

Oligocene fossil leaves of the Perrando Collection: history, preservation, and paleoclimatic meaning

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ABSTRACT - A study of the fossil leaves contained within the Perrando Collection from the lower Oligocene sections outcropping near Santa Giustina and Sassello (Tertiary Piedmont Basin, Central Liguria, NW Italy) is presented. The specimens were collected by Don Pietro Deogratias Perrando during the period 1857-1889 and are presently housed at the University of Genoa in Italy (Department for Studies on the Territory and its Resources). The exact location of the collecting sites has been verified in the field and the history of the Collection which had been subjected to repeated damage and deterioration over time has been reconstructed. Furthermore, the complete catalogue of the collection has been reconstructed and emphasis placed on the taxa identified by Principi and Squinabol traced to date.

A total of 771 fossil leaves of Dicotyledonous (Magnoliopsida) were measured in order to perform a paleoclimatic analysis utilizing the foliar physiognomy method. The data obtained allow the studied flora to be referred to the "tropical basal and premontane belt" as the group of large leaf species attained a proportion of 67.71%. In addition this study allows the paleoenvironmental setting of the sedimentary basin in which the leaves were buried to be better defined. The latter can be reconstructed as an alluvial plain with flooded areas, meanders and small lakes, located within the tropical basal and premontane belt.

RIASSUNTO - [Le foglie fossili oligoceniche della Collezione Perrando: storia, conservazione e significato paleoclimatico] - Vengono esaminate le foglie fossili (filliti) costituenti la Collezione Perrando (conservata presso il Dipartimento per lo studio del Territorio e delle sue Risorse dell'Università degli Studi di Genova) raccolte da Don Pietro Deogratias Perrando negli anni 1857-1889 nelle sezioni oligoceniche inferiori affioranti nei dintorni di Santa Giustina e Sassello (Bacino Terziario del Piemonte, Liguria centrale, Italia nord-occidentale). Per quanto attiene l'aspetto museologico, sono stati verificati sul terreno i siti di provenienza del materiale costituente la Collezione ed è stata ricostruita la sua complessa storia, che è stata caratterizzata, nel tempo, da ripetuti danneggiamenti e depauperamenti. Infine, è stato ricostruito il catalogo completo della Collezione, nel quale sono stati evidenziati i taxa identificati da Principi e Squinabol sino ad ora ritrovati.

Successivamente viene esaminato il significato paleoclimatico della associazione costituente la Collezione. A riguardo sono state misurate 771 foglie fossili riferibili a Dicotyledoni (Magnoliopsida), al fine di procedere ad una analisi paleoclimatica in base al "foliar physiognomy method". I dati ottenuti consentono di riferire la flora esaminata al "tropical basal and premontane belt", in quanto il gruppo delle specie caratterizzate da grandi foglie raggiunge una percentuale pari al 67.71%. Questo studio consente una migliore definizione del contesto paleoambientale nel quale si formarono le "filliti", che può essere individuato in una piana alluvionale caratterizzata da aree di esondazione, meandri e piccoli laghi, ubicata in un "basal and premontane belt" tropicale.

INTRODUCTION: HISTORY OF THE COLLECTIONS AND PREVIOUS STUDIES

The fossil leaves ("filliti" in Italian) of the Santa Giustina and Sassello area are part of the large *corpus* of the Perrando Collection, property of the Dipartimento per lo studio del Territorio e delle sue Risorse (Dip. Te. Ris.) of the Genoa University.

Don Pietro Deogratias Perrando (born in Sassello and pastor of Stella Santa Giustina from 1857 to 1889), although self-taught, successfully devoted himself to Natural History and Earth Sciences studies. During the long years of research in the Santa Giustina-Sassello area, he came into contact with many geologists and paleontologists, especially with A. Issel, and he systematically collected fossils, rocks, minerals and paleoethnologic artifacts. In this way he realised a relevant collection, well-known also in the scientific world.

In 1885 some members of the "Società di Letture e Conversazioni Scientifiche" promoted, along with the Rector of the University of Genoa, the Directors of the Museum of the Genoa University and the Director of the

Civic Museum of Genoa, the creation of a committee in order to solicit the public institutions to buy this collection. The committee members were important political and scientific personages, among which the Marquis G. Doria (Director of the Civic Museum of Natural History), Professor A. Issel (Director of the Geological and Mineralogical Royal Museum of the Genoa University), and Professor C. Parona (Director of the Zoological Royal Museum of the Genoa University). The operation was successful and in 1886, with the assistance of the Ministry of Education (Ministero della Pubblica Istruzione), of the Genoa Municipality and of the Province of Genoa, a large part of the Perrando Collection is purchased for the "Regio Museo Universitario di Geologia e Mineralogia" (Geological and Mineralogical Royal Museum of the Genoa University - GMRMGU) directed by A. Issel, according to the Ministry instructions (Issel, 1885a). The fossil leaves of Perrando Collection were represented by about 2300 samples (= rock fragments with one or more fossil leaf, in some cases pertaining to different species), the large part of which are from Santa Giustina and Sassello (Issel, 1893).

After the death of Don Perrando (1889), his heirs presented 170 samples, mainly plant remains, to the GMRMGU (Issel, 1893). During this period S. Squinabol, Issel's assistant at the GMRMGU, published the first studies dealing with these materials (Squinabol, 1889, 1890, 1891a, b, c, 1892).

In 1912 the GMRMGU moved to Villetta Di Negro (Genoa) with 2400 samples of the Perrando's "filliti" Collection (Issel, 1914), and Principi, an assistant of Issel and Rovereto in the years 1912-1926, began his study of this fossil flora (Principi, 1912, 1914, 1916, 1921).

In 1926, in order to make room for the Archaeological Museum, the university collections are relocated in the repository of the Museum of Natural History "G. Doria" (Genoa) on the understanding of their exposure, which unfortunately will not happen. Unluckily, the fossil materials here suffered from repeated flooding.

About 40 years after, Arena (1962/63) studied and reorganized the "filliti" collection, but this work, which have a good photographic documentation, remains an unpublished thesis.

In 1970 the "filliti" suffered from a new flooding, that caused serious damage because the samples, placed on shelves, lost their tags (Mastrorilli, 1970); moreover, also the lists and inventories get lost. In the early 70s, all the recovered material, with the exception of a few specimens (among which a spectacular very well preserved palm frond) that remained at the G. Doria Museum, was housed in the Museum of the new Institute of Geology of the Genoa University (located in the quarter of S. Martino), where, in 1977, suffered another flooding (Marchini, 1980). In the 80s started a new phase of restoring of the "filliti" (Marchini, 1985, 1992; Tacchino, 2005/2006).

Recently, Gregor & Knobloch (2001) published a preliminary taxonomic revision of the here considered flora relying almost exclusively on the iconography of Principi's papers. Subsequently, L. Hably (Hungarian Natural History Museum, Botanical Department,

Budapest) studied directly the "filliti" collection. Hably worked on largely restored material approaching the matter also using the analysis of the cuticles and defining many synonymies (Hably, 2007, 2010, and personal communication).

THE COLLECTION

Squinabol (1889, 1890, 1891a, b, c, 1892) and Principi (1912, 1914, 1916, 1921) identified 464 species of Tracheophyta including: 2 Equisetopsida, 43 Filicopsida, 9 Pinopsida, 1 Gnetopsida, 60 Liliopsida, and 349 Magnoliopsida. As shown in Appendix, 258 of which (among which 8 identified only at the Genus rank) have been recovered and identified on the basis of the iconography of the papers of Squinabol, Principi, Arena, and Marchini, 17 of which belong to Filicopsida (including 3 types and 3 figured specimens), 4 to Pinopsida (figured specimens), 1 to Gnetopsida, 20 to Liliopsida (including 12 types and 3 figured specimens), and 216 to Magnoliopsida (including 66 types related to 52 species and 98 figured specimens related to 78 species). Many of these species (including those identified only at Genus rank) are represented by several specimens, therefore, at the present time, a total of 892 specimens (65 of which with the related counterpart) were recovered.

The remaining specimens of the Collection (about 600) are very poorly preserved (rock fragments with largely incomplete and hardly recognizable leaf remains) or relatively well preserved but still not identified. Recently, Hably (2007, 2010, and personal communication) provides the revision of the taxonomic position of 127 species (appendix, partially only at family or genus rank) and the identification of 214 specimens of Magnoliopsida (attributed to 7 species, 2 genera and 1 family), 2 of Pinopsida, and 1 of Filicopsida. The new taxonomic identification is presented in Tab. 1.

