to this species (fig. 13 *b*); it is thin, and bears several buds.

XIII. Betulaceæ.

29. *Alnus nostratum*, Ung. Fl. Foss. Arct. p. 103, pl. xlvii. fig. 12.

Two specimens, lying together. One shows on each side eight secondary curved nerves, from the lower of which spring tertiaries.

XIV. Cupuliferæ.

30. *Carpinus grandis*, Ung.? Plate XLIV. fig. 11 *c*. Hr. Fl. Foss. Arct. p. 103, pl. ix. fig. 9.

Only some fragments of leaves.

31. *Corylus M^cQuarrii*, Forb., Plates XLIV. figs. 11 *a*; XLV. 6 *b*. Hr. Fl. Foss. Arct. p. 104, pls. viii. figs. 9–12; ix. 1–8; xvii. 5 *d*; xix. 7 *c*. *Hab.* Atanekerdluk.

This is a very good specimen, showing the very beautiful nervation and acute teeth. Beneath this leaf is a fragment, probably of *Carpinus grandis*, Ung. (fig. 11 *c*), and two portions of leaves of *Ilex macrophylla* (fig. 11 *b*). Plate XLV. fig. 6 *b* is a narrower leaf, of which the sharp, double teeth are very well preserved.

32. *Corylus insignis*, Hr. Plate XLIX. fig. 5. Foliis ovato-ellipticis, apice acuminatis, duplicato-serratis. Hr. Fl. Tert. Helv. ii. p. 43, pl. lxxiii. figs. 11–17. *Hab.* Atanekerdluk.

A fine leaf, agreeing well with the species from the Swiss Molasse. It differs from *C. M^cQuarrii* in the base not being emarginate, and its shape being narrower. It approaches *Alnus nostratum*, Ung. (Fl. Arct. pl. xlvii. fig. 12 *b*), but the secondary nerves spring at more acute angles, and the leaf is narrower, and tapered towards the apex. The leaf is oval-elliptical, acuminate, very sharply toothed, and rounded at the base. There are 6–7 secondary nerves on each side, the lower of which send out tertiaries.

33. *Fagus Deucalionis*, Ung. Hr. Fl. Foss. Arct. p. 105, pl. viii. figs. 1–4; x. 6; xlvi. 4. *Hab.* Atanekerdluk.

Several fragments of leaves. Plate XLVI. fig. 9 is probably a fruit of *Fagus*. It is oval-elliptical, acuminate, and rounded at the base; the surface with some smooth striæ. It is only the impression of one side of the nucule, 14 millims. in length, and 8½ broad. The breadth is the same as in the fruit figured by Professor UNGER (*Chloris protogæa*, pl. xxvii. fig. 4), but is much larger, and the ribs are wanting.

34. *Castanea Ungeri*, Hr., Plates XLV. figs. 1–3; XLVI. 8. Foliis oblongo-lanceolatis, apice acuminatis, dentatis, nervis secundariis numerosis, approximatis, parallelis, strictis, craspedodromis, angulo acuto egredientibus; floribus masculis glomeratis, glomerulis spicatis; cupula globosa, spinis tenuibus echinata, interne rugoso-porosa, seminibus lævigatis, 18 millims. longis. Fl. Foss. Arct. p. 106, pls. x. figs. 8; xlvi. 1, 2, 3. *Fagus castaneæfolia*, Ung. *Chloris protogæa*, p. 104, pl. xxviii. fig. 1. *Hab.* Atanekerdluk.

The collection contains several leaves of this species, already described in the Fl. Arct. The large leaves are fragmentary (Plate XLV. figs. 1 *a*, 3), but one almost entire small leaf is preserved, showing the sharp teeth, into which the numerous, straight secondary nerves run (Plate XLVI. fig. 8). I have already observed (Fl. Arct. p. 106) that these leaves resemble *Castanea* more than *Fagus*: the flowers and the fruits, which I discovered in splitting the stones, confirm this opinion. I found in the collection from Copenhagen, just received, a portion of a leaf of this plant; and beside it a portion of the inflorescence of *Castanea* (Plate XLV. fig. 1. *b*, magn. 1 *b*, *b*); it presents three alternate sessile globose heads of flowers, 4½ millims. in diameter, around a straight, pretty strong peduncle. The uppermost head lies in the axis of a linear, awl-shaped bract, and consists of a number of long, obtusely-rounded leaflets, probably representing the calyx. They are highly compressed, and it is difficult to distinguish the structure of the flowers. I think that numerous similar flowers surrounded the axis, and that each calyx consists of six leaflets connate at the base. As these flowers lie over one another, it is not possible to distinguish the single ones. At some places are black threads, probably filaments originating from the stamens. In all these points this inflorescence agrees with *Castanea*, and the heads are of the same size and at the same distances apart, and the leaflets of the calyx are obtusely rounded, as in *C. vesca*. *Sparganium* has a similar inflorescence, its male flowers form similar small heads in the buds, but the rachis is thinner and curved, and the flowers are differently shaped.

On splitting a slab of Mr. WHYMPER'S, I found the cupula of *Castanea* along with fragments of leaves of *Platanus* and *Diospyros*. This cupula is somewhat broader than long (26 millims. broad, and 22 long), almost globose, provided with numerous fine prickles, 5–7 millims. long; it is furrowed on the inner side, and covered with small holes, marking the places where the prickles have been inserted (fig. 2). The cupula must have been rough and pretty thick, as it forms a pretty thick bark of coal. In splitting the stone, the cupula was divided into two parts, one of which was in the above-described slab (fig. 2); the other shows us the three seeds (fig. 2 *b*), convex dorsally, and flattened anteriorly. They are 18 millims. long and 8 broad in the middle; the surface is smooth.

Castanea Ungeri agrees with the leaves, flowers, and fruits with *Castanea vesca*, Gærtn. (*C. vulgaris*, Lam.), but the teeth of the leaves are not so long pointed, and the fruit is smaller. The *C. pumila*, Michx., from North America has a solitary, ovoid pointed and much smaller nut, and differs more from our Miocene species than the European chestnut does.

35. *Quercus furcinervis*, Rossm. Hr. Fl. Foss. Arct. p. 107, pl. vii. figs. 6 *a*, 7 *a*; xlv. 1 *d*; xlvi. 6. *Hab.* Atanekerdluk. The upper portion of a leaf, with the teeth and apex.

36. *Quercus Lyellii*, Hr., Plate XLVI. fig. 3. Hr. Fl. Foss. Arct. p. 108, pl. xlvii. fig. 9. Lignite of Bovey-Tracey, p. 40, pl. xii. figs. 2–9; xiii. 1–4; xiv. 12 *b*; xv. 1, 2; xvii. 4, 5.

Formerly I had only fragments of this species from Greenland, but fig. 3 gives an almost entire leaf from Atanekerdluk, which confirms the determination of this species. It is tapered towards the base and apex, and has many secondary nerves, and a strongly undulated, quite entire margin. The secondary nerves are curved, and reach nearly to the margin, where they fork; the upper branch bending forwards, and running parallel with the margin to the next following secondary nerve, which it joins.

37. *Quercus Grönlandica*, Hr., Plate XLV. fig. 4. Hr. Fl. Arct. p. 108, pls. viii. figs. 8; x. 3, 4; xl. 4; xlvii. 1. *Hab.* Atanekerdluk.

A very large leaf in the Museum of Copenhagen. Most of the teeth are broken; those which remain are large and entire. Mr. Whymper's collection contains several large leaves of this species, but all broken. A small one (fig. 4 *b*) is 32 millims. broad, and has large obtuse teeth. Fig. 4 *c* is, I believe, an acorn. It is oblong, and the apex is mucronate; it is 32 millims. long, and 15 broad. It is difficult to say to which species of *Quercus* it should be referred.

38. *Quercus Olafseni*, Hr. Plate XLVI. fig. 2. Hr. Fl. Arct. p. 109, pls. x. figs. 5; xi. 7–11; xlvi. 10.

The well-preserved base of a leaf. The petiole is 12 millims. long; the margin of the leaf is obtusely toothed. Fragments of the leaves of this species are not rare at Atanekerdluk.

Var. *β. microdonta*, Plate XLIX. fig. 1. A large leaf, with very small teeth, which alters its appearance; it may, however, be referred to this species.

39. *Quercus platania*, Hr., Plates XLVI. figs. 5; LV. 3 *c*. Hr. Fl. Foss. Arct. p. 109, pls. xi. figs. 6; xlvi. 7. Atanekerdluk.

The leaf tapers towards the base, and the margin has very large teeth. The secondary nerves are long, and send out tertiaries, which run into the teeth.

40. *Quercus Steenstrupiana*, Hr., Plate XLVI. fig. 4. Hr. Fl. Arct. p. 109, pls. xi. figs. 5; xlvi. 8, 9. *Hab.* Atanekerdluk.

A small leathery leaf, more tapered at the base than those figured in my 'Flora Arctica;' the teeth are small and sharp. The collection contains many other leaves, which agree well with pl. xlvi. fig. 8 of Fl. Arct. It seems to agree better with the *Q. densiflora*, Hook., var. *Hartwegi*, from California, than with any of the species with which I have compared it in my 'Flora Arctica.'

41. *Quercus Laharpii*, Gaudin, Plates XLIV. figs. 10; XLIX. 2, 3, 4 *a*. Foliis coriaceis, lanceolatis, basi in petiolum attenuatis, integerrimis, antrorsum sparsim denticulatis, nervis secundariis angulo acuto egredientibus, superioribus, craspedodromis. Gaud. contr. à la Fl. Foss. Ital. ii. p. 45, pl. iii. figs. 5, 10. *Hab.* Atanekerdluk.

Plate XLIV. fig. 10 (other side Plate XLIX. fig. 4 *a*) is a leathery leaf, more tapered towards the base than the apex. The upper portion has some very small teeth, but the lower is entire. On each side seven secondary nerves run into the teeth. The areas are covered with fine nervules.

The leaf agrees well with fig. 5 of GAUDIN, which represents one from the argiles brûlées of the Val d'Arno, which has a petiole, wanting in our Greenland leaf. The apex is acuminate. Plate XLIX. fig. 3 belongs, I believe, also to this species, and agrees with pl. iii. fig. 10 of GAUDIN. The leathery leaf is tapered towards the base, but broader than fig. 4 *a*. The lower secondary nerves are camptodromes, and the areas finely reticulated; the petiole is pretty long. Fig. 2 represents a similar leaf, with the upper secondary nerves craspedodromes. We find similar leaves in *Q. echinocarpa*, Hook.

XV. ULMACEÆ.

42. *Planera Ungeri*, Ett., Plates XLV. figs. 5 *a*, *c*; XLVI. 6, 7 *a*. Hr. Fl. Arct. p. 110, pl. ix. fig. 8 *b*. Plate. XLV. fig. 6 agrees in the nervation, and fig. 5 in the denticulation, with pl. lxxx. fig. 17 *a* of my Fl. Tert. Helv. Fig. 7 has very large teeth, as in fig. 11 of Fl. Tert. Fig. 5 *b* is a very small leaf, such as often occurs in *Planera Ungeri* and one living species.

XVI. MOREÆ.

43. *Ficus? Grönlandica*, Hr., Plate LIV. fig. 2. Foliis petiolatis, amplis, basi inæquilateralibus emarginatis, cordato-rotundatis, integerrimis, palminerviis, nervis secundariis sparsis, camptodromis. Hr. Fl. Foss. Arct. p. 111, pl. xiii. fig. 6.

In my 'Flora Arctica' I have unfortunately placed two species under this name. Pl. xiii. fig. 6 is correct, the other belongs, I believe, to *Pterospermites*,

Leaf very large; petiole strong, ribs much smaller, five midribs are nearly equally strong, a sixth is on the right side, and indicates an inequilateral leaf. Secondary nerves very distant; areas divided by undulated nervules, enclosing a fine reticulation.

It is very like *Ficus tiliæfolia*, A. Braun, but the secondary nerves are much shorter and more distant.

XVII. Plataneæ.

44. *Platanus aceroides*, Gœp. Hr. Fl. Foss. Arct. p. 111, pl. xlvii. fig. 3.

Remains of *Platanus* leaves are not rare at Atanekerdluk, and the collection contains several specimens; none, however, are well preserved, and with many it is difficult to determine if they belong to this or to the following species.

45. *Platanus Guillelmæ*, Gœp., Plates XLVII., XLVIII., XLIX., figs. 4 *b*, *c*, *d*. Foliis indivisis vel modo sublobatis, acute dentatis, in petiolum brevem attenuatis, nervis secundariis angulo acuto egredientibus. Gœp. Tert. Fl. von Schossnitz, p. 21, pl. xi. figs. 1, 2. *Platanus Œynhausiana*, Gœp. (*ex parte*), *l. c.* pl. x. fig. 4. *P. aceroides* var. Hr., Fl. Tert. Helv. ii. p. 7, pl. lxxxviii. figs. 13, 14. Fl. Arct. pl. xii. Ujararsusuk, pls. xlvii., xlviii. figs. 1, 2. Kudliset, pl. xlviii. figs. 3, 4. Atanekerdluk.

In my 'Flora Arctica' I have referred the genus *Platanus* to North Greenland. The leaf there represented (pl. xlvii. fig. 3) agrees in shape and toothing with *P. aceroides*. The plane leaves from Disco differ much from this; they are tapered towards the petiole, slightly or not lobed, and have shorter teeth. The same leaf has been found at Schossnitz, and near the Schrotzburg. Gœppert mentioned it as *P. Guillelmæ*. I have referred it (Flora Tert. Helvet. ii. p. 71, and Fl. Arct.) to *P. aceroides*, the living *P. acerifolia* having similar leaves in its water shoots. As all the leaves from Disco, though differing in size and shape, belong exclusively to this form, it appears to me probable that it represents a different species, and one nearly allied to the American plane. For this species I have adopted Gœppert's name of *Pl. Guillelmæ*, though his description does not quite agree (he says, "folium subquinquangulato-sublobatum"), though he has described another leaf, evidently belonging to this species (Schossnitz, pl. x. fig. 4), as *Pl. Œninghausiana*. Our plant chiefly differs from Gœppert's in the larger teeth, and the secondary nerves diverging less from the primary. The Disco leaves present three different forms:—

(1) A large, slightly 3-lobed leaf, with acutely divergent secondary nerves (Plate XLVII. fig. 1).

(2) Scarcely lobed leaves with many smaller teeth (Plates XLVII. figs. 2, 3; XLVIII. 1, 2, 4); pl. l. fig. 3 *a* of my 'Flora Arctica' also belongs to this variety.

(3) A leaf with a few large teeth (Plate XLVIII. fig. 3). The petiole is proportion-

ally short (Plates XLVII. fig. 2; XLVIII. fig. 2), dilated at the base; towards which the leaf tapers, and is even cuneate at the base (Plate XLVII. fig. 2 *a*). It is triple-nerved, and lateral nerves send strong secondaries into the teeth, and give off tertiaries. The secondary nerves of the midrib spring in most of the leaves at more acute angles than in Schossnitz and Schrotzburg specimens (see Plate XLVII. figs. 1, 2); not so, however, in Plate. XLVIII. fig. 2 *a*, and fig. 3. The teeth, though generally much smaller than in *Pl. aceroides*, are also sharp and bent upwards.

Of the plant leaves from Atanekerdluk, represented in my 'Flora Arctica,' pl. xii. probably belongs to this species, but pl. xlvii. fig. 3, to *Pl. aceroides*.

Besides a leaf of this species (Plate XLIX. fig. 4 *b*) we see the bark of *Platanus* (fig. 4 *c*) and a branch; the bark also in fig. 6 *b*. This bark agrees very well with the bark of the living plane, and also with the bark figured in my Fl. Tert. Helv. ii. pl. lxxxviii. fig. 15.

XVIII. Laurineæ.

46. *Sassafras Ferretianum*, Massal., Plate L. figs. 1, 2. Foliis trilobatis, basi sensim in petiolum attenuatis, triplinerviis, nervis lateralibus in lobos excurrentibus, nervis secundariis camptodromis; lobis integerrimis acuminatis sinubus obtusis vel rotundatis. Massal. Studii sulla Flora Fossile Senegagliese, p. 268, pl. xii. figs. 1, 2, 3; xiii. 1. Gaudin, Contr. à la Flore Fossile Italienne, ii. p. 50, pl. x. fig. 8.

Several fragments of 3 lobed-leaves, on a black slab from Atanekerdluk, cuneate at the base (fig. 2, leaf restored). The lateral lobes are unequal-sided, acuminate at the apex, and the sinus obtuse, the outer edge forming a strong arch, strongly incurved towards the petiole. Of the three principal nerves, the median is the strongest, and gives off some pretty strong, curved lateral ones. The median lobe (Plate L. fig. 1 *a*) is contracted at the base, and the lobes are entire. The median of a second leaf on the same slab (fig. 1 *c*) is much broader than the lateral, but not longer; and all the lobes are much shorter. Happily a fragment accompanies these leaves (fig. 1 *b*), showing that the leaf was cuneate at the base. As far as this leaf is preserved, it agrees very well with that from Senegaglia which Massalongo has represented, particularly with figs. 1 & 3 (Flora Fossile Senegagliese, p. 268, pl. xii. figs. 1–3; pl. xiii. fig. 1). The 3-lobed, entire leaf, cuneate at the base, identifies it with the genus *Sassafras* and *Benzoin*.

The fossil species is very near the living *S. officinarum*, Nees, from North America.

XIX. Proteaceæ.

47. *Dryandra acutiloba*, Brongn., Plate XXXIX. fig. 7. Foliis coriaceis, lineari-lanceolatis, alternatim pinnati-partitis, lobis antice acuminatis, nervo primario crasso prominente, nervis secundariis in quovis lobo 2–4 sub angulo rectiusculo orientibus, simplicibus. Ettings. Fossile Proteac. p. 27, pl. iv. figs. 2, 3; Fossile Flora von Bilin, ii.

p. 17, pl. xxxv. figs. 18–26. *Comptonia acutiloba*, Brongn. Prod. pp. 143, 209. Unger, Gen. et Sp. Pl. Foss. p. 293; Foss. Flor. von Sotzka, p. 32. *Asplenium difforme*, Sternb. Vers. Flora d. Vorw. 1. 2, pp. 29, 33, pl. xxiv. fig. 1. *Comptonia incisa*, R. Ludwig, Paleont. viii. pl. xxx. figs. 7–15. *Hab.* Ujararsusuk.