New taxonomic identification of not classified specimens fide Hably (2007, 2010 and personal communications) and Hably & Kvaček (2008)	Catalog number
Filicales ind.	1357/1
Taxodiaceae ind.	1360/1-1360/2
<i>Acherniaephyllum hydrarchos</i> (Unger) Hably	1364/1 (ex 95/2)
<i>Daphnogene</i> sp.	1353/1-1353/17
<i>Engelhardia orsbergensis</i> (Wessel & Weber) Jänichen, Mai & Walther	1359/2
<i>Engelhardia</i> cf. <i>orsbergensis</i> (Wessel & Weber) Jänichen, Mai & Walther	1359/1
<i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček	1350/7; 1350/15; 1352/1- 1352/26; 1352/27b; 1352/28-1352/147
<i>Laurophyllum</i> sp.	1354/1-1354/11
Leguminosae ind.	1356/1-1356/3
<i>Platanus</i> cf. <i>schimperii</i> (Heer) Saporta & Marion	1362/1
<i>Quercus lonchitis</i> Unger	1363/1
<i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	1350/1 (= SG 18); 1350/10 (= SG 16); 1351/53 (= SG 21); 1358/1; 1358/2 (= SG 22); 1358/3 (= SG 23); 1358/4 (= SG 24); 1358/5 (= SG 25); 1358/6 (= SG 26); 1358/7 (= SG 27); 1358/8 (= SG 28); 1358/9 (= SG 29); 1358/10 (= SG 30); 1358/11 (= SG 31); 1358/12 (= SG 32); 1358/13 (= SG 33); 1361/1
<i>Zizyphus zizyphoides</i> (Unger) Weyland	1355/1-1355/3; 1355/5
cf. <i>Zizyphus zizyphoides</i> (Unger) Weyland	1355/4

Tab. 1 - New taxonomic identification fide Hably (2007, 2010, and personal communications) and Hably & Kvaček (2008).

GEOLOGIC FRAMEWORK

The Tertiary Piedmont Basin (TPB) is located in Northwestern Italy and stretches along the Piedmont-Liguria border. The TPB is a late- to postorogenic basin that evolved in a piggy-back position on the Monferrato thrust belt. Its depositional history is strongly controlled by tectonic and eustatic events (Gelati & Gnaccolini, 1988; Mutti et al., 1995; Giglia et al., 1996; Capponi et al., 2001; Capponi et al., 2009). The basin was filled with mainly marine sediments (upper Eocene - upper Miocene), which unconformably overlie the Ligurian Alps, the Sestri-Voltaggio Zone and the Northwestern sector of the Northern Apennine. The early stage of sedimentation of TPB includes a siliciclastic deposition evolving from upper Eocene breccias through lower Oligocene conglomerate to upper Oligocene - lower Miocene sandstone and silty-marl. These units, grouped into different formations, record a pre-transgressive and transgressive phase (timetransgressive from the eastern to the western sectors), characterized by the deposition of alluvial fan and fan delta siliciclastic conglomerates and sandstones, marine shallow-water coarse to fine grained siliciclastic sediments, and reef limestones (Gelati & Gnaccolini, 1988; Turco et al., 1994; Mutti et al., 1995; Quaranta et al., 2009).

The base of the Santa Giustina - Giovo di Sassello stratigraphic section (lower Oligocene, total thickness about 170 m, Molare Fm.), that rests on the metamorphic rocks of the Voltri Unit, outcrops along the Sansobbia stream (Lorenz, 1969). This lithostratigraphic section is an interesting example of the Oligocene pre-transgressive and transgressive sedimentary evolution of the TPB. The sedimentation starts with non-marine (alluvial fan, river plain and lacustrine) very fine to very coarse grained siliciclastic deposits that grade upwards to fan-delta and brackish water sandstone and conglomerate (characterized by the occurrence of *Polymesoda* sp. and Potamididae facies). They are overlain by beach and very shallow sublittoral deposits (siltstone, sandstone and conglomerate), in which small reefal buildups made of branching coral colonies are rarely interbedded (Lorenz, 1969). The lower part of Santa Giustina section is composed of siliciclastic fine to very coarse grained siliciclastic sedimentary rocks that are the result of alluvial fan, river plain and lacustrine deposition. These rocks are characterized by the mass occurrence of terrestrial plant remains (leaves, trunks and branches), which are unevenly distributed throughout the section. Characeae oogonia [among which *Nitellopsis* (*Tectochara*) *merianii* (L. & N. Grambast) Grambast & Soulié-Märsche] in the pelite beds, and freshwater turtle and crocodile remains very rarely also occur (Issel, 1900).

HISTORICAL SITES

Fossil leaf samples from the Santa Giustina area are described by Sismonda (1859, 1865) in the frame of his studies about the Tertiary fossil flora of Piedmont. The specimens studied by the author (collected by B. Gastaldi and that were once part of the Collections of the University of Turin, subsequently destroyed during the Second World

War) were attributed to 8 species, one of which from Santa Giustina and the others from Stella. Currently the name "Stella" pertains to five villages, among which Stella Santa Giustina; Sismonda probably refers to Stella S. Giovanni, whose neighbourhood comprises the locality of Madonna del Salto, where Issel (1885b) recovered sedimentary rocks with lignite and plant remains.

The location of the Perrando Collection "filliti" collecting sites has been and, in part, remains problematic for the following reasons: a) the indication is often generic (simply Sassello or Santa Giustina), as in the taxonomic paper of Squinabol and Principi; b) in several cases the topographic positions are not clearly defined, because only a generic description of the covered way, not recognizable on the maps, is given (e.g. "one hour walk from Santa Giustina", Issel, 1900); c) old toponyms are used, that are not reported on the modern maps and lost in popular memory or that are now used for several different localities (e.g.: there are at least two localities named "Cascina Rosso" in the Santa Giustina area).

Considering the above reported problems, the collecting sites identified without uncertainty are the following:

Santa Giustina Basin (from north to south):

1) the area between the riverbed of the Sansobbia creek, upstream of Santa Giustina, and Case Ciappe (= Case Timùn in Rovereto, 1914), along the path to Passo del Giovo (Issel, 1885b, 1892; Rovereto, 1914; Lorenz, 1969); site 1 in Fig. 1.

2) the lower part of the Rio Fossato (or Rio Fossa), right tributary of the Sansobbia creek, close to the confluence point (Issel, 1900; Lorenz 1969); site 2 in Fig. 1.

3) Rio Brasso, left tributary of the Sansobbia creek, close to the cemetery of Santa Giustina (Issel, 1900; Lorenz 1969); site 3 in Fig. 1.

4) Cascine Navé (or Cascine Naveto), downstream of Santa Giustina, reported by Issel (1885b) as a Monocotyledonous-rich site; this site is probably identifiable with Case Danaveto, where more or less well preserved fossil leaves and plant remains are present; site 4 in Fig. 1.

5) Madonna del Salto, particularly on the right bank of Sansobbia creek (Issel, 1885b; Lorenz, 1969). The transgressive section crops out in front of Madonna del Salto, close to Case Siria locality. The "filliti" beds are rediscovered along the slope below the Case Siria - Stella S. Bernardo - Santa Giustina road; site 5 in Fig. 1.

Sassello Basin, from which are few species of the Perrando Collection (according to Principi, 1916 and 1921, just 10 of the 453 identified species are exclusively from the Sassello Basin and only 32 come from both basins). The indication of the collecting sites is always generic, with the exception of Rovereto (1914), that record the Case Bergiura locality (now named Case Bergera; Fig. 1), where a marine mollusc-rich stratigraphic section, in which leaves remains are present, crops out.

Finally, it is very difficult to locate the site reported by Issel (1900) for its abundance of palm trees remains and the Cascina al Rosso site quoted by Rovereto (1914, p. 40) and Principi (1916), both in the Santa Giustina area.