An imperfectly preserved leaf, but so characteristic that the species cannot be mistaken. It agrees in size and lobing almost entirely with that represented by LUDWIG in the above-named treatise. It is much larger than those described by ETTINGSHAUSEN.

As intermediate forms occur between the large ones represented in pl. xxx. fig. 7 by LUDWIG, and the smaller ones of the Bilin Flora, all would appear to belong to one species.

This pretty coriaceous leaf is deeply pinnatisect, the lobes are acuminate, entire, somewhat bent upwards. The midrib is very strong, but the nerves are obscure, except on the best preserved lobes, where two prominent nerves are seen running towards the apex.

This species appears in the Bilin Flora, and was also discovered at Frohnsdorf and Münzenberg. *Dryandra Lyellii,* Lath., from Alum Bay resembles it, but the lobes of this species are shorter, broader, and more bent upwards. It is doubtful if this leaf should be referred to *Dryandra* or the *Myrica* (*Comptonia*).

XX. EBENACEÆ.

48. *Diospyros brachysepala*, Plates L. 13; LV. 8. Hr. Fl. Arct. p. 117, pl. xv. figs. 10–12; xvii. 5 *h*, *i*; xlvii. 5–7.

Some remains of leaves and a calyx, which agree with those described in the 'Flora Arctica.' The calyx is 4-lobed, with obtuse lobes (fig. 13 *b*, magn.).

XXI. GENTIANEÆ.

49. *Menyanthes Arctica*, Hr., Plate L. fig. 16. Hr. Fl. Arct. p. 118, pl. xvi. figs. 2, 3.

I formerly knew the leaves only of this species; but the Copenhagen Collection contains a fruit from Atanekerdluk, belonging evidently to *Menyanthes*. It is of exactly the shape and size of the living *M. trifoliata*, and consists of two carpels, opening when ripe. The whole fruit is 8 millims. long, and each carpel is $3\frac{1}{2}$ millims. in breadth. The pedicel (10 *b*, magn.) is dilated at the apex, and as long as that of the *M. trifoliata*. Some indistinct lines indicate longitudinal nerves.

XXII. CAPRIFOLIACEÆ.

50. *Viburnum Whymperi*, Hr., Plate XLVI. fig. 1 *b*. Foliis ovatis, dentatis, penninerviis, nervis secundariis inferioribus ramosis, craspedodromis. *Hab.* Atanekerdluk.

A very fine leaf, very like those of *V. lantana*, L., of Europe, and *V. dentatum*, L., and *V. pubescens*, of North America. The leaves of *Pyrus Aria*, L., have a similar nervation, but the dentation of the margin is very different.

The base of the leaf is rounded, but not emarginate; the margin is toothed, the teeth equal. The secondary nerves spring at acute angles, that nearest the base sends out many tertiary nerves, which reach to the teeth, some being forked. The upper secondary nerves are undivided; the nervules in the areas spring at right angles, and are forked or undivided.

XXIII. Araliaceæ.

51. *Aralia (Sciadophyllum?) Browniana*, Hr., Plates XLII. figs. 6–8; XLIX. 4 *e*. Foliis digitatis? foliolis coriaceis, glaberrimis, oblongo-lanceolatis, basi inæquilateris, integerrimis; petiolo longo, tenui.

Some leaves or leaflets found at Kudliset by Mr. Brown (Plate XLII. figs. 6, 7). Those represented in Plate XLII. fig. 8; XLIX. 4 *e* are from Atanekerdluk. Count Saporta has figured similar leaflets from St. Zacharie and Armissan as those of an *Aralia*, and compared them to those of *Sciadophyllum* (cf. Ann. des. Sc. Nat. 1863, p. 232, and 1866, p. 299). The Greenland leaves support this identification, being leathery (showing a pretty thick coal-bark), long petioled, and having unequal bases, indicating the leaflets of a compound leaf.

The fragments figured in Plate XLII. fig. 8 probably formed together a folium digitatum. They have a long slender petiole (Plate XLII. fig. 6), do not taper into it, and have strongly unequal sides. They are oblong, lanceolate, and probably acuminate, but there is no well-preserved apex. The median nerve is strong, the secondary nerves quite obliterated or slightly projecting (see the lower part of the leaf in fig. 8 *a*), and pretty strongly curved.

In the long petiole it agrees with *A. Zachariensis*, Sap. *l. c.* pl. ix. fig. 2; but differs in not tapering into the petiole, and in its unequal sides. This latter character distinguishes it from *A. lanceolata*, Sap. from Armissan. The leaf from Udsted in Greenland, figured in my Fl. Arct. pl. xlix. fig. 6, probably belongs to this species. The secondary nerves are more delicate, and the leaf more leathery, than in *Juglans Strozziana.*

52. *Hedera M^cClurii*, Hr., Plate LII. fig. 8 *e*. Hr. Fl. Arct. p. 119, pl. xvii. figs. 1 *a*, 2 *o*, 3, 4, 5 *a*. *Hab.* Atanekerdluk.

The collection contains several imperfect fragments, showing the long slender petiole, and the leaf base, which is obtusely rounded. It has five principal nerves, giving off secondary nerves on both sides. Plate XLV. fig. 5 *b* is probably a leaf of the flowering branch.

XXIV. Corneæ.

53. *Cornus hyperborea*, Hr., Plate L. figs. 3, 4. Foliis ellipticis, paucinerviis, nervis secundariis sub angulo acuto egredientibus, acrodromis, distantibus. *Hab.* Atanekerdluk.

Two fragments, one a leaf apex (fig. 3), the other part of a leaf nearer to the base (fig. 4). Leaf entire, acuminate, secondary nerves all distant, running towards the apex in strong arches, with numerous, almost parallel nervules, like those of *Cornus*. As the base of the leaf is not preserved, the number of the secondary nerves cannot be determined, but there were probably 5–6 on each side.

Close to the leaf represented in fig. 4 lies a scale, provided with several longitudinal striæ (fig. 4 *b*), probably representing a bract of the same species. It is very near *Cornus Studeri*, Hr. of our Swiss Molasse, but differs in the more acutely divergent and more distant secondary nerves, and the less crowded nervules.

54. *Cornus ferox*, Ung., Plates XL. figs. 5 *c*, *d*, 7; XLIX. 6 *a*; LIII. 5. Hr. Fl. Foss. Arct. p. 119, pl. l. fig. 8. *Hab.* Atanekerdluk.

Plate XL. fig. 5 *c* represents the base of the leaf, provided with a long slender petiole. It is rounded at the base. The two lowest secondary nerves are opposite, the others alternate; all diverge at acute angles, and uniting in strong arches, form closed areas with the tertiaries. This leaf is larger than that represented by Unger from Parschlug, but in all other points agrees with it. Whether the larger but imperfect leaf (fig. 5 *d*) lying upon the same slab belongs to the same species is doubtful, as the margin is wanting; the acrodome upper secondary nerves, however, resemble those of *Cornus*.

A large leaf (base and apex wanting) is represented in Plate XLIX. fig. 6 *a*. It appears to have been oblong-elliptic; the secondary nerves are distant, forming long arches; the upper ones are acrodome, but fork before reaching the apex.

Plate LIII. fig. 5 represents the base of a leaf, probably belonging to this species.

It is still doubtful whether this species belongs to *Cornus*. Ettingshausen refers it to *Pterospermum*, but, I think, without sufficient reasons.

55. *Nyssa arctica*, Hr., Plates XLIII. fig. 12 *c*; L. 5, 6, 7, magn. 6 *b*. Fructibus ovalibus, sulcatis, transversum striolatis. *Hab.* Atanekerdluk.

Plate L. fig. 6 represents fruit, with a thick coal-bark, 10 millims. in breadth, 21 millims. in length, and equally tapered towards both ends. The apex of the pedicel is indicated at the base. On the left side is a deep furrow, sharply terminating the margin of the fruit, besides which there are six other longitudinal furrows, and on the right side two shortened and shallower ones; these do not run in regular curved lines, and are joined by numerous, nearly parallel, fine transverse striæ. These latter probably originate in the sarcocarp, whilst the longitudinal furrows traverse the putamen. Fig. 5 represents a similar broken stone, with longitudinal furrows and transverse striæ, and is evidently woody. A third (Plate XLIII. fig. 12 *c*) is $19\frac{1}{2}$ millims. in length and 11 millims. in breadth. It is also somewhat shorter and broader than the preceding one. It is provided with longitudinal striæ, and here and there are transverse striæ. At the base it has a short stalk. Plate L. fig. 7 shows the same shorter, broader form.

This species strongly resembles *Nyssa ornithobroma*, Ung., particularly the fruit-stones, which I got from the brown coal of Silesia (cf. Plate L. figs. 8–11). The shape is the same, and the size rather larger; the furrows less deep and less regularly arched, and the transverse striæ are wanting in *N. ornithobroma*, probably owing to its wanting the dried flesh of the fruit. Figs 8–10 show the side of *N. ornithobroma*; fig. 11 is a portion not compressed, seen from the apex. I received these from M. Oberbergrath RUNGE, who informed me that they occurred in great numbers in the lignites of Ferdinands-ville near Naumburg (an der Bober). UNGER has described them from the lignites of Salzhausen, under the names of *Nyssa ornithobroma* and *N. Vertumni* (Syll. Pl. Foss. i. p. 16; pl. viii. figs. 15–20). A similar fruit is the *Nyssa striolata*, Hr., Bov. Tr. pl. xviii. figs. 20–23.

XXV. AMPELIDEÆ.

56. *Vitis arctica*, Hr., Plates LIV. fig. 1; LV. 5 *d*. Hr. Fl. Foss. Arct. p. 120. pl. xlviii. fig. 2. *Hab.* Atanekerdluk.

Fig. 1 represents the base of the leaf; it is not deeply emarginate and rounded. The margin is toothed, and the teeth are equal and acuminated. The secondary nerves are opposite, and run into the teeth.

Besides the leaves and a stone of *Prunus Scottii* is a seed of *Vitis* (fig. 5 *d*, magn., fig. 6) which probably belongs to this species. It is not so acuminate as the seed which I have referred to *V. Olrici* (Fl. Arct. pl. xxviii. 1 *b*, *c*). It is 7 millims. in length, and 5 millims. in breadth. It has a rather prominent ridge, along the middle of which there is at the base a very delicate longitudinal stria; on each side of the ridge is an obsolete, small pit. The seed is obtusely rounded at the base, and tapered towards the apex: the ventral surface alone is visible.

XXVI. MAGNOLIACEÆ.

57. *Magnolia Inglefieldi*, Hr., Plates XLIV. fig. 5 *b*; LI. Fl. Arct. p. 120, pl. iii. fig. 5 *c*; xvi. figs. 5 *b*, 8 *b*; xviii. 1–3. *Hab.* Ujararsusuk (figs. 2, 3); Kudliset (fig. 4); Atanekerdluk (figs. 5–7).

In my 'Flora Arctica' I have figured the large leaves of this species (pl. xviii.), but their base is not preserved. Mr. WHYMPER'S collection contains the completely preserved bases of several leaves (figs. 4, 6 & 7). The leathery leaf tapers into a strong petiole. Fig. 6 is a very large, but broken leaf, which must have been 210 millims. long. The midrib is strong, the secondary nerves strongly curved and arched, far from the margin. The areas are divided by nervules, forming a large, polygonal reticulation. O. WEBER describes a similar plant as *M. attenuata* (Paleontographica, ii. p. 192, pl. xxii. fig. 1), but the base of this leaf is more tapered, and the secondary nerves more approximate.

Figs. 2 & 3 are cones, much resembling those of *Magnolia*, and consisting of many oval carpels, 9–10 millims. long, and 5–7 broad, arranged around a central axis, Several of these carpels show the fissure, precisely as in *M. glauca* (fig. 1). The cone (fig. 2) is 115 millims. long and 32 millims. broad, but the base and apex are wanting. Fig. 3 represents a cone and a twig, and fig. 3 *b* a very large oval bud, like that of *Magnolia*. These fruits confirm the identification of the leaves. The cones indeed are from Ujararsusuk, but leaves occur at Kudliset, a very near locality, and a single carpel was found at Atanekerdluk; it is therefore very probable that both fruit and leaves belong to the same species. The carpels are very like those of *Magnolia glauca*, but the cone is as large as that of *M. grandiflora*, though much narrower; the leaves also are most like those of *M. grandiflora*.

XXVII. Menispermaceæ?

McClintockia.

The collection contains many leaves of this genus, and some in very fine preservation, but its systematic position still remains very doubtful. In the 'Flora Arctica' (p. 114) I described them as possibly belonging to Proteaceæ, but the long and slender petiole does not agree with this family; they more resemble some Menispermaceæ, as *Cocculus laurifolius*; which has three primary nerves reaching to the apex, and a long slender petiole terminating abruptly in the base of the leaf, as in *McClintockia*. But the reticulation of the areas and the denticulation of the margin are very different.

58. *McClintockia Lyallii*, Hr., Plate LII. figs. 1–3. Hr. Fl. Arct. p. 115, pls. xv. figs. 1 *a*, 2; xvi. 7 *a*, *b*; xvii. 2 *a*, *b*; xlvii. 13; xlviii. 8.

Plate LII. figs. 1 & 2 are very large leaves with five nerves, all of the same thickness. The reticulation of the areas is very fine, and agrees perfectly with that of the leaves which I have described in the 'Flora Arctica.' The margin of the upper portion of fig. 1 presents large obtuse teeth. The petiole is slender (fig. 3), and not continuous with the lamina of the leaf. Beside the leaf (fig. 2 *a*) are some remains of fruit, which perhaps belong to this species. Better preserved is another fruit, *Carpolithes cocculoides* (fig. 9. magn. 9 *b*), which belongs, I believe, to Menispermaceæ, and which may perhaps be combined with *McClintockia*. If this is the case the fruit would confirm the occurrence of Menispermaceous plants in North Greenland.

59. *McCintockia dentata*, Hr., Plate LII. figs. 4–7. Hr. Fl. Arct. p. 115, pl. xv. fig. 34. *Hab.* Atenekerdluk.

I formerly knew only the upper portion of these leaves; but Mr. Whymper's collection contains leaves with the base and petiole (Plate LII. fig. 7), which is long and slender, and terminates abruptly in the base of the leaf, as in the former species. The leaf has seven primary nerves, but only three reach the apex. The upper portion presents large, obtuse (fig. 4), or acuminate (figs. 5, 6) teeth. In fig. 4 the right side of the leaf is broader than the left, and the sides are unequal at the base; but in fig. 6, 7 both sides are equal.

60. *M^cClintockia trinervis*, Hr., Plates LII. fig. 8 *a*; L. 12. Hr. Fl. Arct. p. 115, pl. xv. figs. 7–13. *Hab.* Atanekerdluk, with *Populus arctica* (fig. 8 *b*) and *Hedera M^cClurii* (fig. 8, *c*).

A very long, narrow leaf, the upper portion toothed, the lower entire. The teeth large and strongly bent towards the apex. The reticulation between the primary nerves is very well preserved. Plate L. fig. 12 is a fine small leaf, like *Cocculus laurifolius*, Colebr., but the upper portion is toothed.

XXVIII. Sterculiaceæ ?.

61. *Pterospermites spectabilis*, Hr., Plates XLIII. fig. 15 *b*; LIII. 1–4. Foliis amplis, basi leviter emarginatis, cordato- vel ovato-ellipticis integerrimis, nervis secundariis infimis debilibus, sequentibus duobus inferioribus oppositis, validis, nervis tertiariis longis ornatis. *Hab.* Atanekerdluk, not rare.

Plate LIII. fig. 1 is a very large leaf with strong nerves. The first pair of secondaries delicate, and they spring at an obtuse angle; the next two are opposite, very strong, and spring at a right angle; their tertiaries are strong and forked. The succeeding nerves are alternate, and send out tertiaries. The areas are filled with continuous, sometimes forking nervules. A similar leaf is figured at Plate LIII. fig. 3. Plate LIII. fig. 2 and Plate XLIII. fig. 15 *b* are much smaller. One part of the latter leaf is perfectly preserved; it is ovate and tapered at the end, and the strong secondary nerves spring at an acute angle. This is also the case in Plate LIII. fig. 4 *a*, which has only one small basal secondary nerve. Beside these is a leaf of *Populus arctica* (fig. 4 *b*) and the remains of a very large *Platanus*.

We can thus distinguish several forms of this species, viz.:—

(*a*) Leaves very large; strong secondary nerves springing at a right angle, with several basal small secondary nerves (Plate LIII. figs. 1–3).

(*b*) Leaves smaller, strong secondary nerves springing at an acute angle, with several basal small secondary nerves (Plate XLIII. fig. 15 *b*).

(*c*) Leaf large, strong secondary nerves springing at acute angles, with only one basal small secondary nerve (Plate LIII. fig. 4 *a*).

Differs from *P. integrifolius*, Hr., in the leaf not being peltate at the base.

62. *Pterospermites alternans*, Hr., Plate LIV. fig. 3. Foliis amplis, basi rotundatis, subemarginatis, integerrimis, margine glandulosis (?), nervis secundariis infimis debilibus, sequentibus alternis approximatis, validis, extrorsum ramosis, angulo acuto egredientibus.

This and the large leaf figured in my 'Flora Arctica' (pl. xlix. fig. 8) belong to the same species. It differs from *Pt. spectabilis* in the first strong secondary nerves, which are not opposite; and from *Ficus Grönlandica* in the not palmate primary, and in the strong secondary nerves.

Pl. xiii. figs. 2–5 of my 'Flora Arctica' belong, I believe, to this species. The midrib has many strong secondary nerves.