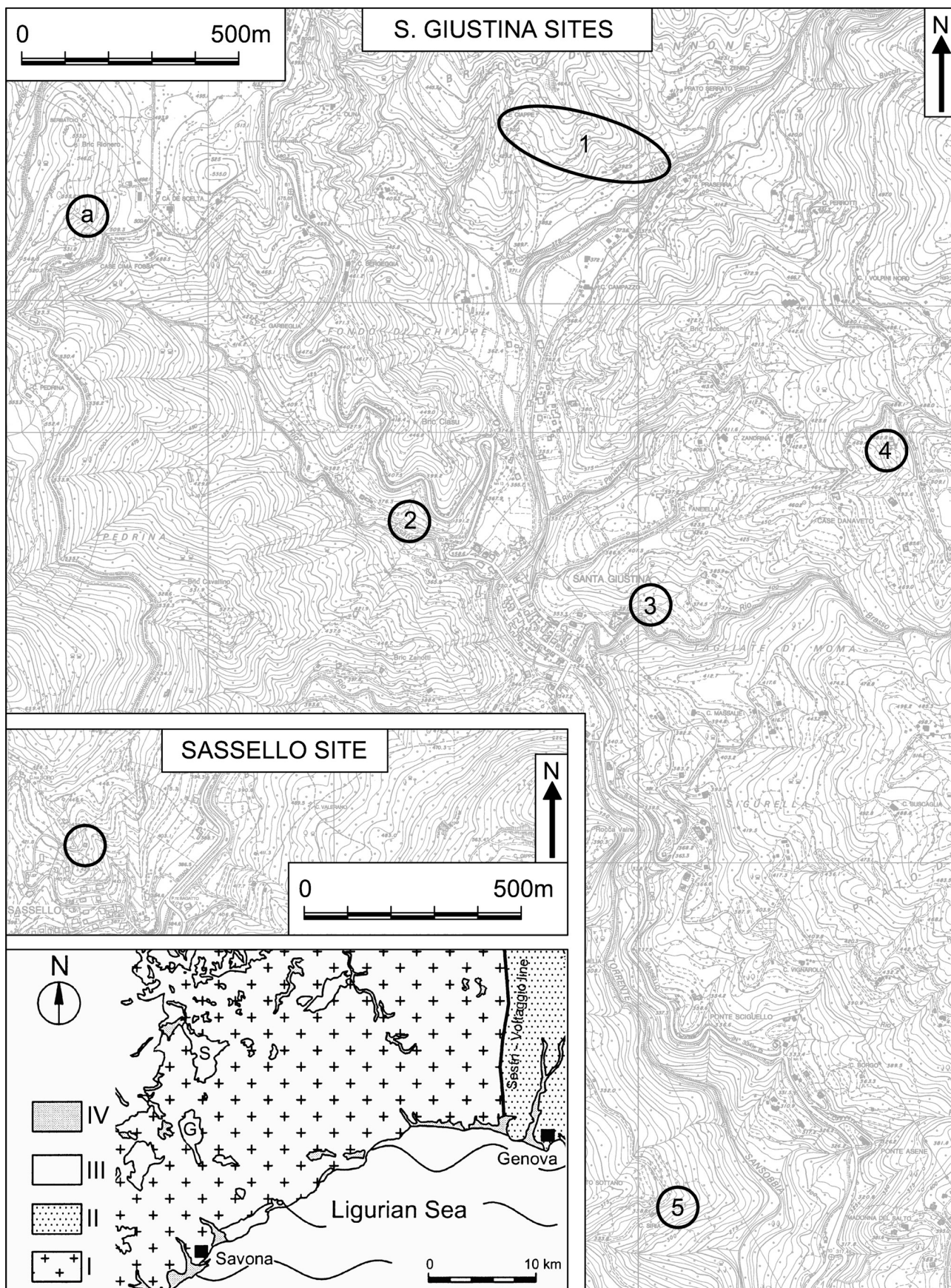


Fig. 1 - Geographic location of the "filliti" collecting sites in the S. Giustina and Sassello area: a = Prà Longo?, 1= Sansobbia creek - Case Ciappe (Case Timùn, along the path to Passo del Giovo), 2= Rio Fossato (or Rio Fossa), 3= Rio Brasso - S. Giustina cemetery, 4= Cascine Navé (or Cascine Naveto) - Case Danaveto, 5= Madonna del Salto - Case Siria. In the lower left corner the geological sketch map of central Liguria with the location of S. Giustina (G) and Sassello (S) sedimentary basins: I= Ligurian Alps, II= Northern Apennines, III= upper Eocene - Oligocene sedimentary rocks of TPB, IV= Neogene - Holocene deposits.

As regards the first site, it is of note that Issel states: "... presso il limite occidentale dell'isola (tongriana) l'argilla di color cinereo tenacissima presenta impronte di dicotiledoni e monocotiledoni ben manifeste. Ivi, a circa un'ora di strada da Santa Giustina don Perrando trasse alcune delle più belle palme della Collezione..." ("... at the western limit of the tongrian outcrop area the hard ashen claystone clearly exhibits Dicotyledonous and Monocotyledonous remains. There, about an hour drive from Santa Giustina, Don Perrando extracted some of the finest palms of the Collection ..."). Rovereto (1914) describes and compares the Monte Prà Longo and Monte Ciappe sections. On the base of Rovereto's description, it can be supposed that the Prà Longo section rests west of the road to Giovo (close to the western limit of the Santa Giustina Basin) and the *Ferussina* beds and the overlying "filliti" may be considered the same reported on by Issel. The field trips performed by the present authors in the area between the Santa Giustina - Giovo road and the western limit of the Basin, show the presence of medium to coarse siliciclastic rocks (probably deposited in fresh- or brackish waters) with abundant coalified plant remains. Therefore, the Prà Longo section may be located on this slope (Fig. 1, site a).

With regard to the Cascina al Rosso site, it should be noted that Rovereto (1914, p. 40) reports "...vicino ed anzi pressoché sul confine del bacino è stata scavata dal Perrando la ricca collezione di Filliti..." ("... Perrando extracted the rich fossil leaves collection very close to the limit of the basin ...") and two localities with this name occur in the study area, one (identified on the base of popular memory only) is close to the Parish Church of Santa Giustina and the other rests on the metamorphic substrate east of the eastern limit of the Basin. Therefore, no one of the Cascina al Rosso localities can be regarded to be the site quoted by Rovereto, in fact the first one is in the middle part of the Basin and the second one is not "very close to the limit" and rests on metamorphic rocks. Concluding, it can be supposed that there was another Cascina al Rosso, located in the area reported on by Issel for the finest fossil palms (= Monte Prà Longo?), which no one has memory of.

THE PALEOCLIMATIC ANALYSIS METHODS AND RELATED PROBLEMS

The main methods currently used in the paleoclimatic interpretation of a subaerial fossil flora are: the "Nearest Living Relative Method" (NLR Method) and the "foliar physiognomy method". The first one is the oldest (MacGinitie, 1953) and requires a correct taxonomic identification of species in order to make a comparison with the climatic tolerances of the extant more similar taxa, unreliable in many cases and assuming that plants have not evolved (Wolfe, 1993, 1995). The second one is based on the relationship between leaf size and the characters of climate, enlightened by many authors (among which Webb, 1959; Dolph & Dilcher, 1979, 1980a, b). Another recent effort to find similar relationships between fossil leaves and climate is "digital leaf physiognomy", a modern approach in capturing shape and size of leaves (Huff et al., 2003; Royer et al., 2005).

According to Dolph & Dilcher (1979), the foliar physiognomy methods present the advantage to be more reliable in paleoclimatic reconstruction than NLR method, on condition that a large number of well-preserved and measurable specimens is available, being unrelated to the correct taxonomic identification. The authors state that "this is particularly true for floras of Cretaceous and Paleogene age where many species cannot be placed in modern genera as required by the nearest living relative method" (Dolph & Dilcher, 1979, p. 153).

The paleoclimatic reconstruction proposed by Principi (1916) is essentially based on a sort of NLR method and is an example of its intrinsic problems. In fact, the author, on the base of its taxonomic identifications, affirms the coexistence of taxa typical of different latitudinal areas in the site of Santa Giustina (i.e.: tropical groups and European or Asian and American temperate genera). The author solves this problem suggesting that in the considered area should exist two zones: a coastal plain with an average temperature of 25°C and a mountain range up to 1000 m high and with a considerably milder temperature ("nel territorio in questione dovevano esistere due zone: una pianeggiante in vicinanza del mare con una temperatura media di 25°C, ed un'altra montuosa elevatesi fino a 1000 m di altezza e dotata di una temperatura notevolmente più mite", Principi, 1916, p. 1).

In the proposed scenario, the leaves referred to higher altitude taxa, before reaching the deposition area (an alluvial plain), would endure a long and turbulent transport by stream waters and suffer fragmentation and damaging. On the contrary, the fossil leaves attributed to the genera *Quercus*, *Myrica* and *Castanea* by Principi are commonly well preserved, with well defined margin and flat lamina, suggesting short or very short transport in a rather quiet environment.

Therefore, the taphonomic analysis seems to disagree with the Principi's hypothesis. The recent partial revisions of the Collection (Gregor & Knobloch, 2001; Hably, 2007, 2010, and personal communication) have already pointed to a taxonomic misidentification. In particular, the studies of the structure of leaf cuticles have revealed that several "temperate" species of Principi must be attributed to the genera *Sloanea* (Hably, 2007) and *Eotrigonobalanus* (Hably, 2010), that are typically distributed in tropical and subtropical regions.

Dilcher (1973), analyzing the worldwide distribution of large leaves species, points out that plants do not respond to single climatic variables, but to the total environment and attempts to correlate leaf-size distribution with both temperature and precipitation. The author concludes that the percentage of species having large leaves (greater than 20.25 cm²) decreases with the decrease of precipitation and/or temperature.

Dolph & Dilcher (1980a) analyze the Costa Rica and Western Hemisphere (sensu Dolph & Dilcher, 1980b) flora to develop a coherent theory relating leaf-size distribution and climate. The authors, on the basis of the leaf-size variation in relation altitude and, therefore, biotemperature, identify three foliar belts (including moist, wet and rain forest life zones) in Costa Rica and Western Hemisphere, and a fourth one exclusive of the Western Hemisphere: a) the first (life zone of tropical basal and premontane altitudinal belt) below the zone of critical

temperature (16-18° C) with average percentage of large leaves species from 60 to 100%; b) the second (life zone of lower montane altitudinal belt) above the zone of critical temperature (mean annual biotemperature of more than 12°C) with average percentage of large leaves species from 25 to 60% for Costa Rica and from 35 to 60°C for Western Hemisphere; c) the third (life zone of montane altitudinal belt) with mean annual biotemperature of less than 12°C and average percentage of large leaves species respectively less 25% and 35%; d) the fourth corresponds to the first foliar altitudinal belt but consists of tropical dry and very dry forest with average percentage of large leaves species less than 30%.

The Dolph & Dilcher (1980a) analysis exhibits that the foliar belts are easily identifiable on the basis of leaf-size, but inside each belt the large leaves percentage varies in a randomly way and not in continuum with the climate gradients; therefore, "leaf size may not be used to discriminate between narrow differences in paleoclimate" (Dolph & Dilcher, 1980a, p. 98). Notwithstanding that, the use of leaf-size method, based on the calculation of the percentage of large leaves, may be considered a valid tool for the interpretation of the paleoclimatic meaning in the frame of the foliar belt identified by Dolph & Dilcher (1980a, b).

MATERIALS AND METHOD

In order to perform an analysis according to the foliar physiognomy method, a total of 771 fossil leaves of Dicotyledonous (Magnoliopsida) were measured, 530 of which belong to taxa identified by Principi and 241 were not reviewed or recently identified by Hably (2007, 2010). The largely incomplete specimens were excluded, even if they were large leaf, because not measurable to high accuracy.