The systematic position of this and the last species is very doubtful. Leaves of this form and nervation are found in the Miocene in many localities, but I cannot refer them to any genus. I have provisionally placed them under *Pterospermites*, because *Pterospermum acerifolium* presents similar leaves. In these also we observe, below the strong opposite secondary nerves, more delicate ones, like the leaves of *Credneria.*

Count SAPORTA has described leaves having this nervation as *Pterospermites* and *Grewiopsis.* (Prod. d'une Fl. Foss. de Sezanne, p. 402; and Ann. des Sc. Nat. 1866, p. 46.)

XXIX. ILICINEÆ.

63. *Ilex longifolia*, Hr., Plates L. fig. 17; LVI. 1. Hr. Fl. Foss. Arct. p. 124, pl. xlviii. figs. 3–6.

In the leaves figured in the 'Flora Arctica' the apex is wanting. Mr. WHYMPER's collection contains one, however, which is toothed, acute, and tapered to the apex (Plate L. fig. 17). Plate LV. fig. 1 is a very large leaf, with the secondary nerves strongly curved, and forming large arches: the surface is smooth

64. *Ilex macrophylla*, Hr., Plates XLIV. fig. 11 *b*; LVI. 2. Foliis coriaceis, lanceolatis, sparsim crenulatis; nervo medio valido, nervis secundariis subtilibus valde antrorsum curvatis, camptodromis; areis confertissime evidenter reticulatis. *Hab.* Atanekerdluk.

This leaf, of which the base and apex are wanting, must have been very long, narrow, coriaceous, tapering towards the apex, and toothed; the teeth small, distant, and obtuse. The midrib is strong, the secondary nerves spring at acute angles; they are strongly curved and form large arches. The areas are divided by delicate nervules, and filled with a still more delicate reticulation. (Plates XLIV. figs. 11 *b*, magn. 11 *b*, *b*; and LV. fig. 2, magn. 2 *b*.)

This species differs from *I. longifolia* and *I. reticulata* in the secondary nerves, which are more curved towards the apex and in the obtuse teeth. *Juglans Heerii*, Ett., and *J. elænoides*, Ung., have similar leaves, but they are not so coriaceous, the secondary nerves are less curved upwards, and the teeth are sharper.

XXX. CELASTRINEÆ.

65. *Euonymus amissus*, Hr., Plate LVI. fig. 10, magn. 10 *b*. Capsula trigona, loculis oblongis. *Hab.* Atanekerdluk.

Fruit, 9 millims. long, each carpel 3 millims. broad, oblong, obtusely rounded at the apex, with a longitudinal stripe in the middle. It agrees with the fruit of *Euonymus*, in having strongly projecting carpels.

XXXI. Rhamneæ.

66. *Zizyphus hyperboreus*, Hr., Plate L. fig. 20. Fl. Foss. Arct. p. 123.

In my 'Flora Arctica' I could only describe two fragments of this; but Mr. Whymper's collection contains a larger and better preserved leaf. It is elliptical, acuminate, and toothed. The lateral principal nerves reach the apex, and are united by numerous secondary ones, which specially distinguishes this species from *Z. ovata*, Weber.

67. *Paliurus Colombi*, Hr., Plate L. figs. 18, 19. Fl. Foss. Arct. p. 122, pls. xvii. fig. 2 *d*; xix. 2, 4.

The collection contains a twig, and some very fine entire leaves of this species from Atanekerdluk (Plate L. fig. 18). Fig. 19 is a small leaf, with a rounded base.

Var b. *foliis margine antice denticulatis. Hab.* Kudliset (Plate XLI. fig. 12). The form and nervation agree with the leaf from Atanekerdluk, but the margin presents some small teeth.

68. *Rhamnus Eridani*, Ung. Fl. Foss. Arct. p. 123, pls. xix. figs. 5–7; xlix. 10.

An almost entire leaf, agreeing with that figured in the 'Flora Arctica.'

XXXII. Anacardiaceæ.

69. *Rhus bella*, Hr., Plate LVI. figs. 3–5. Foliis compositis, foliolis lanceolatis, utrinque attenuatis, breviter petiolatis integerrimis, lateralibus oppositis; nervo primario distincto, nervis secundariis camptodromis, debilibus. *Hab.* Atanekerdluk.

This is nearly related to *Rhus xanthoxyloides*, Ung. (Syll. Pl. p. 45, pl. xxi. fig. 13), but the leaflets are larger, narrower, and provided with a short petiole. Several specimens present leaflets lying together; but it is not possible to decide whether the leaf has been palmate or pinnate. A fine leaf of *R. xanthoxyloides* from Salzedo is pinnate; it is therefore probable that the nearly related Greenland species is similar. The leaflets gradually taper towards the base, and are entire; the secondary nerves are pretty numerous, delicate, and sometimes obliterated. Pl. xi. fig. 3, *b* of my 'Flora Arctica' perhaps belongs to this species.

70. *Rhus arctica*, Hr., Plate XL. fig. 5 *e*, *e*. Foliolis oblongis, grosse dentatis; nervis secundariis angulo acuto egredientibus, craspedodromis. *Hab.* Atanekerdluk, upon the same stone with *Hemitelites Torelli and Cornus ferox.*

Two leaflets, which I believe belong to a compound leaf (Plate XL. fig. 5 *e*), having unequal sides. They are toothed, and the teeth are large and unequal. The primary nerve is little stronger than the secondary nerves, which spring at acute angles, and reach the teeth. The systematic position of these two species is still doubtful.

XXXIII. Juglandeæ.

71. *Juglans acuminata*, A. Braun, Plates LIV. figs. 5, 6; LV. 1. Fl. Foss. Arct. p. 124, pls. vii. figs. 9; xii. 1 *b*; xlix. 7.

Plate LIV. fig. 5 represents an almost perfect leaf from Copenhagen, which agrees very well with the leaves from Œningen and Hohe Rhonen. (Fl. Tert. Helvet. pls. cxxviii. figs. 3; cxxix. 1.) Fig. 6 is larger, but the base is wanting. Plate LV. fig. 1 is an almost entire leaf; the base is unequal.

72. *Juglans denticulata*, Hr., Plate LVI. figs. 6–9. Foliolis apice attenuatis, denticulatis; nervis secundariis camptodromis, arcubus margine approximatis.

Like *J. bilinica*, but the secondary nerves are nearer the margin, and the teeth are more delicate. Under this species I place several forms, which I take to be leaflets of a compound leaf. They have small teeth, and the arches of the secondary nerves run near the margin. Plate LVI. fig. 7 appears to be a terminal leaflet; it is tapered at the base, and near it are the remains of a lateral leaflet. Fig. 8 has a short petiole; it is lanceolate, and the sides are unequal. Fig. 6 is ovate-lanceolate, broadest at the base, obtuse, and gradually tapered towards the acuminate apex; it is quite entire at the base, but finely toothed at the apex. I suppose it to be a leaflet from the base of the leaf.

Whether fig. 9 *a* agrees with this species is still doubtful, as all of the upper part is wanting. It must be a terminal leaflet.

XXXIV. Pomaceæ.

73. *Sorbus grandifolia*, Hr., Plate LIV. fig. 4. Foliis magnis, grosse duplicato-serratis; nervis secundariis erectis, craspedodromis, inferioribus ramosis.

Apex and base of leaf wanting. It appears to have been oval, and cuneate at the base. The teeth are large, and each has a lateral toothlet. The secondary nerves spring at an acute angle; the lower are opposite, and send out tertiary nerves towards the teeth. The areas are provided with distinct nervules.

XXXV. Amygdaleæ.

74. *Prunus Scottii*, Hr., Plate LV. fig. 5 *a*, *b*, *c*. Fl. Foss. Arct. p. 126, pl. viii. figs. 7, 15 *a*.

Two fragments of leaves with well-preserved teeth, and a third with the base, towards which it tapers. Beside this leaf are some fragments of the same species (fig. 5 *b*), and the impression of a stone (fig. 5 *c*) of 7½ millims. in diameter, which probably belongs to this species. Fl. Arct. pl. viii. fig. 15 *a*.

XXXVI. Leguminosæ.

75. *Leguminosites*, sp., Plate XXXIX. fig. 3 *b*. *Hab.* Kudliset.

Probably a portion of a legume, like the fruit of *Robinia* (Fl. Tert. pl. cxxxii. figs. 35–41), but it is too imperfect for determination.

76. *Carpolithes cocculoides*, Hr., Plate LII. fig. 9, magn. 9 *b*. Obovatus, sessilis, lignosus, monospermus leviter costatus, cicatrice stylari subterminali, excentrico. *Hab.* Atanekerdluk.

A woody fruit, 8 millims. long and 5 broad, with a very short peduncle. The right side is nearly rectilineal, the other strongly arched. The ribs are bent towards the right, and reach the excentric apex. It is much like the fruits of *Menispermum* and *Cocculus*, and belongs, I believe, to the same family. The unequal sides favour the supposition that there were several carpels in the same flower. It is perhaps the fruit of *M'Clintockia.*

77. *Carpolithes Potentilloides*, Hr., Plate XLIII. fig. 11 *b*, magn. 11 *c*.

Many small round carpels, forming a globose body, like *Potentilla.* Each carpel is 1 millim. long, quite smooth externally, and provided with a short tip.

78. *Carpolithes follicularis*, Hr., Plate L. figs. 14, 15. Membranaceus, oblongo-ovalis, bicarpellaris, carpellis longitudinaliter sulcatis.

Plate L. fig. 15 represents two carpels, which lie so close together as certainly to have formed one oblong-oval fruit, dorsally convex, ventrally rectilineal, and provided with several curved longitudinal furrows. A second specimen (fig. 14) is much larger; the two carpels are membranous, and connected at the base. Perhaps the fruit of an Asclepiad or Apocyn.

79. *Carpolithes sulcatulus*, Hr., Plate LVI. fig. 11, magn. 11 *b*. Subglobosus $4\frac{1}{2}$ millims. longus, medio leviter sulcatus. *Hab.* Atanekerdluk.

A small, nearly globose fruit, somewhat tapered towards the apex, with a very flat, longitudinal furrow in the middle, and on both sides some indistinct stripes.

80. *Carpolithes pusillimus*, Hr., Plate LVI. fig. 12, magn. 12 *b*. Semine globoso, $1\frac{1}{2}$ millim. longo, obsolete carinato. *Hab.* Atanekerdluk.

An exceedingly small globose seed, with a flat furrow and some obsolete stripes.

Animals from Atanekerdluk.

A. *Insecta.*

1. *Cistelites punctulatus*, Hr., Plate LVI. fig. 14; twice magn. 14 *b*; restored, 14 *c*. Thorace brevi, antrorsum angustato, elytris $10\frac{1}{2}$ millims. longis, punctatissimis.

Two elytra are lying together. The best preserved is $10\frac{1}{2}$ millims. long and 4 broad, and terminates in an acute point. Their suture is rectilineal, the outer margin slightly curved, the surface is densely covered with delicate points, not arranged in a series. Besides the elytra are lying some remains of the thorax. I have a similar well-preserved species from Œningen (*Cistelites spectabilis*, Hr.), fig. 13, twice magn.; the elytra are of the same size, form, and punctation, but the tip is obtuse.

2. *Cercopidium rugulosum*, Hr., Plate XLIV. fig. 9 *b*, magn. 9 *b*, *b*.

This is probably an elytron of a Cercopideous insect (Hemipteron), but the nervation is very different from that of the known fossil species (Hr. die Insectenfauna der Tertiargebilde von Œningen und von Radoboj, iii. p. 93). It is 9 millims. in length and breadth, pretty rough, and strongly tapered at the base. The dorsal line is straight, the ventral line curved, obtusely rounded outwards. Two veins spring from the base, forking in two branches, and united by transverse veins. Small areolæ join them. The whole surface is provided with very small transverse stripes, only visible with a lens. The surface appears finely furrowed.

B. *Mollusca.*

3. *Cyclas*, sp., Plate LII. fig. 10, magn. 10 *b*.

Dr. Charles Mayer has examined this species, and communicated to me the following observations:—This unfortunately incomplete shell must very probably be referred to the genus *Cyclas*. The size, the round and convex shape, the thin granulated shell and concentric striæ are those of existing *Cyclas*. This shell does not agree so well with the nearly related genus *Pisidium*, which is everywhere unequilateral, and almost tri- or quadrangular. Of the second section of the genus *Cyclas* (including the irregularly striated species) the section of *Cyclas rivularis* alone can be taken into consideration. It is of the same size, is of a convex shape, and has distinct transverse striæ. The condition of the shell does not, however, allow of its identification.

Explanation of the Plates.

PLATE XXXIX.

Fig. 1–3, *Aspidium Meyeri*, Hr. 1: *a a*, magn., the sori with the indusia; *f f*, sori with the sporangia; *b b*, *d d*, *h h*, the pinnules magn. Fig. 3 *b*, *Leguminosites*, sp. Figs. 4, 5, *Aspidium Heerii*, Ett. Fig. 4 *b*, *Salix Raeana*? Fig. 6 *a*, *Aspidium ursinum*, Hr.; *b*, *Platanus*. Fig. 7, *Dryandra acutiloba*, Brgn., sp. Fig. 7 *b*, *Diospyros*?

PLATE XL.

Figs. 1–5 *a*, *Hemitelites Torelli*, Hr., 4 magn. Figs. 5 *c*, *d*, 7, *Cornus ferox*, Ung. Fig. 5 *b*, *Sequoia Langsdorfii*, Br., sp. Fig. 5 *e*, *Rhus arctica*, Hr. Fig. 6, *Woodwardites arcticus*, Hr.

PLATE XLI.

Figs. 1–9, *Sequoia Couttsiæ*: 1, biennial branch; 2, 3, 4, young shoots with spreading leaves; 5, young shoot with adnate leaves; 7, cone; 8, scales of cone; 9, *Amentum masculinum.* Figs. 10, 11, *Widdringtonia helvetica*, Hr., 10 *b*, *c* magn. Fig. 12, *Paliurus Colombi*, var. Fig. 13, *Liquidambar europæum*, A. Braun. Fig. 14, *Platanus.*

PLATE XLII.

Fig. 1, *Sequoia Couttsiæ*, Hr.: *a*, an old twig; *b*, *c*, young twigs with adhering leaves; *d*, scales of a cone. Figs. 2–4 *a*, *Phragmites Œningensis*, A. Braun; 2 *a*, a culm; *b*, leaf; *d*, *e*, ferns; 3, a small culm. Fig. 4 *a*, a portion of the rhizome. Fig. 4 *b*, *Sparganium.* Fig. 5, fruits of *Sparganium Stygium*, Hr.; 5 *b*, magn. Figs. 6, 7, 8, *Aralia Browniana*, Hr.

PLATE XLIII.

Figs. 1–3, *Sequoia Langsdorfii*, Brongn.: 1, cone, longitudinal vertical section; 2, a transverse section of cone; 2 *b*, twig; *c*, branch; *d*, *Osmunda Heerii*, Gaud.; fig. 3, fragment of a scale in a nodule. Figs. 4, 5, *Taxodium distichum miocenum*; 4 *b*, amber. Figs. 6, *Pinus polaris*; 7, a scale of a Pine. Figs. 8, 9, *Phragmites Œningensis*; 8, portion of a culm; 9, roots. Fig. 10, *Caulinites costatus*, Hr. Fig. 11, *Salix Raeana*, Hr.; 11 *b*, *Carpolithes Potentilloides*; 11 *c*, magn. Figs. 12, 13, *Salix varians*, sp.?; 13 *b*, twig; 12 *c*, *Nyssa arctica*, Hr. Fig. 14, *Populus arctica*, Hr., young leaf. Fig. 15 *a*, *Populus Zaddachi*, Hr.; 15 *b*, *Pterospermites spectabilis*, Hr. Fig. 16, *Equisetum boreale*, Hr.

PLATE XLIV.

Fig. 1 *Salisburea adiantoides*, Ung. Figs. 2–4, *Sequoia Langsdorfii*, A. Brongn.; 2, 3, young cone; 4, male catkin; 3 *b*, seed. Fig. 5 *a*, *c*, *Pinus hyperborea*; 5 *b*, *Magnolia Inglefieldi.* Fig. 6, *Populus Zaddachi*, Hr. Figs. 7, 8, 9 *a*, *Populus Richardsoni*, Hr.; 9 *b*, *Cercopidium rugulosum*, Hr.; 9 *b*, *b*, magn. Fig. 10, *Quercus Laharpii*, Gaud. Fig. 11 *a*, *Corylus McQuarrii*; 11 *b*, *Ilex macrophylla*, Hr.; 11 *b*, *b* magn; 11 *c*, *Carpinus.*

PLATE XLV.

Figs. 1–3, *Castanea Ungeri*, Hr. Fig. 1 *a*, leaf; 1 *b*, male flowers; 1 *b*, *b* magn.; 2, cup; 2 *b*, cup with fruit; 3, leaf. Fig. 4, *Quercus Grönlandica*, Hr.; 4 *b*, teeth of the leaf; 4 *c*, acorn. Fig. 5, *Planera Ungeri*; 5 *c*, young leaf; 5 *b*, *Hedera McClurii.* Fig. 6 *a*, *Smilax grandifolia*, Ung.; 6 *b*, *Corylus McQuarrii*, Forbes, sp. Fig. 7, *Smilax grandifolia*, restored leaf.

PLATE XLVI.

Fig. 1 *a*, *Sequoia Langsdorfii.* 1 *b*, *Viburnum Whymperi*, Hr. Fig. 2, *Quercus Olafseni*, Hr. Fig. 3, *Quercus Lyellii*, Hr. Fig. 4, *Quercus Steenstrupiana*, Hr. Fig. 5, *Quercus platania*, Hr. Figs. 6, 7 *a*, *Planera Ungeri*, Ett. 7 *b*, *Sequoia Langsdorfii*, Br. Fig. 8, *Castanea Ungeri*, Hr., young leaf. Fig. 9, *Fagus*, fruit.

PLATE XLVII.

Figs. 1–3, *Platanus Guillelmæ*, Gœp. Ujararsusuk.

PLATE XLVIII.

Figs. 1–4, *Platanus Guillelmæ*, Gœp. Fig. 3 *b*, a fern. Fig. 4 *d*, *e*, *Sequoia Couttsiæ*, Hr. Figs. 1, 2 from Ujararsusuk. Figs. 3, 4 from Kudliset.

PLATE XLIX.

Fig. 1, *Quercus Olafseni*, var. Figs. 2, 3, 4 *a*, *Quercus Laharpii*, Gaud. Fig. 4 *b*, *c*, *d*, *Platanus Guillelmæ*, Gœp.; *b*, leaf; *c*, bark; *d*, branch; 4 *e*, *Aralia Browniana*, Hr. Fig. 5, *Corylus insignis*, Hr. Fig. 6 *a*, *Cornus ferox*, Ung.; *b*, *Platanus*, bark.

PLATE L.

Figs. 1, 2, *Sassafras Ferretianum*; 2, the leaf restored. Figs. 3, 4, *Cornus hyperborea*, Hr. Figs. 5–7, *Nyssa arctica*, Hr.; 6 *b*, magn. Figs. 8–11, *Nyssa ornithobroma*, Ung., from Naumburg an der Bober (Silesia). Fig. 12, *McClintockia trinervis*, Hr. Fig. 13, *Diospyros*, calyx; 13 *b*, magn. Figs. 14, 15, *Carpolithes follicularis.* Fig. 16, *Menyanthes arctica*, Hr.; 16 *b*, magn. Fig. 17, *Ilex longifolia.* Figs. 18, 19, *Paliurus Colombi.* Fig. 20, *Zizyphus hyperboreus.*

PLATE LI.

Fig. 1, *Magnolia glauca*, L., fruit. Figs. 2–7, *Magnolia Inglefieldi*, Hr.; 2, 3, cones from Ujararsusuk; 3 *b*, twig with a bud; 3 *b*, a carpel from Atanekerdluk; 4–7, leaves. Fig. 4 from Kudliset.

PLATE LII.

Figs. 1–3; *McClintockia Lyallii*, Hr.; 2 *b*, fruit; 2 *c*, *Salix.* Figs. 4–7, *McClintockia dentata*, Hr. Fig. 8 *a*, *McClintockia trinervis*, Hr.; 8 *b*, *Populus arctica*, Hr.; 8 *c*, *Hedera McClurii*, Hr. Fig. 9, *Carpolithes cocculoides*, Hr.; 9 *b*, magn. Fig. 10, *Cyclas*; 10 *b*, magn.

PLATE LIII.

Figs. 1–4 *a*, *Pterospermites spectabilis*; 4 *b*, *Populus arctica*, Hr. Fig. 5, *Cornus ferox*, Ung.

PLATE LIV.

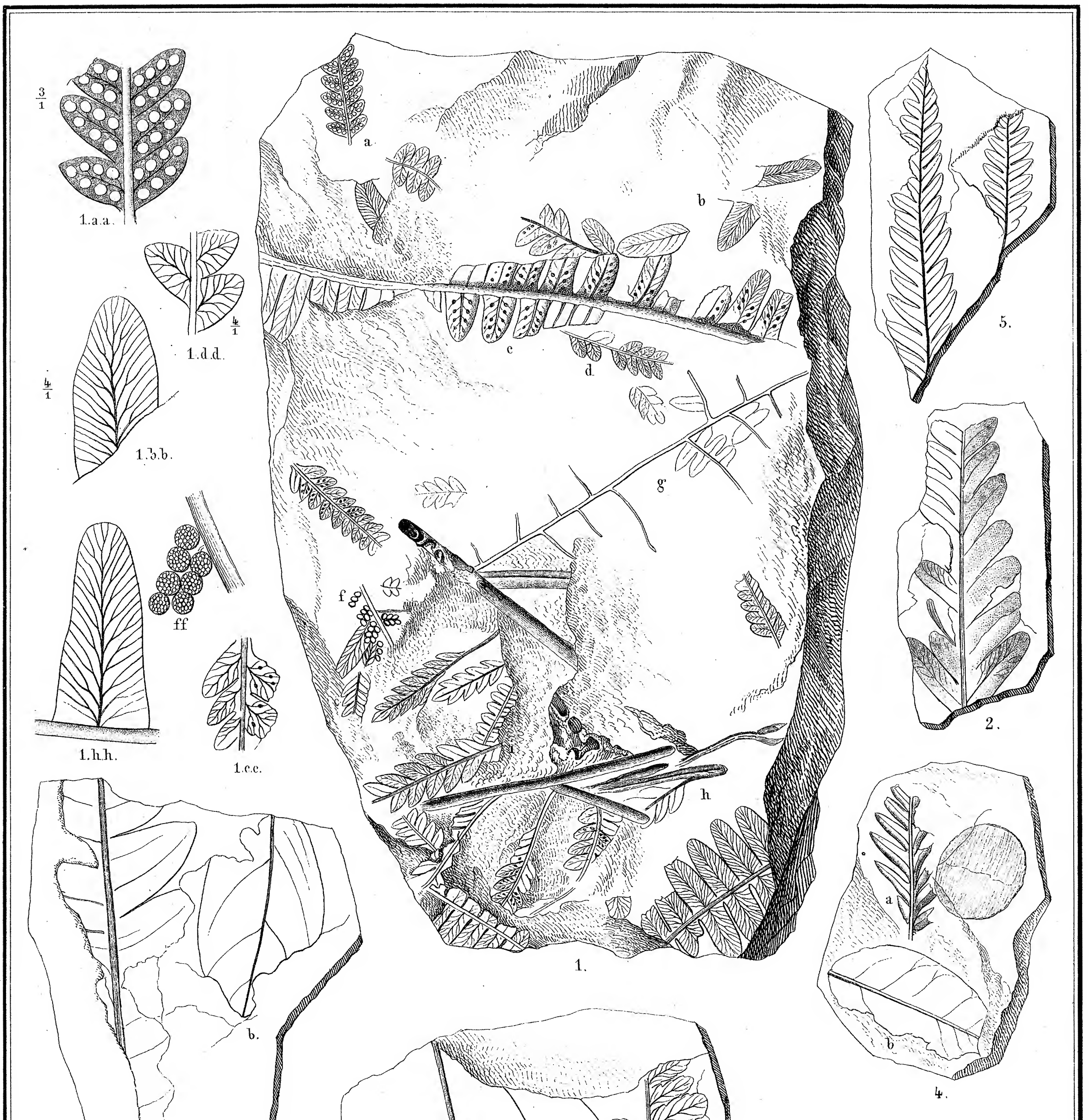
Fig. 1, *Vitis arctica*, Hr. Fig. 2, *Ficus? Grönlandica*, Hr. Fig. 3, *Pterospermites alternans*, Hr. Fig. 4, *Sorbus grandifolia*, Hr. Figs. 5, 6, *Juglans acuminata*, A. Braun.

PLATE LV.

Fig. 1, *Juglans acuminata*, A. Braun. Fig. 2, *Hemitelites Torelli*, Hr. Fig. 3 *a*, *Sequoia Langsdorfii*; 3 *b*, *Populus Richardsoni*, Hr.; 3 *c*, *Quercus platania*, Hr. Fig. 4, branch of *Populus*. Fig. 5 *a*, *b*, *Prunus Scottii*, Hr., leaves; *c*, stone; 5 *d*, *Vitis*, seed; 6, magn. Fig. 7, *Taxites Olriki*, Hr. Fig. 8, *Diospyros brachysepala*, A. Braun. Figs. 9, 10, *Poacites Mengeanus*, Hr.; 10 *c*, magn. Fig. 11, *Cyperites microcarpus*, Hr.; 12 magn.

PLATE LVI.

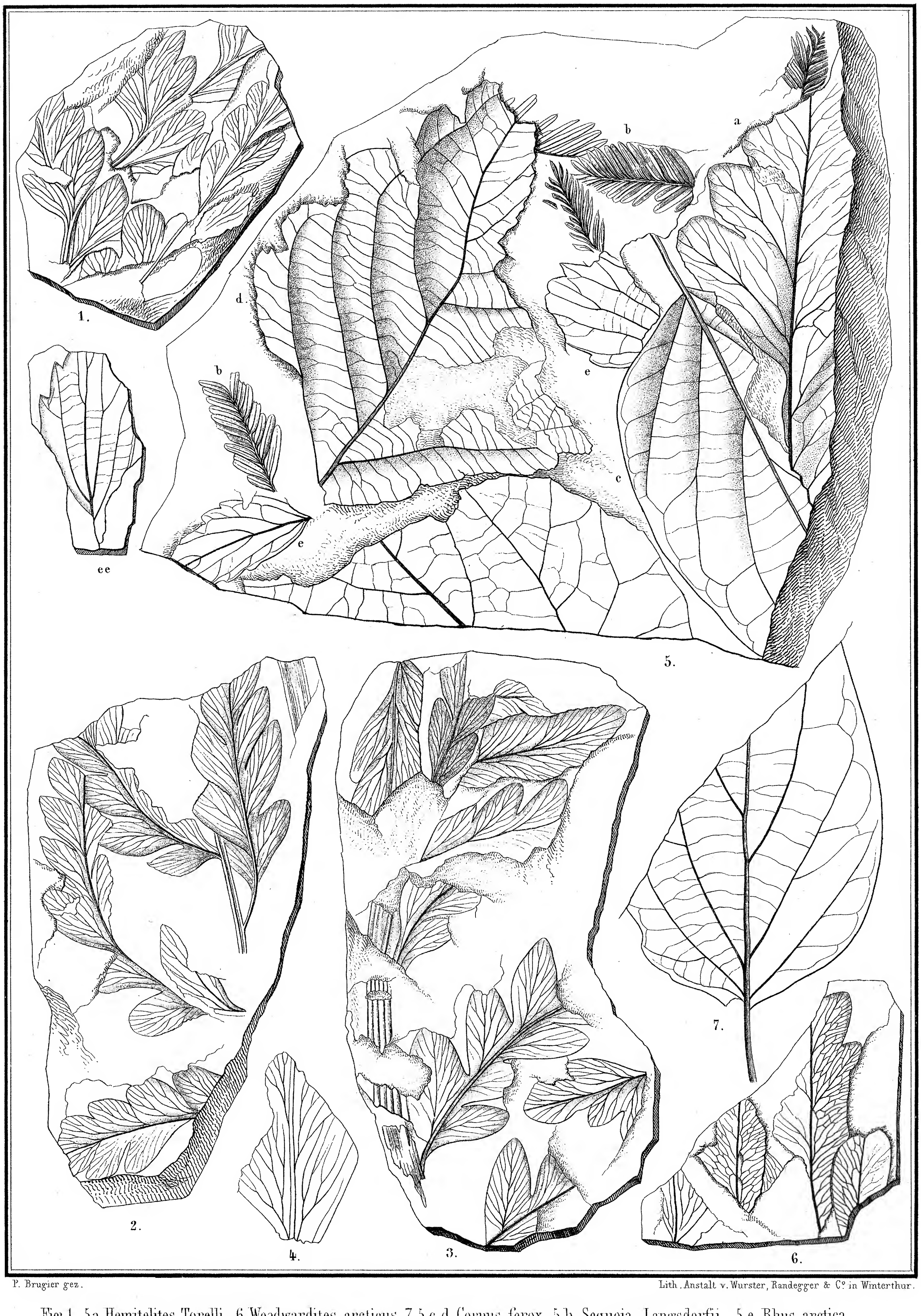
Fig. 1, *Ilex longifolia*, Hr. Fig. 2, *Ilex macrophylla*, Hr. Figs. 3–5, *Rhus bella*, Hr. Figs. 6–9, *Juglans denticulata*, Hr.; 9 *c*, *Pinus hyperborea*, Hr. Fig. 10, *Euonymus amissus*, Hr.; 10 *b*, magn. Fig. 11, *Carpolithes sulcatulus*, Hr.; 11 *b*, magn. Fig. 12, *Carpolithes pusillimus*, Hr.; 12 *b*, magn. Fig. 13, *Cistelites spectabilis*, Hr., from Œningen, magn. Fig. 14, *Cistelites punctulatus*, Hr., from Atanekerdluk; 14 *b*, magn.; 14 *c*, restored.



P. Brugier gez.

Lith. Anstalt v. Wurster, Randegger & Co. in Winterthur

Fig. 1_3. Aspidium Meyeri. 4.5. Aspidium Heerii Ettingsh. 6.a. Aspidium ursinum 7. Dryandra acutiloba.



P. Brugier gez.

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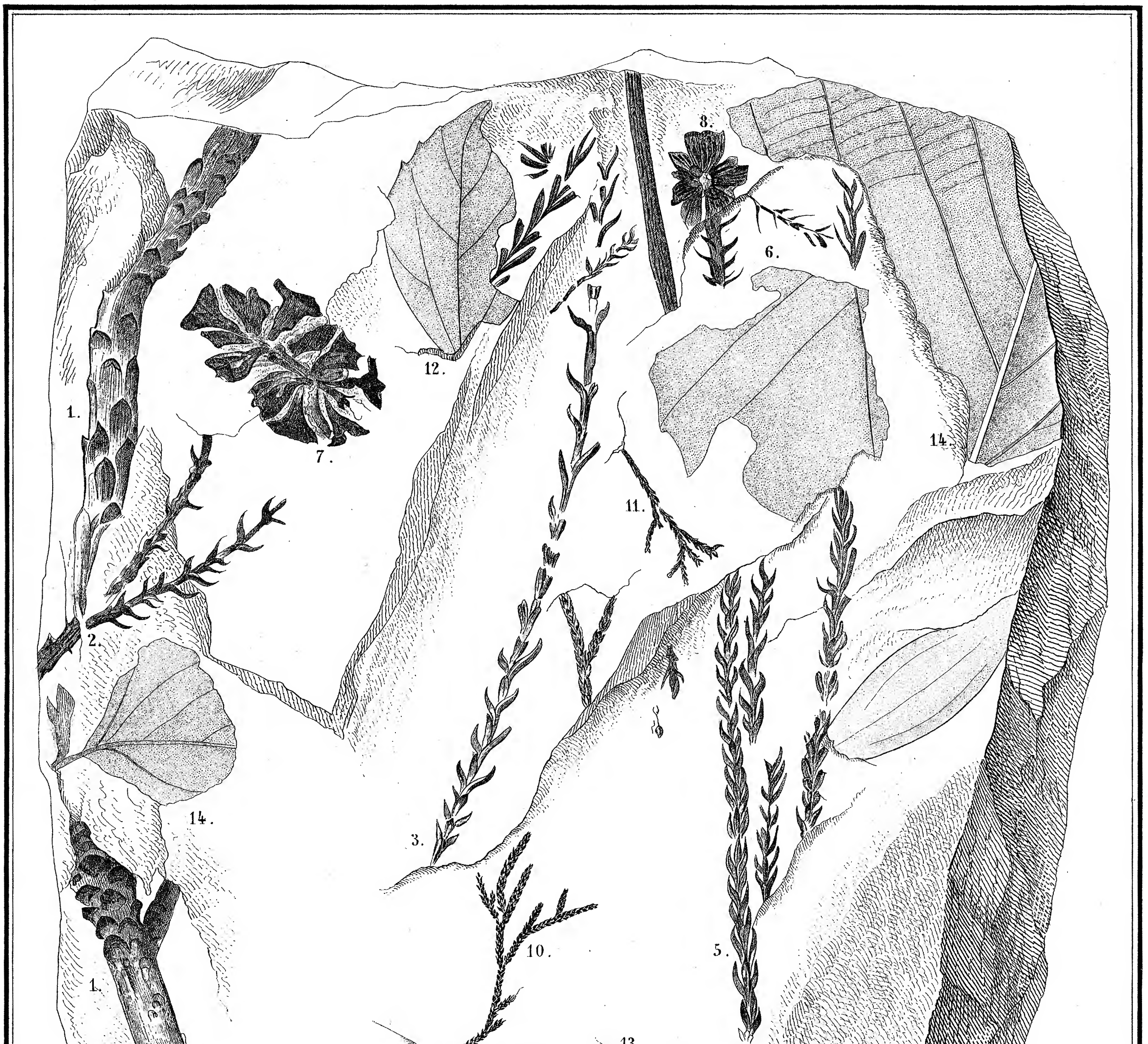
Fig. 1. 5.a. Hemitelites Torelli 6. Woodwardites arcticus 7.5.c.d. Cornus ferox. 5.b. Sequoia Langsdorfii. 5.e. Rhus arctica.