In the cases in which only half leaf was available, the measured width has been doubled. The length of slightly incomplete leaves, lacking the apical or basal part, was inferred on the basis of leaf shape.

Although abundant in the fossil flora of Santa Giustina, Monocotyledonous (Liliopsida) are not considered in this preliminary study, because they are always represented by badly preserved or fragmented material (even if of large size leaves), that do not allow high accuracy measurements; as regard, it is of note that a lot of fragments occurring in a sample may be part of the same leaf.

The leaf area has been calculated with the Cain & Castro (1959) formula:

$$A = \frac{2}{3} \times (L \times W)$$

where A = leaf or leaflet area in cm², L = leaf length in cm, W = leaf width in cm.

The obtained leaf areas have been distributed into the following seven categories (according to the life-size geometric classification of Raunkier, 1934, modified by Webb, 1959): 1) Leptophyll (<0.25 cm²), 2) Nanophyll (0.25-2.25 cm²), 3) Microphyll (2.25-20.25 cm²), 4) Notophyll (20.25-45.0 cm²), 5) Mesophyll (45.0-182.25 cm²), 6) Macrophyll (182.25-1640.2 cm²), 7) Megaphyll (>1640.2 cm²).

According to Dolph & Dilcher (1980a, b) the percentage of species having large leaves (greater than 20.25 cm², sensu Dilcher, 1973) is obtained by summing the percentage of notophylls, mesophylls, macrophylls and megaphylls.

MORPHOMETRIC ANALYSIS AND PALEOCLIMATIC MEANING OF THE SANTA GIUSTINA FLORA

According to the geologic and sedimentologic information available in literature (Lorenz, 1969; Bonci et al., 2001), the sedimentary basin in which the here considered plant remains deposited can be regarded to be an alluvial plain with flood areas, meanders and small lakes (testified by the occurrence of Characeae-rich pelite levels).

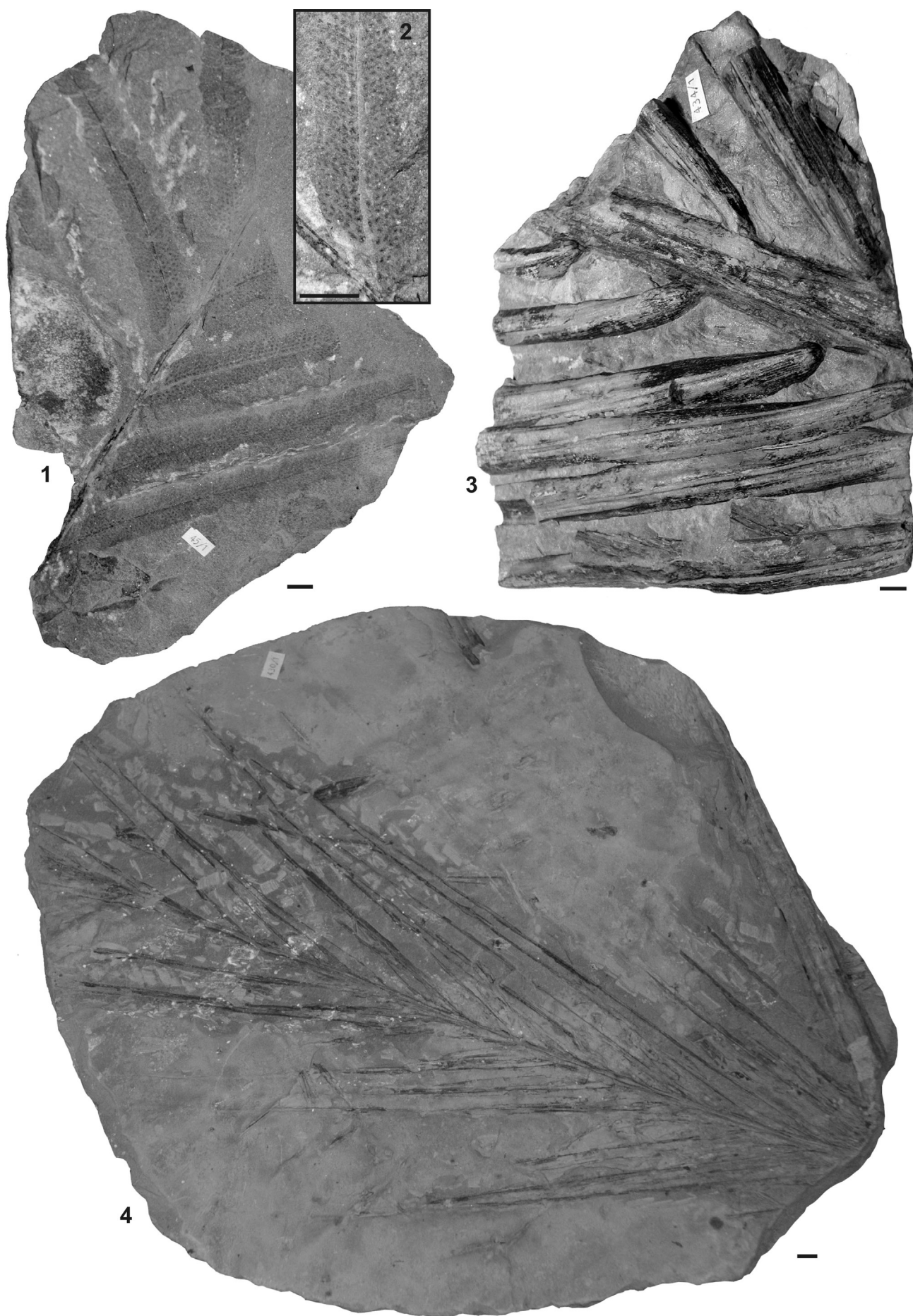
The morphometric data obtained by the measuring of the Dicotyledonous fossil leaves forming the actual *corpus* of the Perrando Collection and coming from the Santa Giustina basin can be summarized as follows:

nanophyll = 0.26%
microphyll = 32.04%
notophyll = 31.13%
mesophyll = 32.56%
macrophyll = 4.02%

It is noteworthy that in the Santa Giustina Dicotyledonous flora are not represented the leptophyll and megaphyll classes, micro- noto- and mesophyll classes reach a balanced proportion, and the nanophylls are negligible. In the present case the proportion of large leaf species

EXPLANATION OF PLATE 1

- Figs 1-2 - *Goniopteris polypodioides* Ettingshausen.
1 - fertile frond, Dip.Te.Ris. Coll. Perrando N. 45/1, figured (Squinabol, 1889, pl. 9); scale bar = 1 cm.
2 - sporangia (detail of fig. 1); scale bar = 1 cm.
- Fig. 3 - *Cocos robustifolia* Squinabol, Dip.Te.Ris. Coll. Perrando N. 434/1, holotype (Squinabol, 1892, pl. 23, fig. 3); scale bar = 1 cm.
- Fig. 4 - *Arecites rarifolius* (De Visiani) Squinabol, Dip.Te.Ris. Coll. Perrando N. 430/1, figured (Principi, 1921, pl. 6, fig. 3); scale bar = 1 cm.



attains the value of 67.71%, so the flora can be referred to the “tropical basal and premontane belt” of Dolph & Dilcher (1980a, b). This belt is reported by the authors to be the tropical life zone below the zone of critical temperature (16-18° C) with evapotranspiration ratio less than 1.0.

The inferred paleoclimatic allocation appears to be corroborated and confirmed by:

a) the common occurrence of large Ferns (mainly *Goniopteris polypodioides* Ettingshausen; Pl. 1, figs. 1-2) and of large Arecaceae remains (attributed to the genera *Arecites*, *Cocos*, *Flabellaria*, etc. by Squinabol, 1892; Principi, 1921; Pl. 1, figs 3-4);

b) the most common taxa (*Sloanea olmediaefolia*, *Eotrigonobalanus furcinervis*, and subordinately the members of Lauraceae Family and *Daphnogene* genus; Pl. 2, figs 2-7, 9) and several accessory taxa (*Kydia kraeuseli*, *Acherniaephyllum hydrarchos*, *Zizyphus zizyphoides*, *Platanus neptuni*, and *Engelhardia orsbergensis*; Pl. 2, fig. 8), that are recently identified in the Santa Giustina fossil flora (Hably, 2007, 2010), are considered to be warm climate elements. Relevant is the large occurrence of *Sloanea olmediaefolia*, because the living species of *Sloanea* are typically distributed in the tropical - subtropical areas and the European Paleogene species are related to warm climate (Kvaček et al., 2001);

c) the great abundance of very large leaves of *Sloanea olmediaefolia* associated with the high occurrence of fossil leaves pertaining to other taxa with dimensions larger than the usual (in particular the common *Eotrigonobalanus furcinervis*), indicates, according to Hably (2007, 2010), a riparian habitat or an environment with abundant water supply;

d) the fact that the taxa with untoothed margin largely outnumber the species with toothed margin, which are an indication of tropical climate;

e) the available information on paleotemperature of paleogeographic area including the TPB.

As regards the latter point, during early Rupelian-middle Chattian the paleotemperature was about 22°C (according to Selby, 1985) or 18-22.5°C, the latter value is deduced from the mean annual temperatures (MAT) reported by Mosbrugger et al. (2005) for the land areas surrounding the Molasse Basin and corrected assuming a zonal gradient of 0.4°C per degree of latitude (according to Mosbrugger et al., 2005). It is noteworthy that the Molasse Basin was located just north of TPB, to which it was connected by a seaway (Rögl, 1998). Moreover, Rögl (1998) suggests that the Molasse Basin was a narrow arm of the Paratethys Sea linked only with the North Sea (in the north) by the Rhinegraben seaway and with the TPB (in the south). Conversely the TPB was fully connected with the Mediterranean Basin, and therefore with the Indo-Pacific Ocean and the Atlantic Ocean. As a consequence, the paleotemperatures inferred here might be underestimated. Finally, the temperature range appears basically in agreement with the minimum sea-surface paleotemperature estimated for the Mediterranean for the Oligocene time by Bosellini & Perrin (2008).

CONCLUSIONS

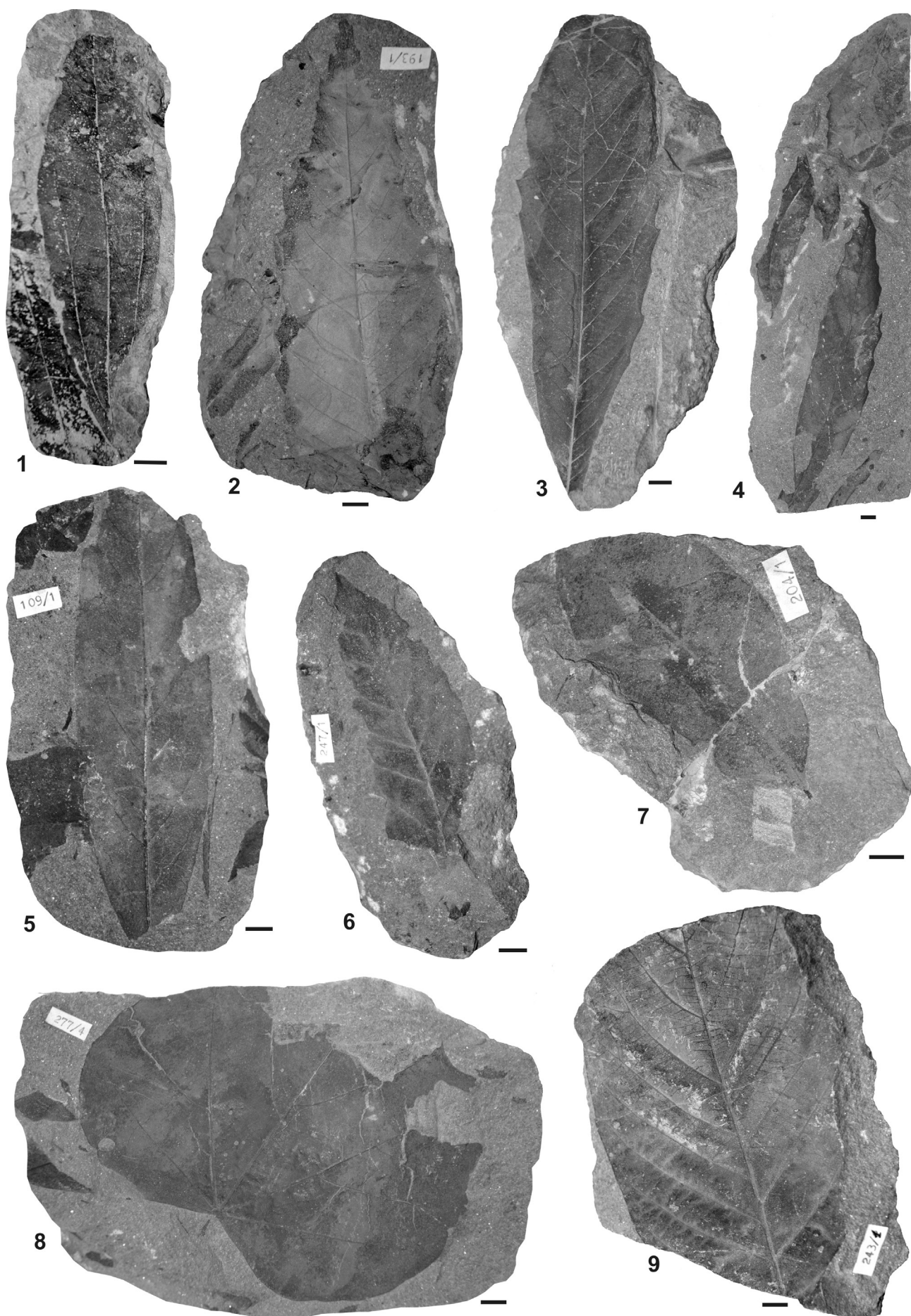
This study represents a contribution to the interpretation of the paleoclimatic meaning of the Oligocene fossil flora of the Santa Giustina area, based on the material forming the Perrando Collection.

The investigation has been carried out according to the “foliar physiognomy method” and involved a total of 771 fossil leaves of Dicotyledonous (Magnoliopsida).

The morphometric data indicate that in the Santa Giustina Dicotyledonous flora are not represented the leptophyll and megaphyll classes, the micro- noto- and mesophyll classes reach a balanced proportion, and the nanophylls are negligible. The proportion of large leaf species reaches the value of 67.71%, therefore the flora

EXPLANATION OF PLATE 2

- Fig. 1 - *Daphnogene* sp. (previously treated as *Cinnamomum rossmassleri* Heer, Dip.Te.Ris. Coll. Perrando N. 83/3; scale bar = 1 cm.
- Figs 2-4 - *Eotrigonobalanus furcinervis* (Rossmässler) Walther & Kvaček
 2 - specimen previously treated as *Castanea perrandoi* Principi, Dip.Te.Ris. Coll. Perrando N. 193/1; scale bar = 1 cm.
 3 - specimen previously treated as *Quercus furcinervis* Heer, Dip.Te.Ris. Coll. Perrando N. 208/7; scale bar = 1 cm.
 4 - specimen previously treated as *Quercus furcinervis* Heer, Dip.Te.Ris. Coll. Perrando N. 208/5, figured (Principi, 1916, pl. 4, fig. 3); scale bar = 1 cm.
- Figs 5-6 - Lauraceae gen. et sp.
 5 - specimen previously treated as *Laurus longifolia* Principi, Dip.Te.Ris. Coll. Perrando N. 109/1, type (Principi, 1916, pl. 46, fig. 2); scale bar = 1 cm.
 6 - specimen previously treated as *Ficus arcinervis* Heer, Dip.Te.Ris. Coll. Perrando N. 247/1, figured (Principi, 1916, pl. 30, fig. 6); scale bar = 1 cm.
- Fig. 7 - *Sloanea olmediaefolia* (Unger) Kvaček & Hably (previously treated as *Quercus chlorophylla* Unger), Dip.Te.Ris. Coll. Perrando N. 204/1, figured (Principi, 1916, pl. 4, fig. 6); scale bar = 1 cm.
- Fig. 8 - *Kydia kraeuseri* (Räski) Hably (previously treated as *Ficus tiliaefolia* Al. Brongniart), Dip.Te.Ris. Coll. Perrando N. 277/4; scale bar = 1 cm.
- Fig. 9 - *Sloanea olmediaefolia* (Unger) Kvaček & Hably [previously treated as *Juglandophyllum peramplum* (Saporta) Schenker], Dip.Te.Ris. Coll. Perrando N. 243/1, figured (Principi, 1916, pl. 15, fig. 1); scale bar = 1 cm.



can be indicative of the “tropical basal and premontane belt” (sensu Dolph & Dilcher 1980a, b). This paleoclimatic allocation is consistent with reliable information from literature dealing with the paleontological aspects of the Santa Giustina area, particularly with the aspect highlighted by the study carried out by Hably (2007) on the *Sloanea* specimens included in the Principi (1916) material.

According to the geologic and sedimentologic evidence the sedimentary basin in which the plant remains deposited can be regarded to be an alluvial plain with flood areas, meanders and small lakes. This reconstruction is fully consistent with the large abundance of fossil leaves larger than the usual that suggests riparian or wet habitats, and with the sporadic occurrence of freshwater and/or brackish turtles (*Trionyx*) and small crocodiles remains and pelite beds with Characeae.

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APPENDIX - List of the taxa forming the Perrando Collection (housed at the DIP.TE.RIS. of the Genoa University. "a" and "b" linked to the catalog numbers indicate the specimens with the counterpart, unless otherwise stated; SG indicates the specimens studied by Hably (2007); "figured specimens" refers to Principi (1916) and Squinabol (1889).