P. Brugier gez.

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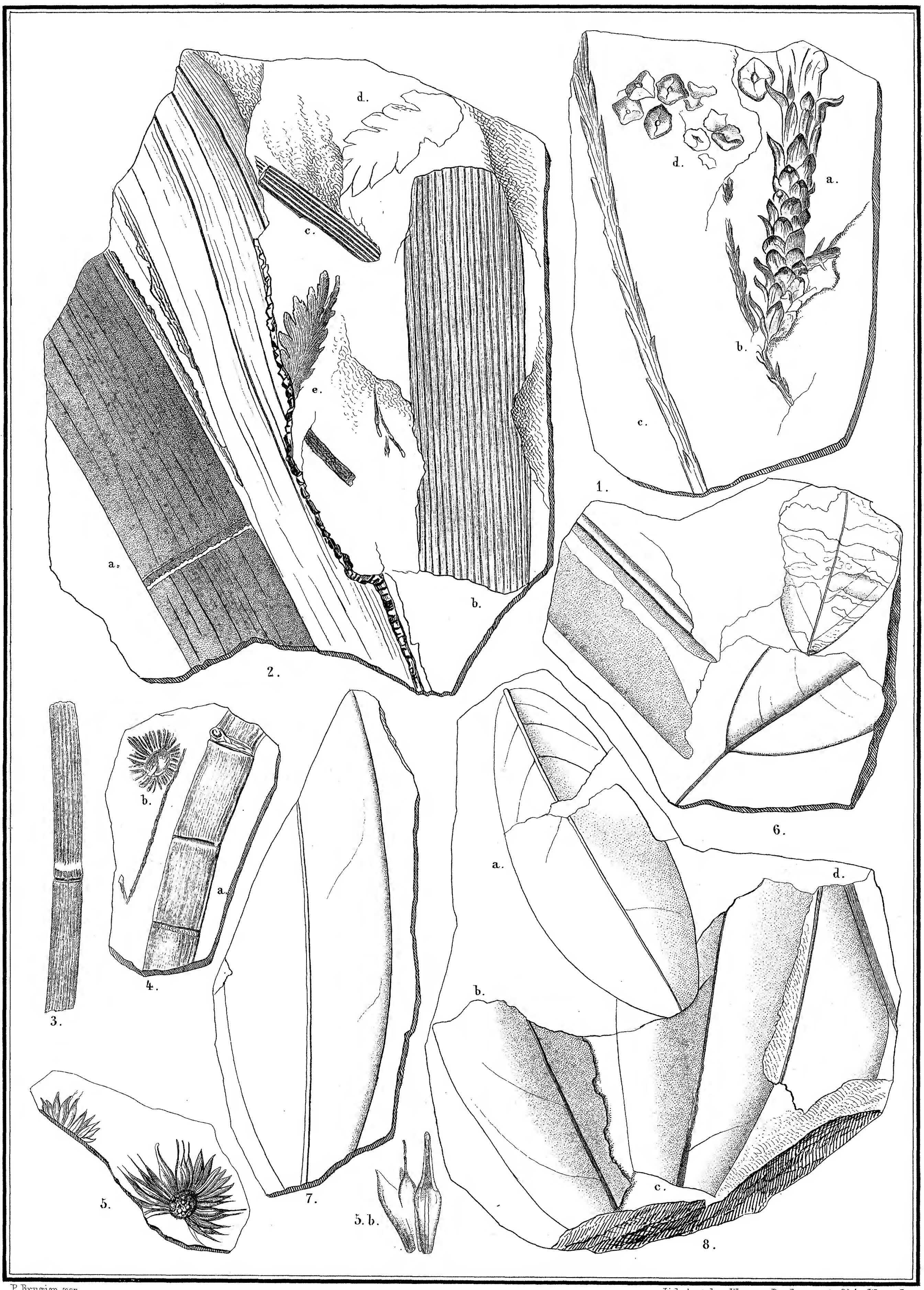
Fig. 1–9. Sequoia Couttsiae. 10. 11. Widdringtonia helvetica. 12. Paliurus Colombi. 13. Liquidambar europaeum.



P. Brugier gez.

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Fig. 1. Sequoia Couttsiae. 2. 3. 4. a. Phragmites oeningensis. 4 b. 5. Sparganium Stygium. 6–8. Aralia Browniana.

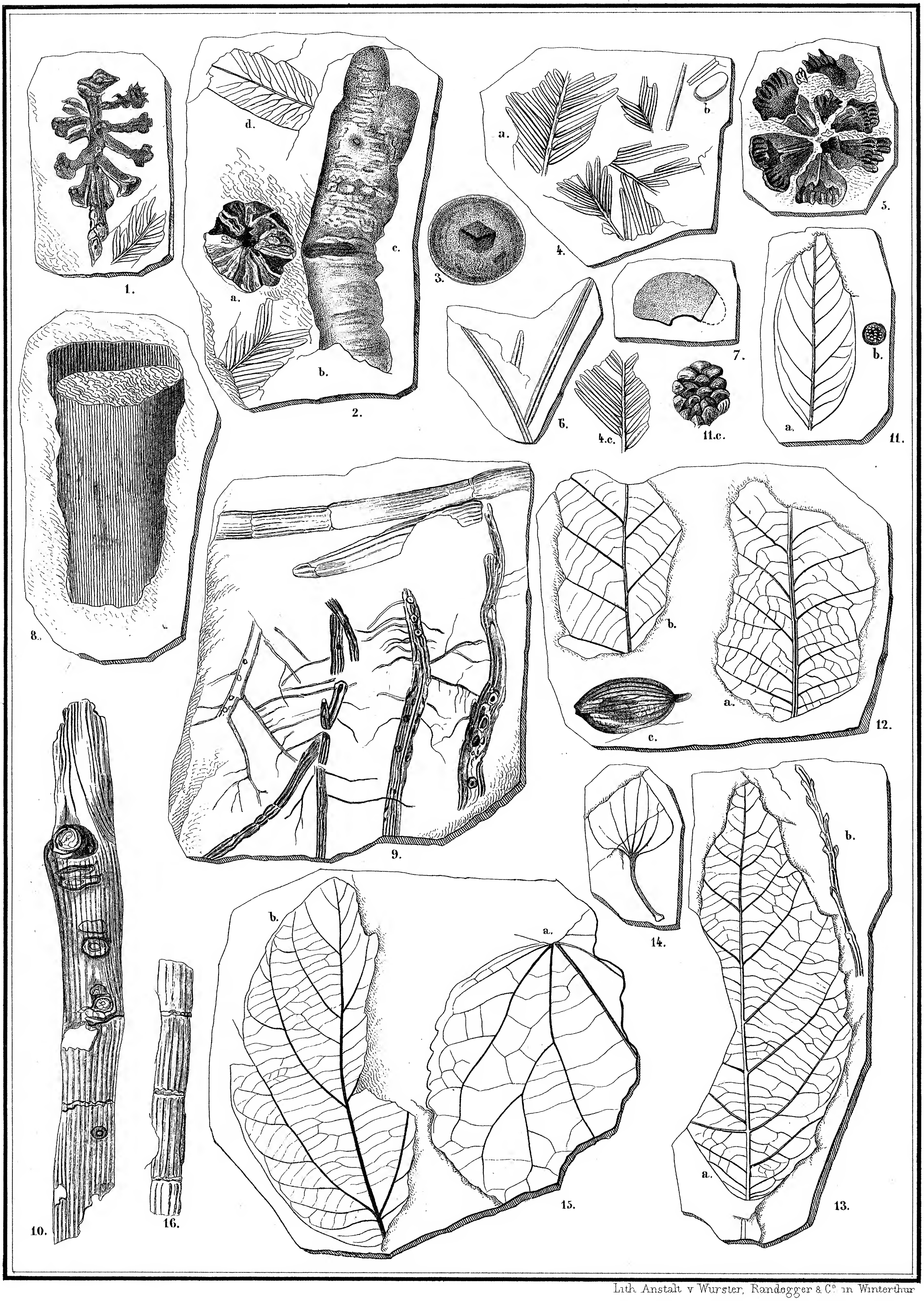

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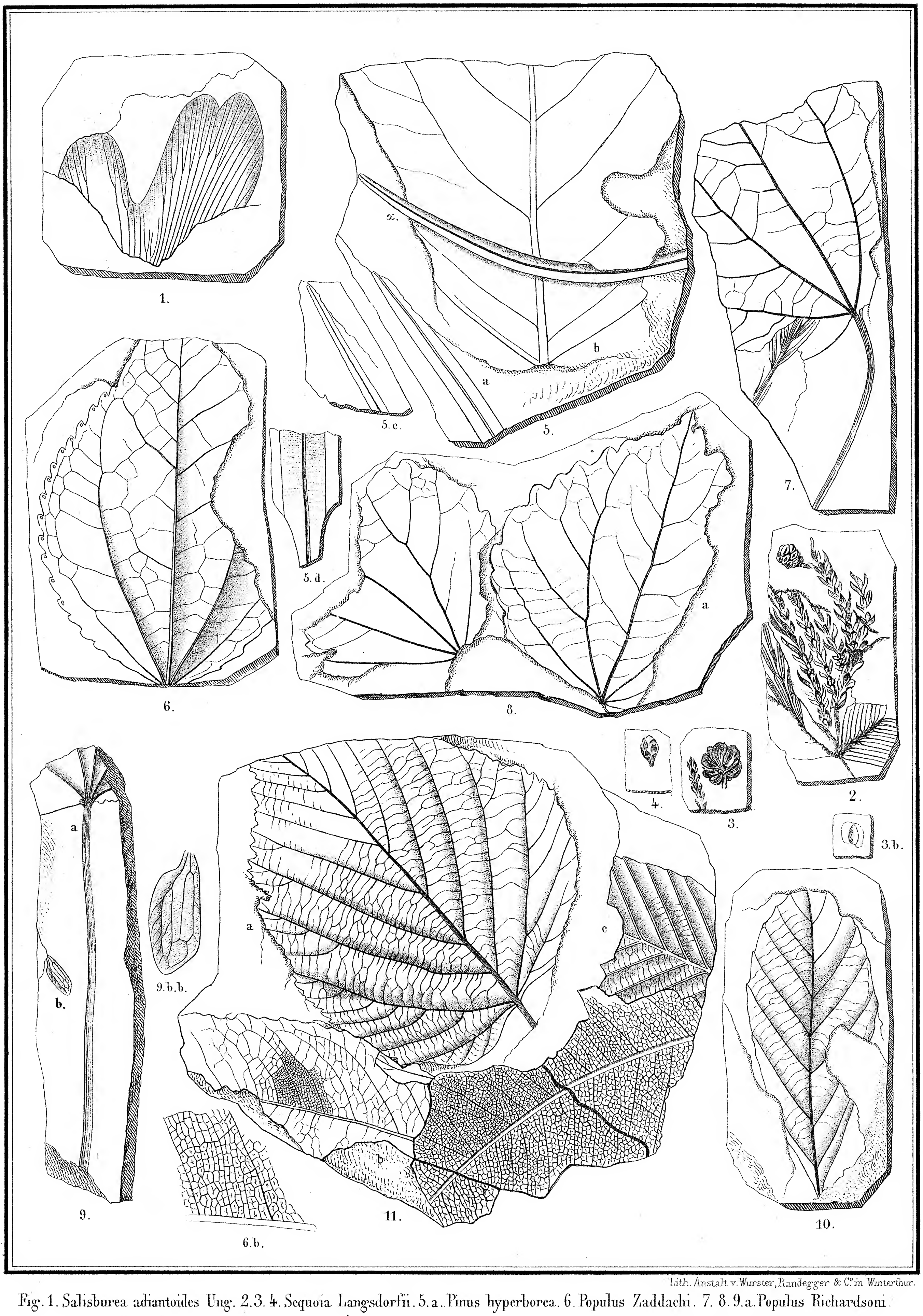
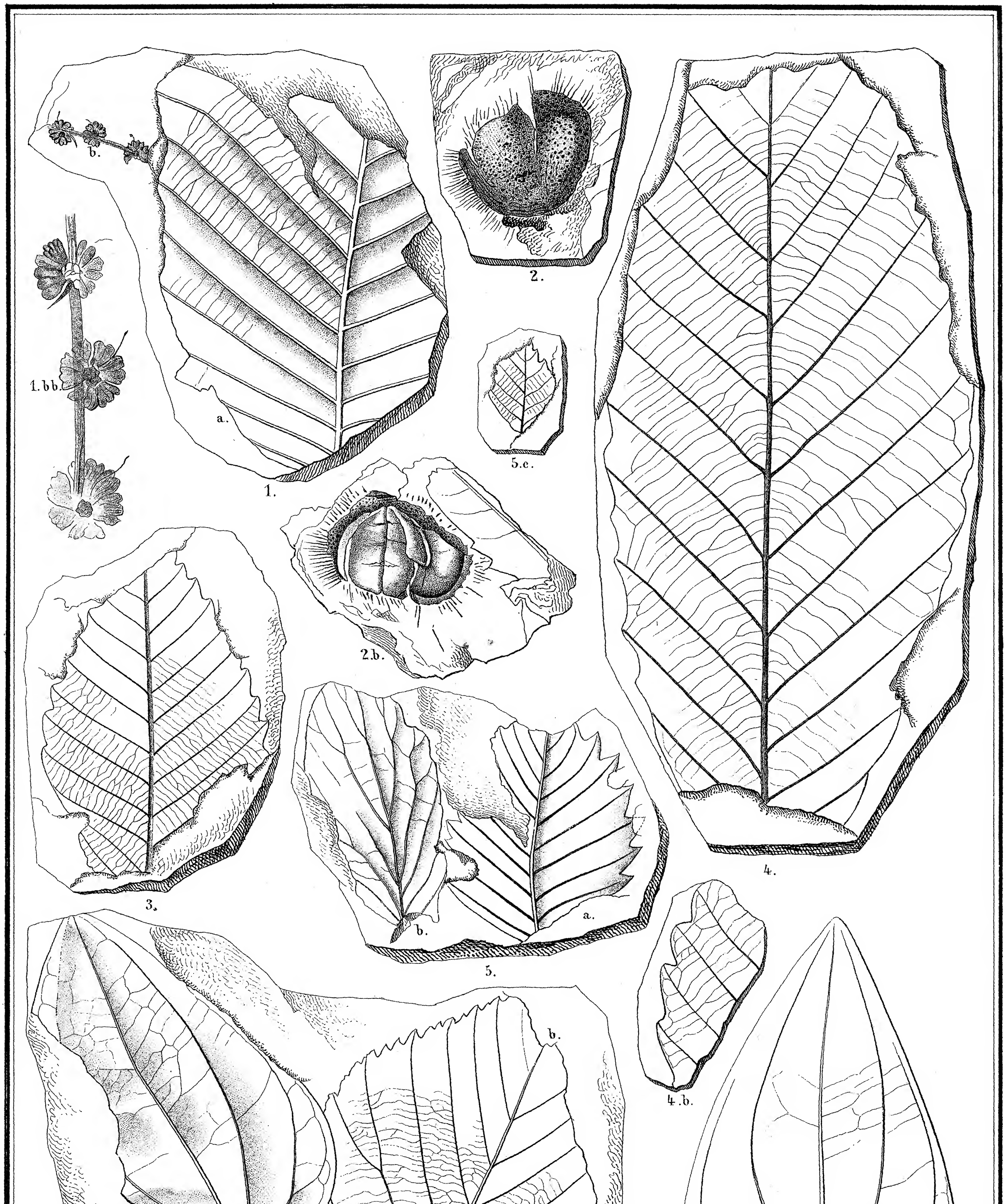
Fig. 1_3. Sequoia Langsdorfii. 2.d. Osmunda Heerii Gaud 4_5. Taxodium distichum miocenum. 6. Pinus polaris 8_9. Phragmites oeningensis. 10. Caulinites costatus. 11.a. Salix Raeana 11.b. Carpolithes Potentilloides 12_13. Salix varians. 12.c. Nyssa arctica. 14. Populus arctica. 15. P. Zaddachi. 15.b. Pterospermites spectabilis. 16. Equisetum boreale.



Lith. Anstalt v. Wurster, Randegger & C°. in Winterthur.

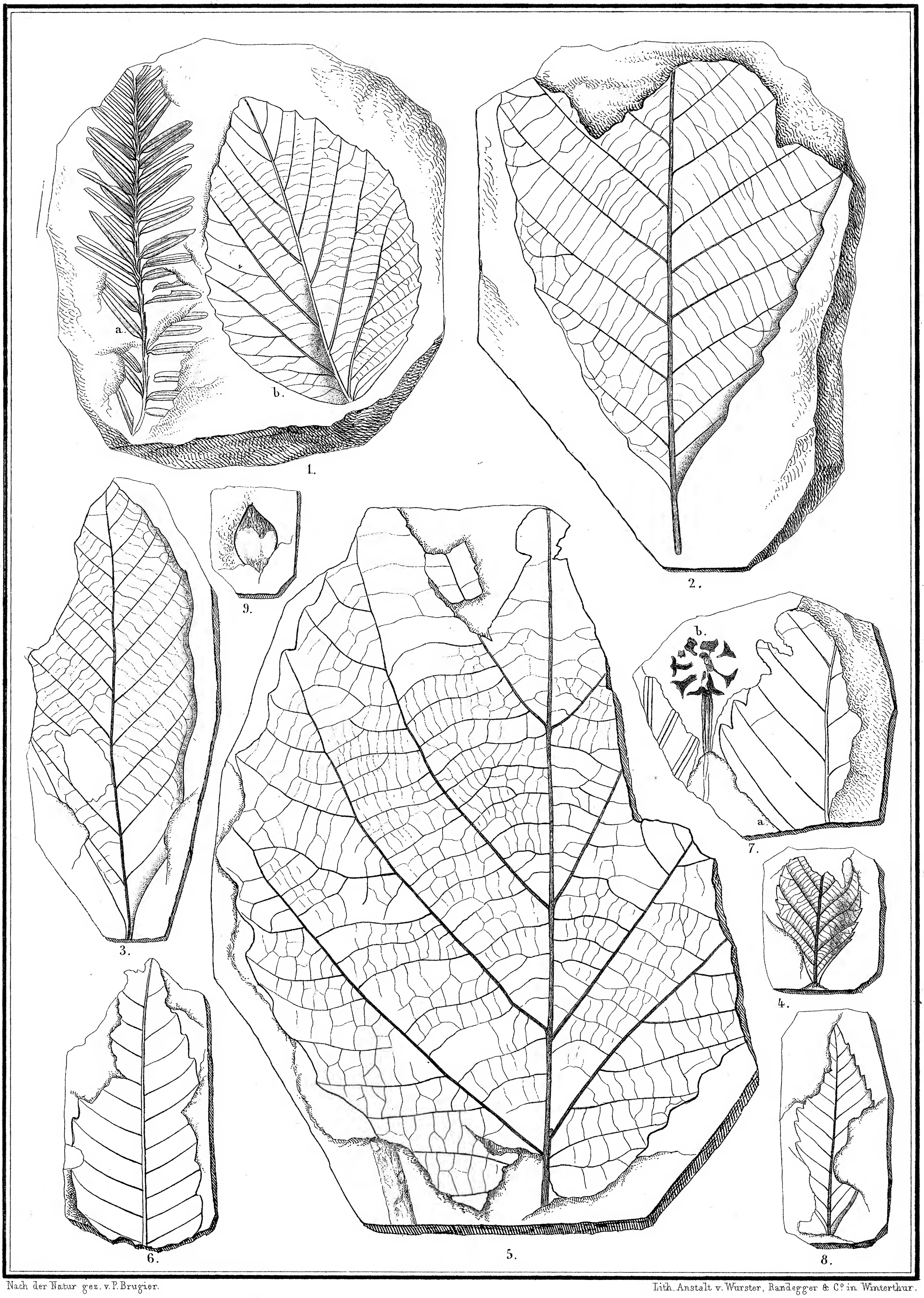
Fig. 1. Salisburea adiantoides Ung. 2. 3. 4. Sequoia Langsdorfii. 5. a. Pinus hyperborea. 6. Populus Zaddachi. 7. 8. 9. a. Populus Richardsoni. 10. Quercus Laharpii. 11. a. Corylus M'Quarrii. 11. b. Ilex macrophylla. 11. c. Carpinus 9. b. Cercopidium rugulosum.