Original name in Squinabol (1889) and Principi (1916) = New taxonomic identification fide Hably (2007, 2010 and personal communication) and Hably & Kvaček (2008)	Catalog number of Types and figured specimens	Catalog number of non figured specimens identified by comparison	Catalog number of not yet recovered specimens
Equisetopsida			
<i>Equisetum grande</i> Principi			10
<i>Equisetum parlatorii</i> (Heer) Schimper			11
Filicopsida			
<i>Adiantum deperditum</i> Squinabol			25
<i>Adiantum oligocenicum</i> Principi			26
<i>Hymenophyllum beccarii</i> Squinabol			27
<i>Aneimia sepulta</i> Squinabol		13/1-13/4	
<i>Aspidium apenninicum</i> Squinabol		35/1-35/4	
<i>Aspidium escheri</i> Heer			36
<i>Aspidium gracile</i> Principi		37/1	
<i>Aspidium meyeri</i> Heer			38
<i>Aspidium paretoi</i> Squinabol			39
<i>Asplenium bilobum</i> Squinabol			29
<i>Asplenium eocenicum</i> (Ettingshausen) Principi		30/1	

<i>Asplenium laurenti</i> Principi			31
<i>Asplenium schimperi</i> Principi			32
<i>Asplenium subcretaceum</i> Saporta (fide Principi = <i>Aneimia subcretacea</i> (Saporta) Gardner & Ettingshausen, inv. 14)	figured 33/1	33/2-33/6	
<i>Blechnum molassicum</i> Squinabol			49
<i>Blechnum woodwardiaeforme</i> Squinabol	Type 50/2	50/1; 50/3-50/4	
<i>Crysodium lanzaneanum</i> (De Visiani) Gardner & Ettingshausen			54
<i>Crysodium doriai</i> Squinabol			55
<i>Crysodium strictum</i> Squinabol			56
<i>Goniopteris fischeri</i> (Heer) Schimper			41
<i>Goniopteris heeri</i> Principi			42
<i>Goniopteris minuta</i> Principi	Type 44/1	44/2	
<i>Goniopteris polypodioides</i> Ettingshausen	figured 45/1	45; 45/2-45/26; 45/28-45/30; 45/32-45/48; 45/50	
<i>Goniopteris stiriaca</i> (Unger) Al. Brongniart		46/1a; 46/1b; 46/2-46/7	
<i>Hypolepis amissa</i> Squinabol			34
<i>Lygodium gaudinii</i> Heer		12/1-12/2	
<i>Osmunda lignitum</i> (Giebel) Stur			40
<i>Pellaea saportana</i> Squinabol			53
<i>Polypodium isseli</i> Squinabol			51
<i>Polypodium (Campyloneuron) morellii</i> Squinabol			
<i>Pteris blechnoides</i> Heer			15
(?) <i>Pteris crenata</i> Weber		16/1	
<i>Pteris inaequalis</i> Heer		17/2	
<i>Pteris ligustica</i> Squinabol	Type 18/1	18/2	
<i>Pteris oeningensis</i> Heer		19/1-19/2	
<i>Pteris pennaeformis</i> Heer			20
<i>Pteris perrandoi</i> Squinabol			21
<i>Pteris protogaea</i> Principi			22
<i>Pteris ruppensis</i> Heer			23
<i>Pteris urophylla</i> Unger	figured 24/1		
<i>Trichomanes saccoi</i> Principi		28/1	
<i>Woodwardia macrophylla</i> Principi		47/1	
<i>Woodwardia roessneriana</i> (Unger) Heer			48
Pinopsida			
<i>Glyptostrobus europaeus</i> (Brongniart) Heer = <i>Dolirostrobus taxiformis</i> (Sternberg) Kvaček	figured 59/1		
<i>Pinus capellinii</i> Squinabol			63
<i>Pinus palaeostrobus</i> Ettingshausen	figured 64		
<i>Pinus</i> sp.	figured 65/1		
<i>Podocarpus eocenica</i> Unger			61
<i>Sapinus (Picea)</i> sp.	figured 62		
<i>Sequoia langsdorfi</i> (Brongniart) Heer			57
<i>Sequoia sternbergi</i> (Goeppert) Heer = <i>Dolirostrobus taxiformis</i> (Sternberg) Kvaček			58
<i>Taxodium disticum-miocenicum</i> Heer			60
Gnetopsida			
<i>Ephedra soztkiana</i> (Unger) Schimper		66/1	
Magnoliopsida			
<i>Acacia parschlugana</i> Unger			134
<i>Acer ponzianum</i> Gaudin			379
<i>Acerates veterana</i> Heer			390
<i>Alnus nostratum</i> Unger = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably			188
<i>Alstonia stoppanii</i> Principi	Type 381/1		
<i>Amelanchier rotundifolia</i> Principi	Type 124/1	124/2	
<i>Anona elliptica</i> Unger		76/1-76/2	
<i>Anona ungeri</i> Principi	Type 77/1		
<i>Apeibopsis deloesi</i> (Gaudin) Heer	figured 301/1a; 301/1b		
<i>Apeibopsis fischeri</i> Heer			302
<i>Apeibopsis gaudini</i> Heer			303

<i>Apocynophyllum ettingshauseni</i> Principi	Type 383/2	383/1	
<i>Apocynophyllum helveticum</i> Heer			384
<i>Apocynophyllum longe-petiolatum</i> Ettingshausen	figured 386/1		
<i>Apocynophyllum longinervis</i> Principi		385/1-385/2	
<i>Apocynophyllum plurinervis</i> Principi		387/1	
<i>Apocynophyllum reussi</i> Ettingshausen			388
<i>Aralia longifolia</i> Principi	Type 153/1a; 153/1b		
<i>Aralia venulosa</i> Saporta	figured 154/1; 154/3	154/2a; 154/2b; 154/4-154/5	
<i>Aristolochia sanctae-justinae</i> Principi	Type 400/1		
<i>Artocarpidium bilanicum</i> Ettingshausen = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 280/1	280/2	
<i>Artocarpidium desnoyersi</i> Watelet = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 281/1	281/2	
<i>Artocarpidium integrifolium</i> Unger		282/2-282/3	
<i>Artocarpidium notabile</i> Principi	Type 283/1		
<i>Artocarpus capellinii</i> Principi	Types 284/1a; 284/1b; 284/4	284/2a; 284/2b; 284/3; 284/5a; 284/5b; 284/6-284/11	
<i>Artocarpus isseli</i> Principi	Type 285/1a; 285/1b	285/2-285/5	
<i>Artocarpus macrophylla</i> Principi	Type 286/1	286/2a; 286/2b; 286/3; 286/4a; 286/4b; 286/5; 286/6a; 286/6b; 286/7a; 286/7b; 286/8-286/9	
<i>Artocarpus massalongoi</i> Principi	Type 287/1	287/2a; 287/2b; 287/3	
<i>Artocarpus multinervis</i> Principi	Types 288/1; 288/3; 288/7	288/2; 288/4; 288/5a; 288/5b; 288/6; 288/8-288/21; 288/22a; 288/22b; 288/24	
<i>Artocarpus ovalifolia</i> Principi	Type 289/1	289/2-289/3; 289/4a; 289/4b; 289/5	
<i>Artocarpus sismondai</i> Principi	Types 290/1; 290/2	290; 290/3-290/9; 290/10a; 290/10b; 290/11a; 290/11b; 290/12	
<i>Artocarpus taramellii</i> Principi	Type 291/1	291/2-3; 291/4	
<i>Banksia deikeana</i> Heer		298/1	
<i>Banksia haidingeri</i> Ettingshausen			299
<i>Banksia helvetica</i> Heer			300
<i>Benzoin antiquum</i> Heer			98
<i>Berchenia multinervis</i> (Al. Brogniart) Heer			342
<i>Bombax longifolium</i> Principi = Lauraceae gen. et sp.	Type 312/1		
<i>Bombax oblongifolium</i> Ettingshausen	figured 313/1		
<i>Bombax procaccinii</i> Principi = Lauraceae gen. et sp.			314
<i>Bumelia minor</i> Unger			469
<i>Bumelia oblongifolia</i> Ettingshausen			470
<i>Carpinus grandis</i> Unger		220/1-220/2	
<i>Carpites drupaceus</i> Principi			404
<i>Carpites oblongus</i> Principi			405
<i>Carpites polycostatus</i> Principi			406
<i>Carpites pruniformis</i> (Heer) Schimper			407
<i>Carpites</i> cfr. <i>tiliaeformis</i> (Heer) Schimper			408
<i>Carpites verrucosus</i> (Heer) Schimper			409
<i>Carya bilinica</i> (Unger) Ettingshausen = ? <i>Platanus neptuni</i> (Ettingshausen) Bůžek, Holý & Kvaček		223/1-223/2	
<i>Cassia berenices</i> Unger = Leguminosae gen. et sp.		125/1	
<i>Cassia fischeri</i> Heer = Leguminosae gen. et sp.			126
<i>Cassia lignitum</i> Unger = Leguminosae gen. et sp.		127/1	
<i>Cassia palaeo-speciosa</i> Staub = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably			128
<i>Cassia phaseolites</i> Unger = Leguminosae gen. et sp.		129/1-129/3; 129/32	
<i>Cassia vulcanica</i> Ettingshausen = Leguminosae gen. et sp.		130/1	
<i>Cassia zephyri</i> Ettingshausen = Leguminosae gen. et sp.			131
<i>Castanea atavia</i> Unger		190/1	
<i>Castanea kubinyi</i> Kováts			191
<i>Castanea nervosa</i> Principi = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček		192/1	
<i>Castanea perrandoi</i> Principi = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček		193/1-193/6	
<i>Castanea recognita</i> Schimper = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček	figured 194/1; 194/3	194/2; 194/5-194/10	