P. Brugier. gez.

Lith. Anstalt v. Wurster, Randegger & Co. in Winterthur.

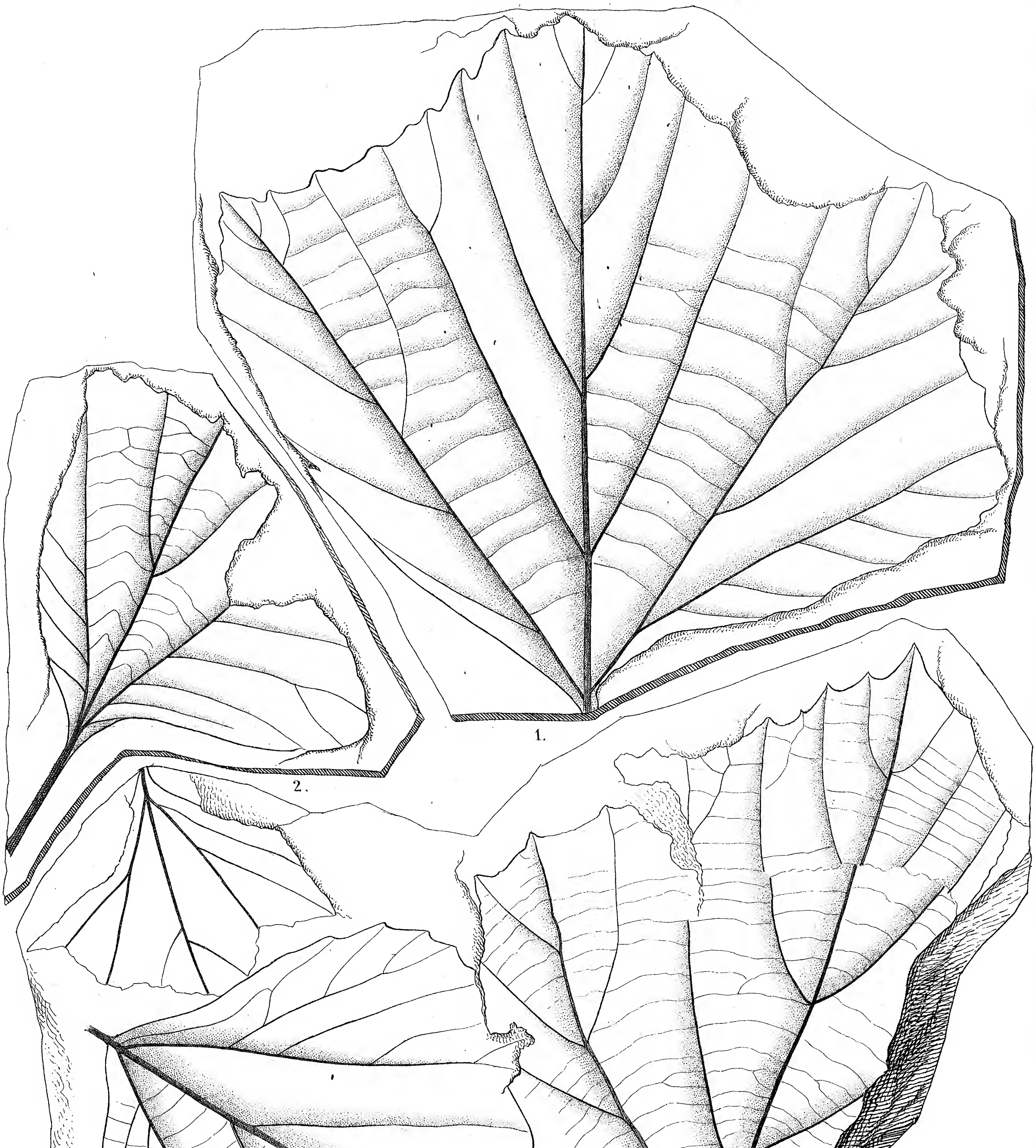
Fig. 1. 2. 3. Castanea Ungeri. 4. Quercus grönlandica. 5. a. c. Planera Ungeri. 5. b. Hedera M' Clurii. 6. a. 7. Smilax grandifolia. 6. b. Corylus M' Quarrii.



Nach der Natur gez. v. P. Brugier.

Lith. Anstalt v. Wurster, Randegger & Cº in Winterthur.

Fig. 1.a. 7.b. Sequoia Langsdorfii. 1.b. Viburnum Whymperi. 2. Quercus Olafseni. 3. Quercus Lyellii. 4. Quercus Steenstrupiana. 5. Quercus platania. 6. 7.a. Planera Ungeri. 8. Castanea Ungeri.



P. Brugier gez.

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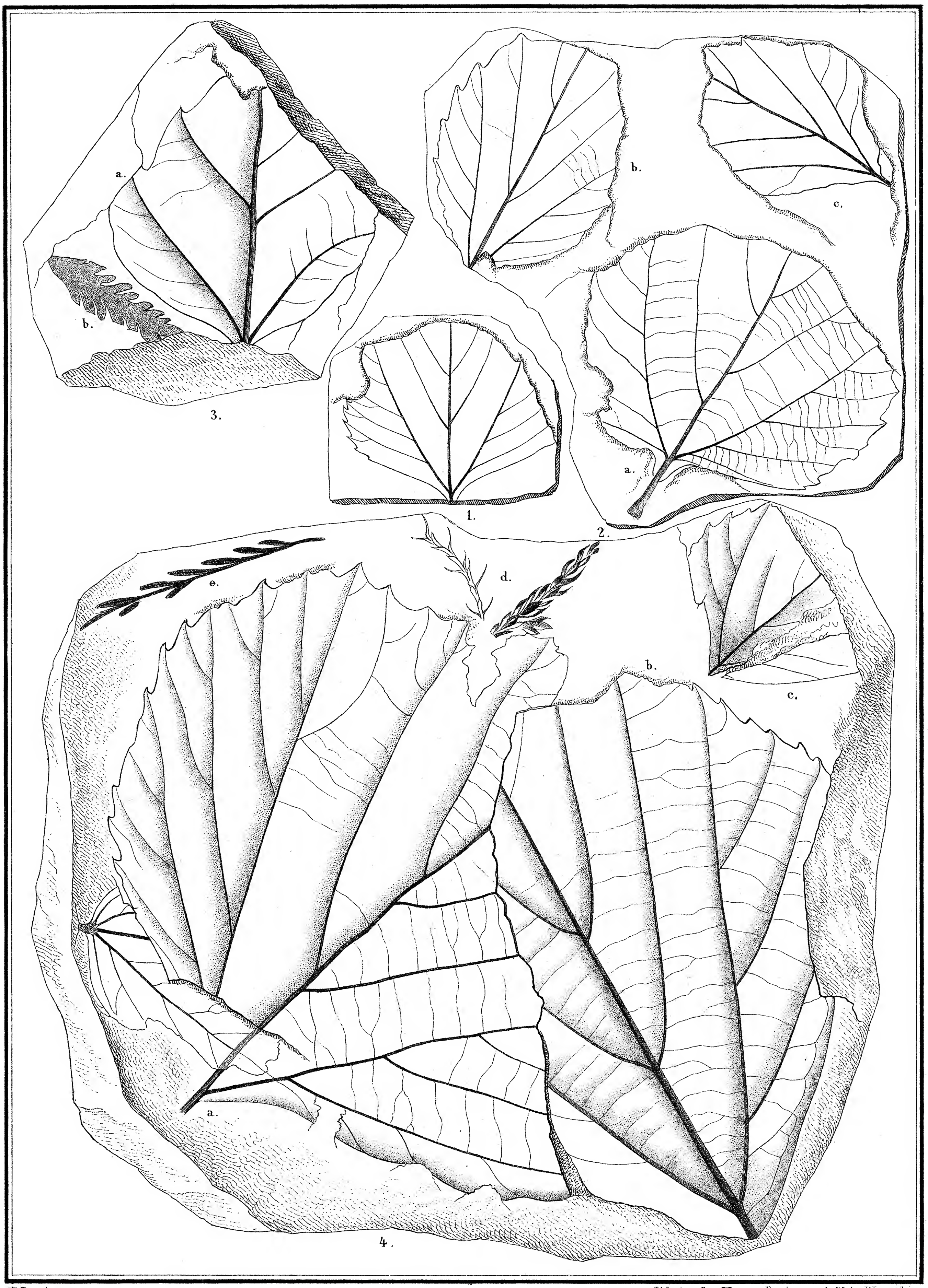
Platanus Guillelmae.



P. Brugier ges.

Lith. Anstalt v. Wurster, Randegger & C^o^ in Winterthur.

Platanus Guillelmae.

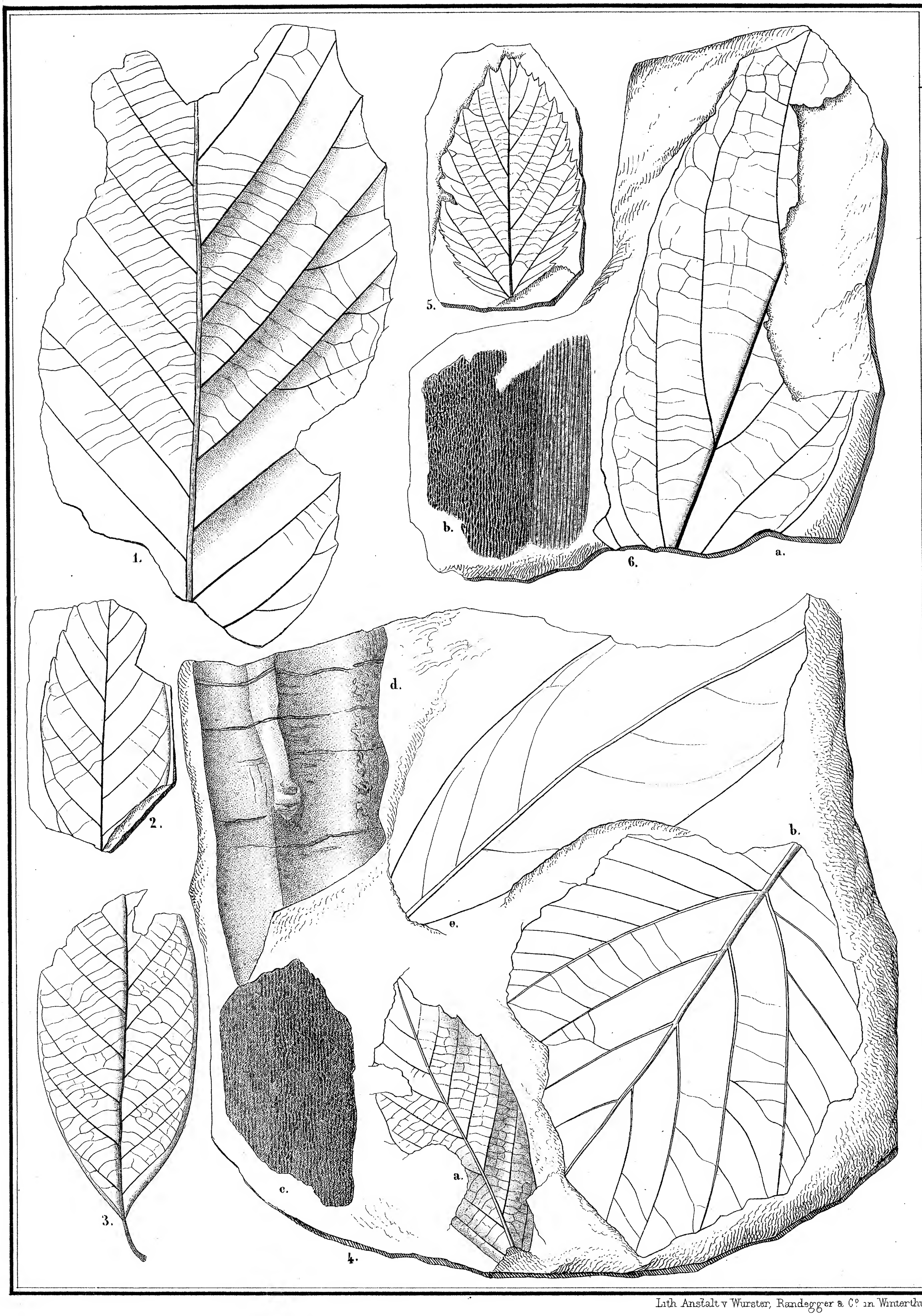


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Fig.1.Quercus Olafseni var. 2_4.a. Quercus Laharpii. 4.b.c.d. u.6.b. Platanus Guillelmae.4.e. Aralia Browniana. 5.Corylus insignis. 6.Cornus ferox.