<i>Castanea sezannensis</i> Watelet = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walthier & Kvaček	figured 195/1	195/2; 195/3a; 195/3b	
<i>Castanea ungeri</i> Heer			196
<i>Celastrorhynchium actaeonis</i> Ettingshausen			335
<i>Celastrus de stefanii</i> Principi			332
<i>Celastrus hippolyti</i> Ettingshausen			333
<i>Celastrus sordidus</i> Saporta			334
<i>Cercis virgilianum</i> Massalongo = <i>Kydia kraeuseri</i> (Ráski) Hably		132/1	
<i>Cinchonidium bilanicum</i> Ettingshausen			391
<i>Cinchonidium multinerve</i> Ettingshausen			392
<i>Cinchonidium pannonicum</i> (Unger) Schimper		393/1	
<i>Cinchonidium randiaefolium</i> Ettingshausen = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably			394
<i>Cinchonidium sagorianum</i> Ettingshausen			395
<i>Cinchonidium samnitum</i> (Massalongo) Schimper		396/1	
<i>Chrysophyllum ungeri</i> Principi	Type 365/1		
<i>Cinnamomum buchi</i> Heer = <i>Daphnogene</i> sp.		78/1-78/3	
<i>Cinnamomum grandifolium</i> (Ettingshausen) Schimper = <i>Daphnogene</i> sp.	figured 79/1	79/2	
<i>Cinnamomum lanceolatum</i> Heer = <i>Daphnogene</i> sp.		80/1-80/6	
<i>Cinnamomum paoluccii</i> Principi = <i>Daphnogene</i> sp.			81
<i>Cinnamomum polymorphum</i> Heer = <i>Daphnogene</i> sp.		82/1-82/3; 82/4a; 82/4b	
<i>Cinnamomum rosmassleri</i> Heer = <i>Daphnogene</i> sp.		83/1-83/3	
<i>Cinnamomum rotundifolium</i> Principi = <i>Acherniaephyllum hydrarcos</i> (Unger) Hably	figured 84/2	84/1; 84/3-84/5	
<i>Cinnamomum scheuchzeri</i> Heer = <i>Daphnogene</i> sp.		85/1-85/10	
<i>Cinnamomum spectabile</i> Heer = <i>Daphnogene</i> sp.	figured 86/1	86/2a; 86/2b; 86/3-86/7	
<i>Cinnamomum transversum</i> Heer = <i>Daphnogene</i> sp.			87
<i>Cinnamomum</i> sp. = <i>Daphnogene</i> sp.		1348/1-1348/30; 1348/33-1348/44; 1348/46-1348/47; 1348/49-1348/66; 1348/68; 1348/70-1348/75	
<i>Coccolobites massalongiana</i> Visiani	figured 401/1	401/2	
<i>Cocculites transversum</i> Principi			399
<i>Cocculus arctica</i> (Heer) Principi	figured 397/1a; 397/1b; 397/2	397/3	
<i>Cocculus spectabilis</i> Principi			398
<i>Comptonia berryi</i> Principi = <i>Comptonia difformis</i> (Sternberg) Berry			185
<i>Comptonia elegans</i> (Ettingshausen) Principi = <i>Comptonia difformis</i> (Sternberg) Berry	figured 186/1		
<i>Comptonia materonii</i> (Saporta) Berry			75
<i>Comptonia schranki</i> (Sternberg) Berry	figured 187 (ex 1705, R. Museo Geologico original label " <i>Dryandra schranki</i> ")		
<i>Cornus benthamoides</i> Goeppert			146
<i>Cornus buchi</i> Heer = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably		147/1	
<i>Cornus macrophylla</i> Heer			148
<i>Cornus orbifera</i> Heer	figured 149/1		
<i>Cornus ovalifolia</i> Principi			150
<i>Cornus rhamnifolia</i> Weber		151/1-151/2	
<i>Cornus studei</i> Heer = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 152/1	152/2	
<i>Corylus insignis</i> Heer		222/1	
<i>Daphne protogaea</i> Ettingshausen		293/1; 293 (?)	
<i>Daphnogene gastaldii</i> Sismonda = <i>Daphnogene</i> sp.		101/1	
<i>Daphnogene raincourtii</i> Saporta = <i>Daphnogene</i> sp.			102
<i>Dewalquea gelindenensis</i> Saporta & Marion	figured 155		
<i>Dewalquea grandifolia</i> Principi	Type 156/1	156/2	
<i>Dioclea protogaea</i> Ettingshausen = <i>Lauraceae</i> gen. et sp.	figured 137/1		
<i>Diospyros anceps</i> Heer			356
<i>Diospyros brachysepalis</i> Unger = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 357/1; 357/2	357/3-357/6	
<i>Diospyros discreta</i> Saporta	figured 358/1		
<i>Diospyros loveni</i> Heer			359
<i>Diospyros macrophylla</i> Principi = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	Type 360/1	360/2-360/3	
<i>Diospyros oligocenica</i> Principi			361

<i>Diospyros palaeogaea</i> Ettingshausen			362
<i>Diospyros sagoriana</i> Ettingshausen			363
<i>Diospyros wodani</i> Unger			364
<i>Dodonaea pteleaefolia</i> (Weber) Heer			377
<i>Dodonaea salicites</i> Ettingshausen			378
<i>Dombeyopsis dubia</i> Principi = <i>Acherniaephyllum hydrarcos</i> (Unger) Hably		308/1	
<i>Dombeyopsis phyllirae</i> Ettingshausen			309
<i>Dryophyllum dewalquei</i> Saporta = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček	figured 197/1	197/4	
<i>Dryophyllum massalongoi</i> Principi		198/1-198/2	
<i>Dryophyllum palaeocastanea</i> Saporta			199
<i>Elaeagnus acuminata</i> Weber			338
<i>Elaeodendron dubium</i> Ettingshausen		331/1	
<i>Echitonium sophiae</i> Weber			382
<i>Eucalyptus haeringiana</i> Ettingshausen		320/7	
<i>Eucalyptus oceanica</i> Unger		321/1; 321/2a; 321/2b	
<i>Eugenia aizoon</i> Unger = Lauraceae gen. et sp.			322
<i>Eugenia haeringiana</i> Unger = Lauraceae gen. et sp.		323/2; 323/4	
<i>Evonymus proserpinae</i> Ettingshausen	figured 330/1		
<i>Fagus antipofi</i> Heer	figured 189/1	189/2	
<i>Ficus arcinervis</i> Heer = Lauraceae gen. et sp.	figured 247/1		
<i>Ficus atlantidis</i> Ettingshausen = Lauraceae gen. et sp.		248/1-248/3	
<i>Ficus axonensis</i> Watelet			249
<i>Ficus clusiaefolia</i> Ettingshausen	figured 250/1		
<i>Ficus coriacea</i> Principi = Lauraceae gen. et sp.		252/1-251/2	
<i>Ficus daphnogenes</i> Ettingshausen = Lauraceae gen. et sp.			252
<i>Ficus deshayesi</i> Watelet			253
<i>Ficus deschmanni</i> Ettingshausen			254
<i>Ficus ettingshauseni</i> Principi = Lauraceae gen. et sp.	Type 255/1	255/2-255/3	
<i>Ficus grandifolia</i> Principi	Type 256/1a; 256/1b	256/2; 256/3	
<i>Ficus jynx</i> Unger			257
<i>Ficus heeriana</i> Principi	Types 258/1; 258/2		
<i>Ficus lanceolata</i> Heer = Lauraceae gen. et sp.	figured 259/1; 259/2	259/3-259/7; 259/9; 259/11-259/15; 259/17-259/18	
<i>Ficus lanceolata-acuminata</i> Ettingshausen	figured 260/2	260/1; 260/3; 260/8	
<i>Ficus ligustica</i> Principi = Lauraceae gen. et sp.		261/1-261/2	
<i>Ficus longifolia</i> Principi			262
<i>Ficus multinervis</i> Heer			263
<i>Ficus occidentalis</i> Lesquereux	figured 264/1		
<i>Ficus pantanellii</i> Principi			266
<i>Ficus paretoi</i> Principi		267/1a; 267/1b; 267/2	
<i>Ficus perseaeefolia</i> Principi = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	Type 268/1	268/3-268/5; 268/6a; 268/6b	
<i>Ficus planicostata</i> Kunth et Bouché var. <i>latifolia</i> Lesquereux			269
<i>Ficus populina</i> Heer = <i>Acherniaephyllum hydrarcos</i> (Unger) Hably	figured 270/1		
<i>Ficus ruminiana</i> Heer	figured 271/1	271/2	
<i>Ficus sagoriana</i> Ettingshausen	figured 272/1		
<i>Ficus savii</i> Principi	Type 273/1	273/2-273/3	
<i>Ficus scabriuscula</i> Heer			274
<i>Ficus sordellii</i> Principi	Type 275/1		
<i>Ficus suezzi</i> Principi (<i>nomen nudum</i>)		276/1	
<i>Ficus tiliaefolia</i> Al. Brongniart = <i>Kydia kraeuseri</i> (Ráski) Hably	figured 277/9	277/1-277/2; 277/3a; 277/3b; 277/4; 277/5a; 277/5b; 277/6; 277/7a; 277/7b; 277/8; 277/11-277/20	
<i>Ficus uranii</i> Ettingshausen = Lauraceae gen. et sp.	figured 278/1		
<i>Ficus zignoi</i> Principi	Type 279/1		
<i>Ficus</i> sp.		265/1-265/16; 265/17a; 265/17b; 265/18-265/55	
<i>Grevillea lancifolia</i> Ettingshausen = Lauraceae gen. et sp.			296
<i>Ilex longifolia</i> Sismonda = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 328/1a	328/2	
<i>Ilex studei</i> Heer = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček	figured 329/1; 329/2		