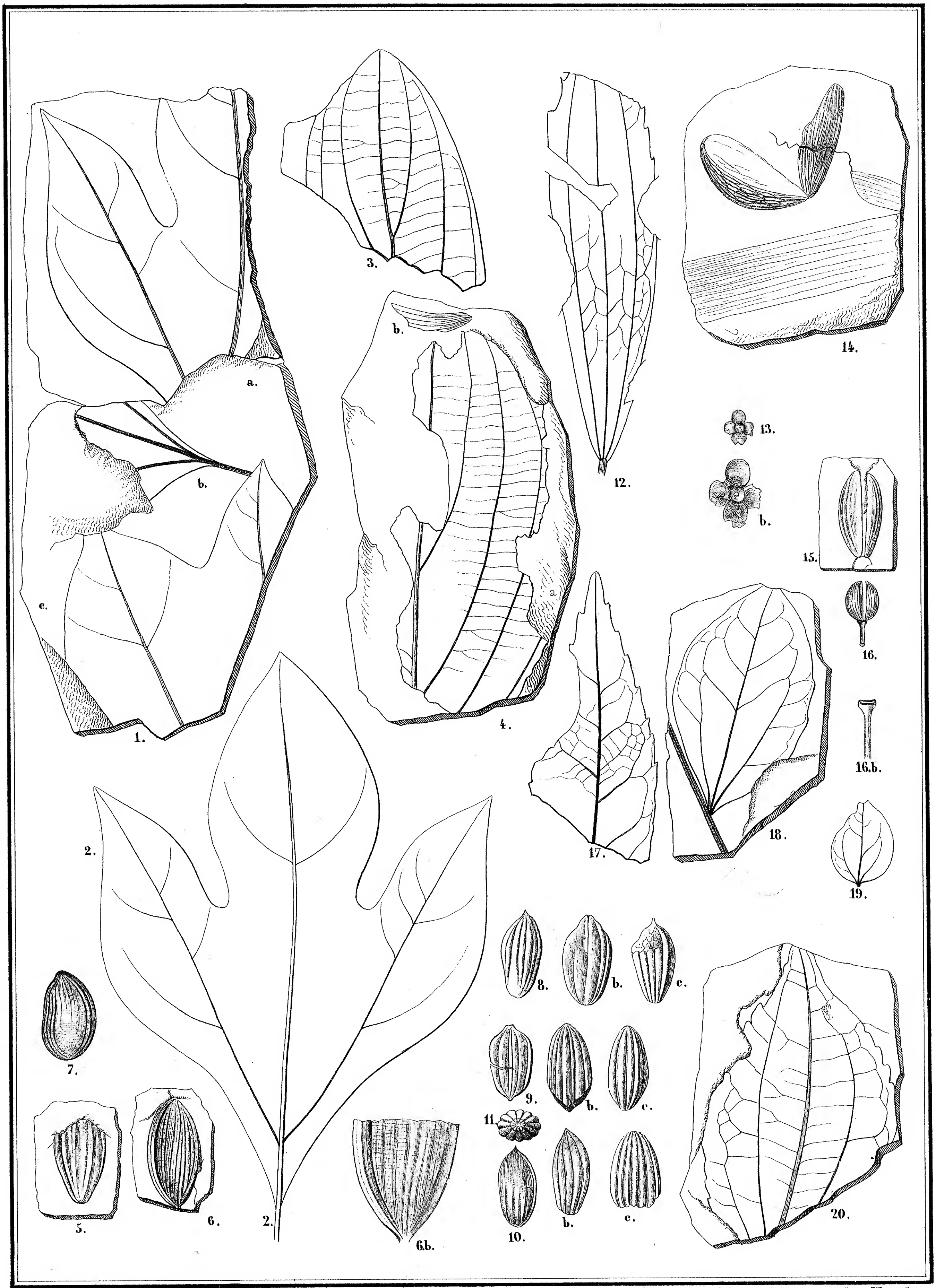

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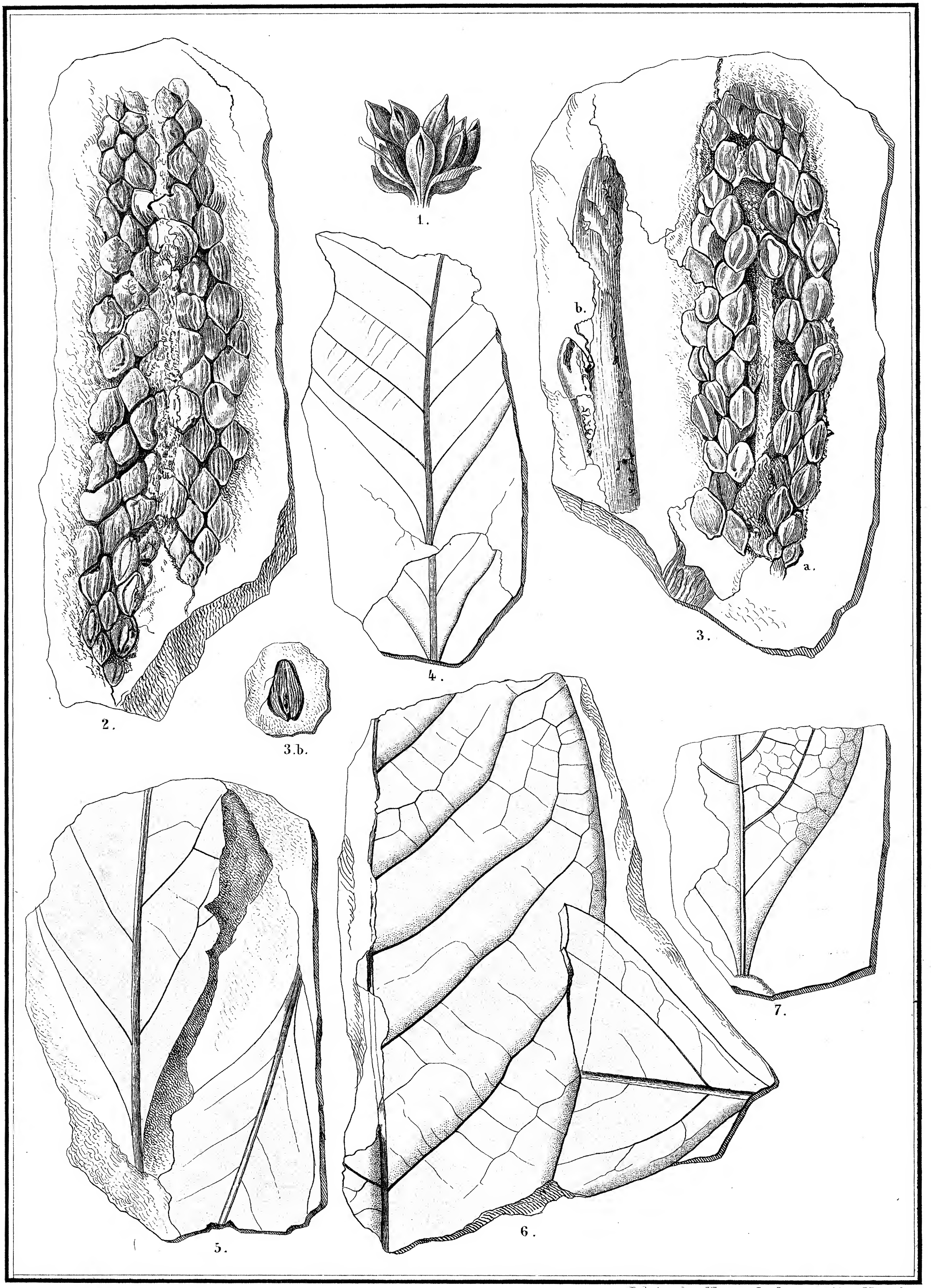
Fig. 1.2. Sassafras Ferretianum. 3_4. Cornus hyperborea. 5_7. Nyssa arctica. 8_11. Nyssa ornithobroma 12. M'Clintockia trinervis. 16. Menyanthes arctica. 18.19. Paliurus Colombi. 17. Jlex longifolia. 13. Diospyros. 14. 15. Carpolithes follicularis 20. Zizyphus hyperboreus.



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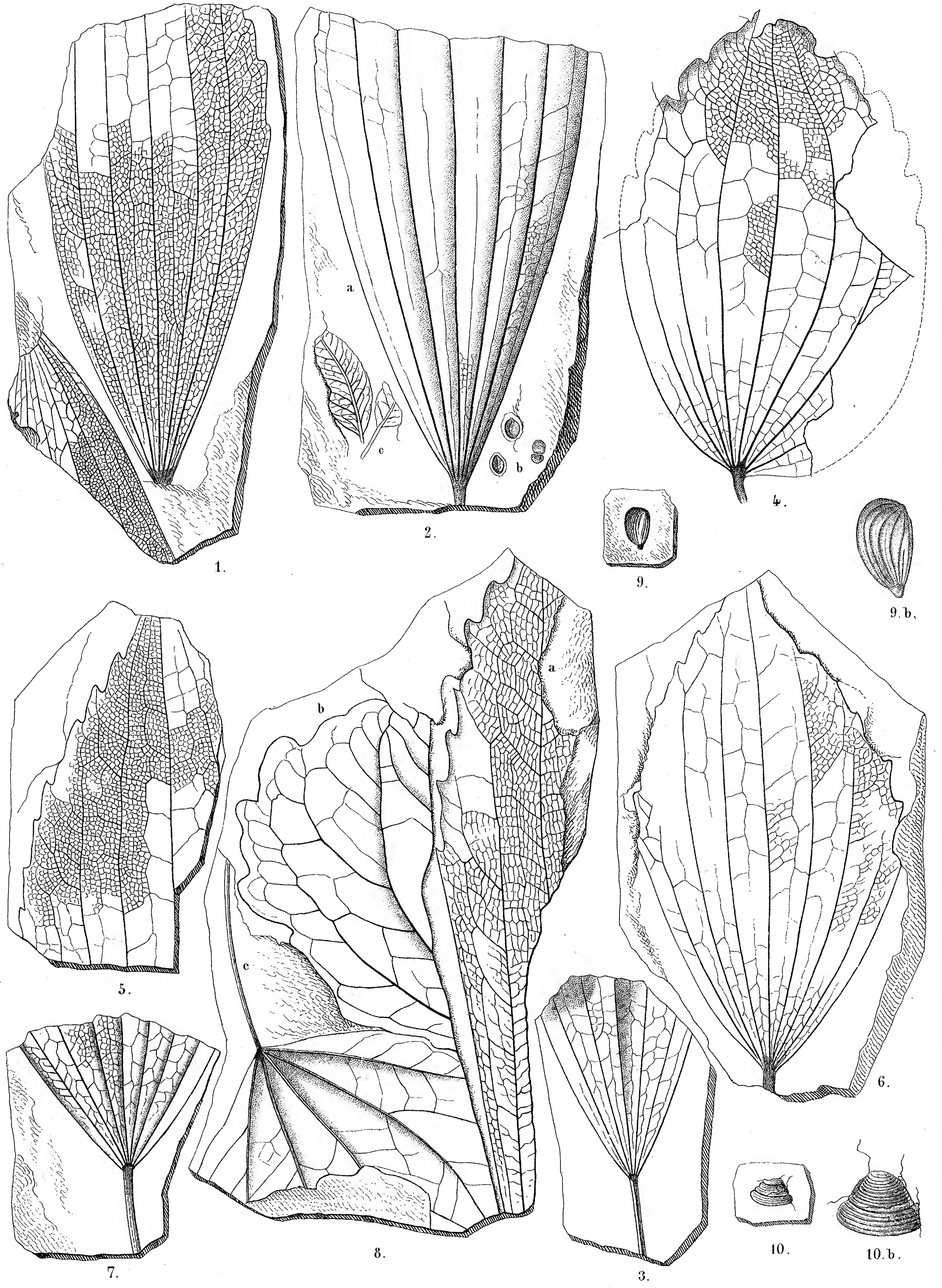
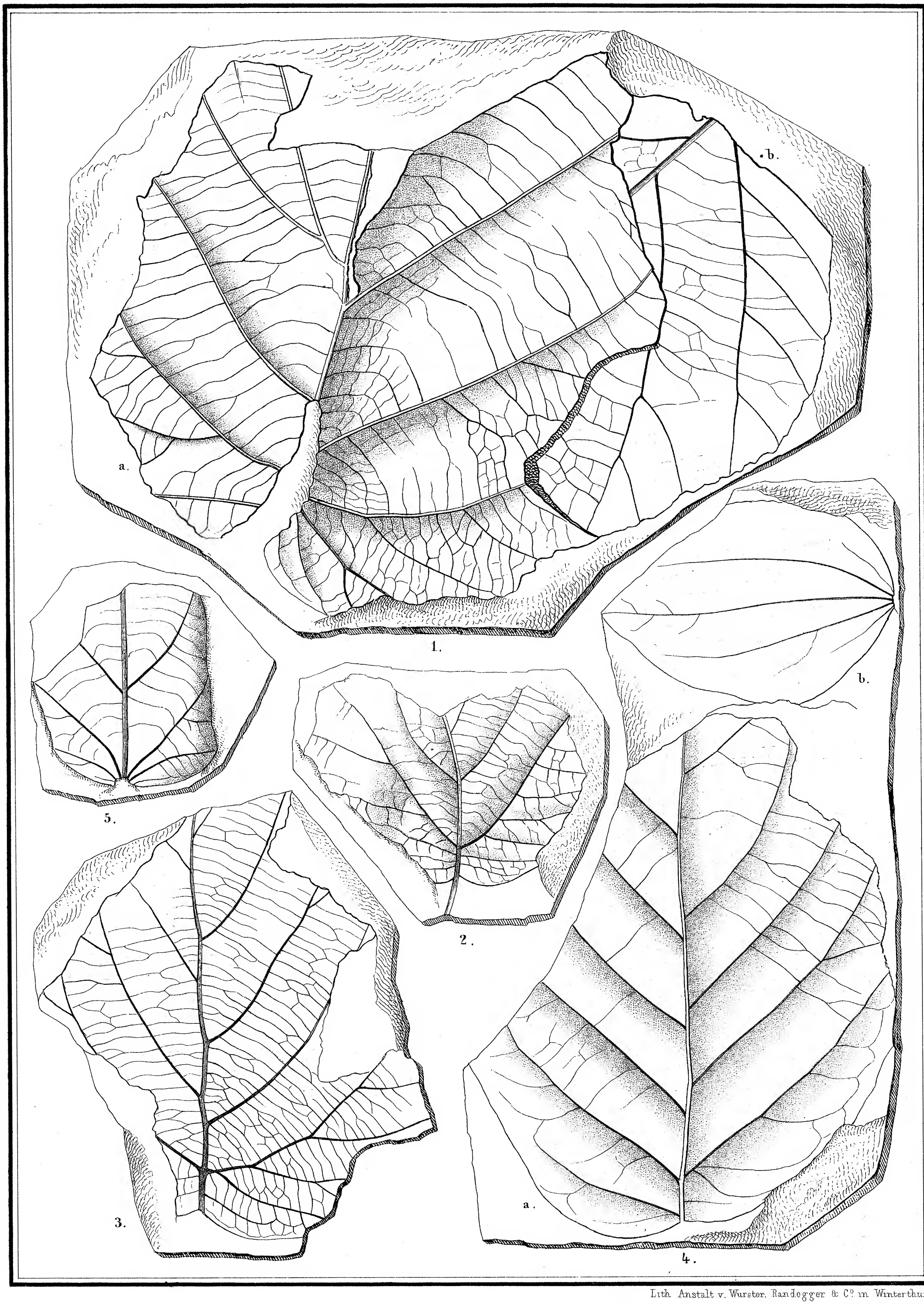
1. Magnolia glauca. L. 2 _ 7. Magnolia Inglefieldi.



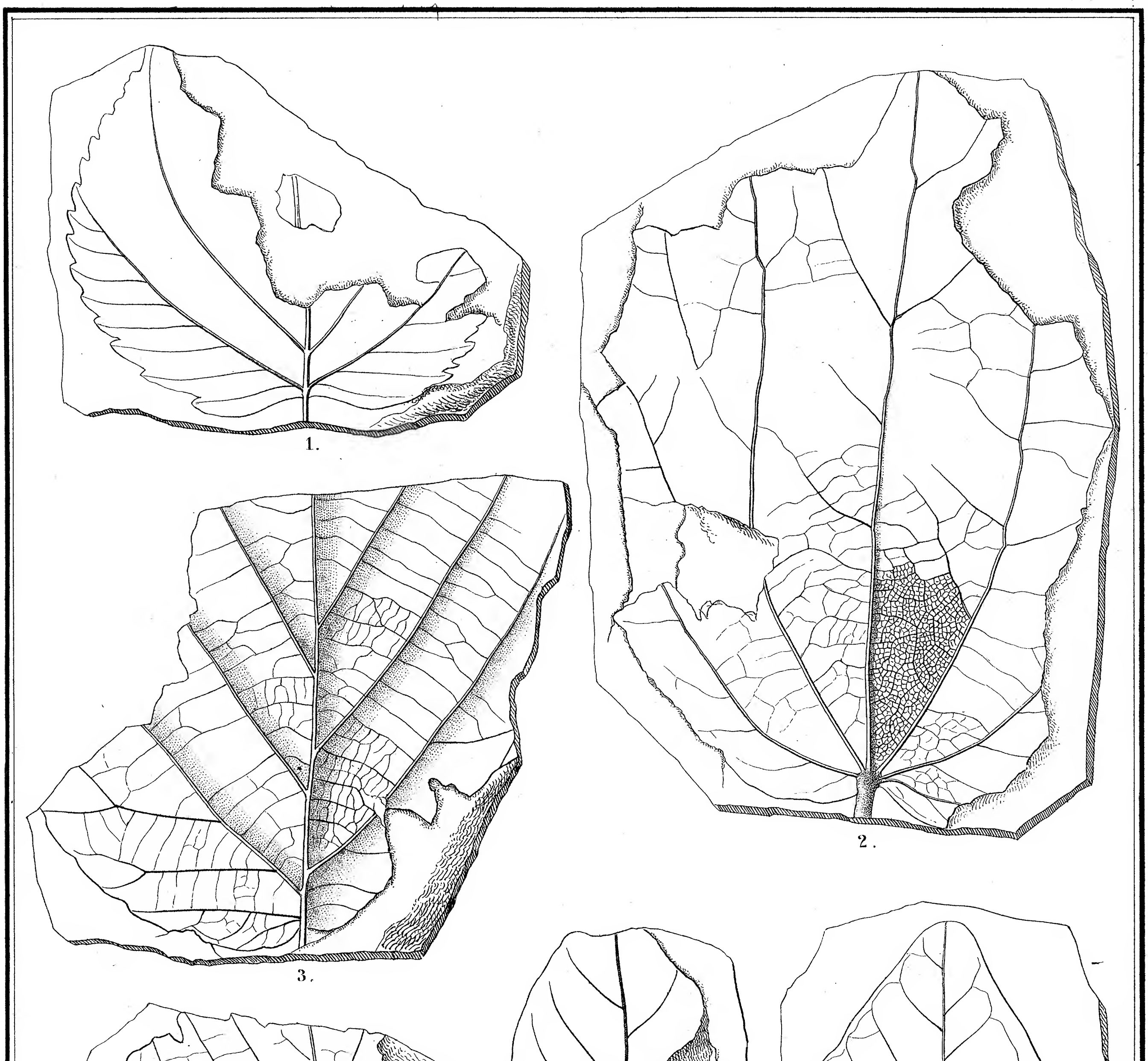
Lith. Anstalt v Wurster, Randegger & C°. in Winterthur

Fig. 1 _ 3. M'Clintockia Lyallii. 4 _ 7. M'Clintockia dentata. 8. a. M'Clintockia trinervis. 8. b. Populus arctica. 8. c. Hedera M'Clurii. 9. Carpolithes cocculoides. 10. Cyclas.



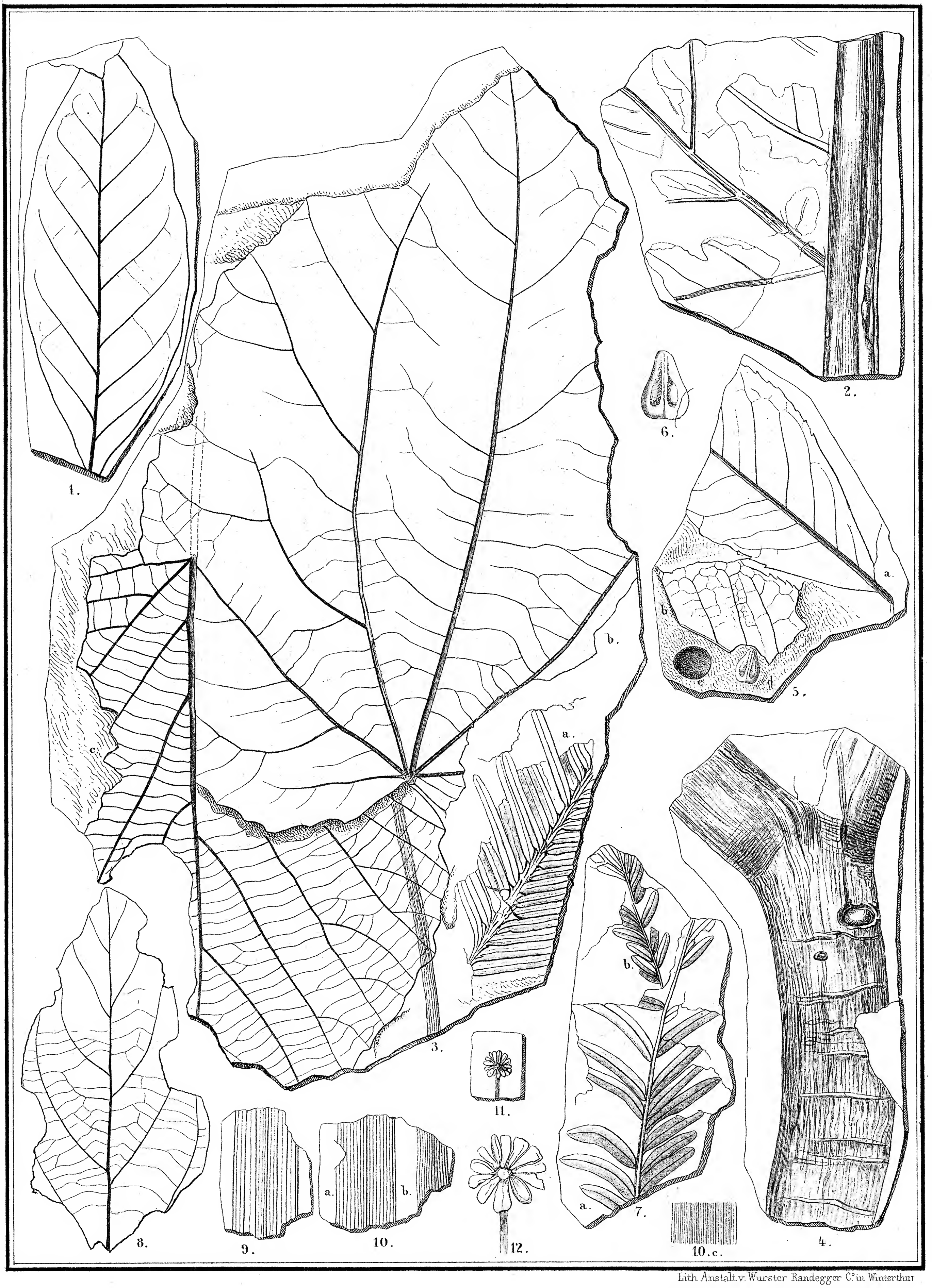
Lith. Anstalt v. Wurster, Randegger & Co. in Winterthur.

1_4.a. Pterospermites spectabilis. 4.b. Populus arctica 5. Cornus ferox.



Lith. Anstalt v. Randegger & C°. in Winterthur.

Fig. 1. Vitis arctica. 2. Ficus? Grönlandica 3. Pterospermites alternans 4. Sorbus grandifolia. 5. 6. Juglans acuminata



Lith Anstalt v. Wurster Randegger C° in Winterthur

Fig. 1. Juglans acuminata. 2. Hemitelites Torelli. 3.a. Sequoia Langsdorfii. var. 3.b. Populus Richardsoni. 3.c. Quercus platania. 4. Populus. 5.a.b.c. Prunus Scottii. 5.d. 6. Vitis. 7. Taxites Olriki. 8. Diospyros brachysepala. 9. 10. Poacites Mengeanus. 11. 12. Cyperites microcarpus.

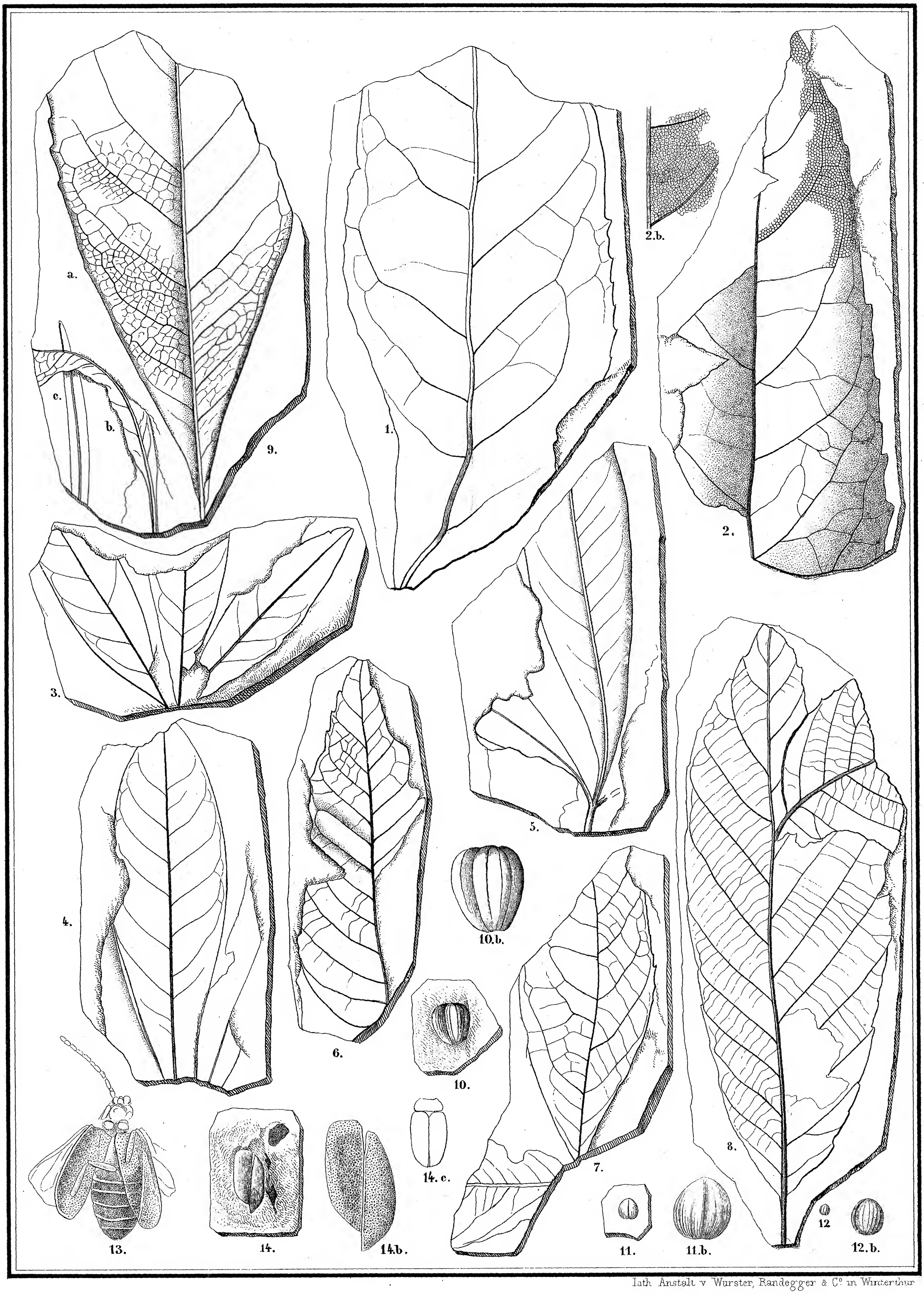


Fig. 1. Jlex longifolia. 2. Jlex macrophylla. 3 _ 5. Rhus bella. 6 _ 9. Juglans denticulata. 10. Evonymus amissus. 11. Carpolithes sulcatulus. 12. Carpolithes pusillimus 13. Cistelites spectabilis. 14. Cistelites punctulatus.

PLATE XXXIX.

Fig. 1–3, *Aspidium Meyeri*, Hr. 1: *a a*, magn., the sori with the indusia; *f f*, sori with the sporangia; *b b*, *d d*, *h h*, the pinnules magn. Fig. 3 *b*, *Leguminosites*, sp. Figs. 4, 5, *Aspidium Heerii*, Ett. Fig. 4 *b*, *Salix Raeana*? Fig. 6 *a*, *Aspidium ursinum*, Hr.; *b*, *Platanus*. Fig. 7, *Dryandra acutiloba*, Brgn., sp. Fig. 7 *b*, *Diospyros*?

PLATE XL.

Figs. 1–5 *a*, *Hemitelites Torelli*, Hr., 4 magn. Figs. 5 *c*, *d*, 7, *Cornus ferox*, Ung. Fig. 5 *b*, *Sequoia Langsdorfii*, Br., sp. Fig. 5 *e*, *Rhus arctica*, Hr. Fig. 6, *Woodwardites arcticus*, Hr.

PLATE XLI.

Figs. 1–9, *Sequoia Couttsiæ*: 1, biennial branch; 2, 3, 4, young shoots with spreading leaves; 5, young shoot with adnate leaves; 7, cone; 8, scales of cone; 9, *Amentum masculinum*. Figs. 10, 11, *Widdringtonia helvetica*, Hr., 10 *b*, *c* magn. Fig. 12, *Paliurus Colombi*, var. Fig. 13, *Liquidambar europæum*, A. Braun. Fig. 14, *Platanus*.

PLATE XLII.

Fig. 1, *Sequoia Couttsiæ*, Hr.: *a*, an old twig; *b*, *c*, young twigs with adhering leaves; *d*, scales of a cone. Figs. 2–4 *a*, *Phragmites Œningensis*, A. Braun; 2 *a*, a culm; *b*, leaf; *d*, *e*, ferns; 3, a small culm. Fig. 4 *a*, a portion of the rhizome. Fig. 4 *b*, *Sparganium*. Fig. 5, fruits of *Sparganium Stygium*, Hr.; 5 *b*, magn. Figs. 6, 7, 8, *Aralia Browniana*, Hr.

PLATE XLIII.

Figs. 1–3, *Sequoia Langsdorfii*, Brongn.: 1, cone, longitudinal vertical section; 2, a transverse section of cone; 2 *b*, twig; *c*, branch; *d*, *Osmunda Heerii*, Gaud.; fig. 3, fragment of a scale in a nodule. Figs. 4, 5, *Taxodium distichum miocenum*; 4 *b*, amber. Figs. 6, *Pinus polaris*; 7, a scale of a Pine. Figs. 8, 9, *Phragmites Œningensis*; 8, portion of a culm; 9, roots. Fig. 10, *Caulinites costatus*, Hr. Fig. 11, *Salix Raeana*, Hr.; 11 *b*, *Carpolithes Potentilloides*; 11 *c*, magn. Figs. 12, 13, *Salix varians*, sp.?; 13 *b*, twig; 12 *c*, *Nyssa arctica*, Hr. Fig. 14, *Populus arctica*, Hr., young leaf. Fig. 15 *a*, *Populus Zaddachi*, Hr.; 15 *b*, *Pterospermites spectabilis*, Hr. Fig. 16, *Equisetum boreale*, Hr.

PLATE XLIV.

Fig. 1 *Salisburea adiantoides*, Ung. Figs. 2–4, *Sequoia Langsdorfii*, A. Brongn.; 2, 3, young cone; 4, male catkin; 3 *b*, seed. Fig. 5 *a*, *c*, *Pinus hyperborea*; 5 *b*, *Magnolia Inglefieldi*. Fig. 6, *Populus Zaddachi*, Hr. Figs. 7, 8, 9 *a*, *Populus Richardsoni*, Hr.; 9 *b*, *Cercopidium rugulosum*, Hr.; 9 *b*, *b*, magn. Fig. 10, *Quercus Laharpii*, Gaud. Fig. 11 *a*, *Corylus McQuarrii*; 11 *b*, *Ilex macrophylla*, Hr.; 11 *b*, *b* magn; 11 *c*, *Carpinus*.

PLATE XLV.

Figs. 1–3, *Castanea Ungeri*, Hr. Fig. 1 *a*, leaf; 1 *b*, male flowers; 1 *b*, *b* magn.; 2, cup; 2 *b*, cup with fruit; 3, leaf. Fig. 4, *Quercus Grönlandica*, Hr.; 4 *b*, teeth of the leaf; 4 *c*, acorn. Fig. 5, *Planera Ungeri*; 5 *c*, young leaf; 5 *b*, *Hedera McClurii*. Fig. 6 *a*, *Smilax grandifolia*, Ung.; 6 *b*, *Corylus McQuarrii*, Forbes, sp. Fig. 7, *Smilax grandifolia*, restored leaf.

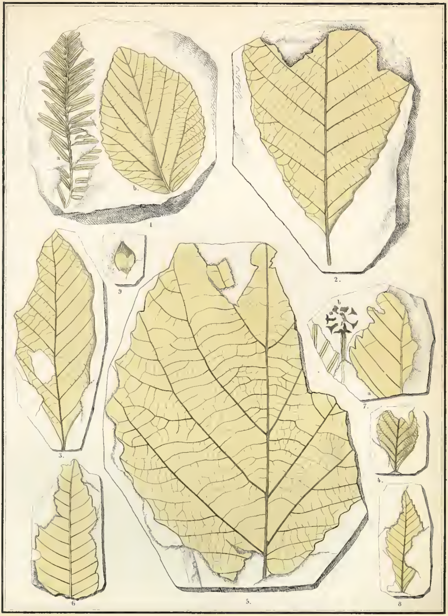


PLATE XLVI.

Fig. 1 *a*, *Sequoia Langsdorfii.* 1 *b*, *Viburnum Whymperi*, Hr. Fig. 2, *Quercus Olafseni*, Hr. Fig. 3, *Quercus Lyellii*, Hr. Fig. 4, *Quercus Steenstrupiana*, Hr. Fig. 5, *Quercus platania*, Hr. Figs. 6, 7 *a*, *Planera Ungeri*, Ett. 7 *b*, *Sequoia Langsdorfii*, Br. Fig. 8, *Castanea Ungeri*, Hr., young leaf. Fig. 9, *Fagus*, fruit.

PLATE XLVII.

Figs. 1–3, *Platanus Guillelmæ*, Gœp. Ujararsusuk.

PLATE XLVIII.

Figs. 1–4, *Platanus Guillelmæ*, Gœp. Fig. 3 *b*, a fern. Fig. 4 *d*, *e*, *Sequoia Couttsiæ*, Hr. Figs. 1, 2 from Ujararsusuk. Figs. 3, 4 from Kudliset.

PLATE XLIX.

Fig. 1, *Quercus Olafseni*, var. Figs. 2, 3, 4 *a*, *Quercus Laharpii*, Gaud. Fig. 4 *b*, *c*, *d*, *Platanus Guillelmæ*, Gœp.; *b*, leaf; *c*, bark; *d*, branch; 4 *e*, *Aralia Browniana*, Hr. Fig. 5, *Corylus insignis*, Hr. Fig. 6 *a*, *Cornus ferox*, Ung.; *b*, *Platanus*, bark.

PLATE L.

Figs. 1, 2, *Sassafras Ferretianum*; 2, the leaf restored. Figs. 3, 4, *Cornus hyperborea*, Hr. Figs. 5–7, *Nyssa arctica*, Hr.; 6 *b*, magn. Figs. 8–11, *Nyssa ornithobroma*, Ung., from Naumburg an der Bober (Silesia). Fig. 12, *M^cClintockia trinervis*, Hr. Fig. 13, *Diospyros*, calyx; 13 *b*, magn. Figs. 14, 15, *Carpolithes follicularis*. Fig. 16, *Menyanthes arctica*, Hr.; 16 *b*, magn. Fig. 17, *Ilex longifolia*. Figs. 18, 19, *Paliurus Colombi*. Fig. 20, *Zizyphus hyperboreus*.

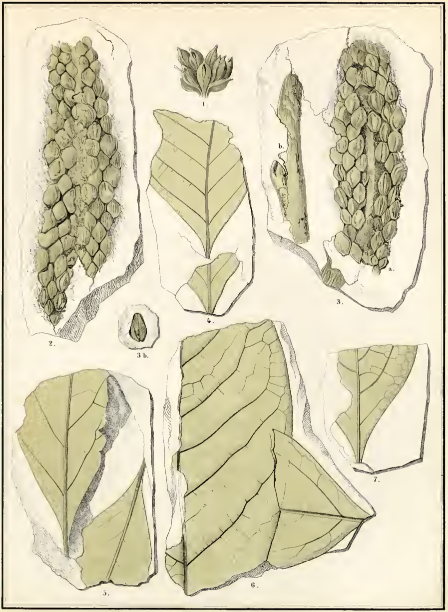


PLATE LI.

Fig. 1, *Magnolia glauca*, L., fruit. Figs. 2–7, *Magnolia Inglefieldi*, Hr.; 2, 3, cones from Ujararsusuk; 3 *b*, twig with a bud; 3 *b*, a carpel from Atanekerdluk; 4–7, leaves. Fig. 4 from Kudliset.

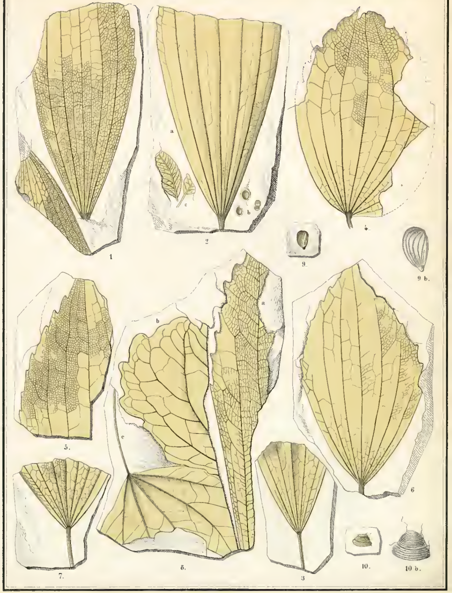


PLATE LII.

Figs. 1–3; *M^cClintockia Lyallii*, Hr.; 2 *b*, fruit; 2 *c*, *Salix*. Figs. 4–7, *M^cClintockia dentata*, Hr. Fig. 8 *a*, *M^cClintockia trinervis*, Hr.; 8 *b*, *Populus arctica*, Hr.; 8 *c*, *Hedera M^cClurii*, Hr. Fig. 9, *Carpolithes cocculoides*, Hr.; 9 *b*, magn. Fig. 10, *Cyclas*; 10 *b*, magn.

PLATE LIII.

Figs. 1–4 *a*, *Pterospermites spectabilis*; 4 *b*, *Populus arctica*, Hr. Fig. 5, *Cornus ferox*, Ung.

PLATE LIV.

Fig. 1, *Vitis arctica*, Hr. Fig. 2, *Ficus? Grönlandica*, Hr. Fig. 3, *Pterospermites alternans*, Hr. Fig. 4, *Sorbus grandifolia*, Hr. Figs. 5, 6, *Juglans acuminata*, A. Braun.

PLATE LV.

Fig. 1, *Juglans acuminata*, A. Braun. Fig. 2, *Hemitelites Torelli*, Hr. Fig. 3 *a*, *Sequoia Langsdorfii*; 3 *b*, *Populus Richardsoni*, Hr.; 3 *c*, *Quercus platania*, Hr. Fig. 4, branch of *Populus*. Fig. 5 *a*, *b*, *Prunus Scottii*, Hr., leaves; *c*, stone; 5 *d*, *Vitis*, seed; 6, magn. Fig. 7, *Taxites Olriki*, Hr. Fig. 8, *Diospyros brachysepala*, A. Braun. Figs. 9, 10, *Poacites Mengeanus*, Hr.; 10 *c*, magn. Fig. 11, *Cyperites microcarpus*, Hr.; 12 magn.

PLATE LVI.

Fig. 1, *Ilex longifolia*, Hr. Fig. 2, *Ilex macrophylla*, Hr. Figs. 3–5, *Rhus bella*, Hr. Figs. 6–9, *Juglans denticulata*, Hr.; 9 *c*, *Pinus hyperborea*, Hr. Fig. 10, *Euonymus amissus*, Hr.; 10 *b*, magn. Fig. 11, *Carpolithes sulcatulus*, Hr.; 11 *b*, magn. Fig. 12, *Carpolithes pusillimus*, Hr.; 12 *b*, magn. Fig. 13, *Cistelites spectabilis*, Hr., from Œningen, magn. Fig. 14, *Cistelites punctulatus*, Hr., from Atanekerdluk; 14 *b*, magn.; 14 *c*, restored.