<i>Juglandophyllum italicum</i> Principi	Type 240/1	240/2-240/3	
<i>Juglandophyllum longissimum</i> Principi	Type 241/1a; 241/1b		
<i>Juglandophyllum maximum</i> Principi	Type 242/2	242/1a; 242/1b; 242/3-242/4; 242/5a; 242/5b	
<i>Juglandophyllum peramplum</i> (Saporta) Schenk. = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 243/1	243/2; 243/3; 243/4	
<i>Juglans acuminata</i> Al. Brogniart	figured 226/1; 226/2; 226/3	226/4a; 226/4b; 226/5-226/8; 226/9a; 26/9b; 226/10	
<i>Juglans acuminata</i> Al. Brogniart var. <i>latifolia</i> Heer		227/1	
<i>Juglans acuminata</i> Al. Brogniart var. <i>multinervis</i> Principi	Types 228/1; 228/2	228/3	
<i>Juglans acuminata</i> Al. Brogniart var. <i>validissima</i> Principi			229
<i>Juglans denticulata</i> Heer = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 231/2 (= SG 13)	231/1 (= SG 1)	
<i>Juglans elliptica</i> Principi = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	Types 232/1 (= SG 2); 232/3b (= SG 4); 232/4a; 232/4b (not counterpart of 232/4a) (= SG 12); 232/7	232/2 (= SG 5); 232/6 (= SG 3); 232/8, 232/9 (= SG 8); 232/10 (= SG 11); 232/11 (= SG 10); 232/12; 232/13 (= SG 6); 232/15; 232/16 (= SG 7)	
<i>Juglans elliptica</i> Principi = <i>Sloanea peolai</i> (Principi) Hably, Tamás & Cioppi		232/14 (= SG 34)	
<i>Juglans obtusifolia</i> Heer = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably (not in synonymy but in pl. 2 fig. 7)		233/1 (= SG 9)	
<i>Juglans rectinervis</i> Ettingshausen			234
<i>Juglans saportai</i> Principi	Type 235/1		
<i>Juglans sismondai</i> Principi	Types 236/1a; 236/1b; 236/2	236/3; 236/4a; 236/4b; 236/5- 236/6	
<i>Juglans ungeri</i> Heer	figured 237/1a; 237/1b; 237/2	237/3-237/5	
<i>Juglans venosa</i> Ettingshausen	figured 238/1		
<i>Juglans vetusta</i> Heer		239/1-239/2	
<i>Laurus agathophyllum</i> Unger			103
<i>Laurus</i> cf. <i>angustata</i> Principi		104/1	
<i>Laurus attenuata</i> Watelet = Lauraceae gen. et sp.			105
<i>Laurus fürstenbergi</i> Al. Brogniart = Lauraceae gen. et sp.			106
<i>Laurus grandifolia</i> Ettingshausen = Lauraceae gen. et sp.		107; 107/1-107/2	
<i>Laurus haueri</i> Ettingshausen = Lauraceae gen. et sp.		108/1	
<i>Laurus longifolia</i> Principi = Lauraceae gen. et sp.	Type 109/1	109/2b; 109/3; 109/4a; 109/4b	
<i>Laurus nectandroides</i> Ettingshausen = Lauraceae gen. et sp.			110
<i>Laurus notarisii</i> (Massalongo) Principi = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 111/1	111/2-111/5	
<i>Laurus obovata</i> Weber (?) = Lauraceae gen. et sp.		113/1-113/2	
<i>Laurus ocoteaefolia</i> Ettingshausen = Lauraceae gen. et sp.			112
<i>Laurus primigenia</i> Unger = Lauraceae gen. et sp.	figured 114/3	114/1-114/2; 114/4-114/11	
<i>Laurus princeps</i> Heer = Lauraceae gen. et sp.		115/1-115/2; 115/3a; 115/3b; 115/4-115/6	
<i>Laurus reussi</i> Ettingshausen = Lauraceae gen. et sp.			116
<i>Laurus szwosowicziana</i> Unger = Lauraceae gen. et sp.			117
<i>Laurus tetrantheroides</i> Ettingshausen = Lauraceae gen. et sp.	figured 118/1; 118/2a; 118/2b	118/3	
<i>Laurus tristaniaefolia</i> Weber = Lauraceae gen. et sp.			119
<i>Laurus vetusta</i> Saporta = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 120/1; 120/2	120/3	
<i>Laurus zeilleri</i> Principi = Lauraceae gen. et sp.	Type 121/1	121/2-121/5	
<i>Leguminosites brunneri</i> Heer			144
<i>Leguminosites zizyphoides</i> Paolucci			145
<i>Leucothoe protogaea</i> (Unger) Schimper	figured 318/1		
<i>Litsaea magnifica</i> Saporta = <i>Daphnogene</i> sp.		97/1; 97/2	
<i>Lomatia grandis</i> Principi	Type 297/1		
<i>Machaerium oligocenicum</i> Principi	Type 138/1		
<i>Magnolia diana</i> Unger	figured 67/1		
<i>Magnolia ingelefeldi</i> Heer	figured 68/1a; 68/1b	68/2; 68/3a; 68/3b; 68/4a; 68/4b; 68/5-68/6	
<i>Magnolia lanceolata</i> Principi	Type 69/1a; 69/1b (1-2)	69/2-69/3	
<i>Magnolia ligustica</i> Principi	Type 70/1	70/2-70/5; 70/6a; 70/6b; 70/7a; 70/7b	
<i>Magnolia macrophylla</i> Principi	Type 71a; 71/1b	71/2-71/3; 71/4a; 71/4b; 71/5- 71/7	
<i>Magnolia massalongoi</i> Principi	Type 72/1	72/2	
<i>Magnolia ovalifolia</i> Principi = <i>Acherniaephyllum hydrarcos</i> (Unger) Hably	Type 73/1a; 73/1b		

<i>Magnolia paronai</i> Principi	Type 74/1		
<i>Malpighiastrum dalmaticum</i> Ettingshausen	figured 315/1	315/2	
<i>Malpighiastrum protogaeum</i> Staub. = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 316/1		
<i>Malpighiastrum rotundifolium</i> Ettingshausen	figured 317/1		
<i>Myrica acuminata</i> Unger		171/1	
<i>Myrica aemula</i> (Heer) Schimper = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček		172/1-172/9	
<i>Myrica banksiaefolia</i> Unger		173/1	
<i>Myrica dentata</i> Principi = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček		174/1	
<i>Myrica dilleniaeefolia</i> (Ettingshausen) Schimper			175
<i>Myrica hakeaeefolia</i> (Unger) Saporta	figured 176/1		
<i>Myrica laevigata</i> (Heer) Saporta		177/1	
<i>Myrica lignitum</i> (Unger) Saporta	figured 178/1	178/2-178/4	
<i>Myrica longa</i> Heer		179/1	
<i>Myrica longifolia</i> Unger = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček		180/2	
<i>Myrica salicina</i> Unger		181/1-181/2	
<i>Myrica sismondai</i> Meschinelli & Squinabol			182
<i>Myrica squinaboli</i> Principi			183
<i>Myrica studeri</i> Heer			184
<i>Myrsine doryphora</i> Unger			354
<i>Myrsine endymionis</i> Unger			355
<i>Neritinium majus</i> Unger			389
<i>Oreodaphne heeri</i> Gaudin = Lauraceae gen. et sp.	figured 99/1	99/2; 99/3 (?); 99/4	
<i>Oreodaphne massalongoi</i> Paolucci = Lauraceae gen. et sp.	figured 100/1	100/2	
<i>Ostrya atlantis</i> Unger			221
<i>Palaeolobium haeringianum</i> Unger			139
<i>Palaeolobium heterophyllum</i> Unger = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably			140
<i>Palaeolobium radobojense</i> Unger			141
<i>Palaeolobium sotzkianum</i> Unger			142
<i>Paliurus ovoideus</i> (Göppert) Heer			339
<i>Paliurus sismondanus</i> Heer		340/1	
<i>Persea brauni</i> Heer = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 88/1; 88/4	88/2-88/3; 88/5	
<i>Persea engelhardti</i> Principi	Types 89/1a-b-c; 89/2	89/3; 89/3a-b-c; 89/4-89/5; 89/6?; 89/7?; 89/8a; 89/8b; 89/9?; 89/10?	
<i>Persea heeri</i> Ettingshausen			90
<i>Persea paolinae</i> Principi	Type 91/1	91/2	
<i>Persea cf. paucinervis</i> Principi		92/1	
<i>Persea styracifolia</i> (Weber) Principi			93
<i>Persea superba</i> Saporta = Lauraceae gen. et sp.		94/1	
<i>Persoonia myrtillus</i> Ettingshausen			295
<i>Pirus troglodytarum</i> Unger		123/1-123/2	
<i>Pisonia bilica</i> Ettingshausen	figured 294/1		
<i>Planera ungeri</i> (Kováts) Ettingshausen (?)		244/1	
<i>Platanus deperdita</i> (Massalongo) Sordelli = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably			159
<i>Podogonium knorrii</i> (Al. Brongniart) Heer			133
<i>Populus balsamoides</i> Göppert			160
<i>Populus gaudini</i> Fischer	figured 161/1	161/2	
<i>Populus integra</i> Principi	Types 162/1a; 162/1b; 162/2	162/3	
<i>Populus leuce</i> Unger = <i>Kydia kraeuseri</i> (Ráski) Hably	figured 163/1; 163/2; 163/4	163/3; 163/5-163/6	
<i>Populus mutabilis</i> Heer		164/3	
<i>Populus mutabilis</i> Heer var. <i>crenata</i> Heer = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 164/1; 164/2		
<i>Populus mutabilis</i> Heer var. <i>ovalis</i> Heer = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 1349/1	1349/2	
<i>Porana oeningensis</i> (Unger) Heer = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably		402/1-402/2	
<i>Porana ungeri</i> Heer	figured 403/1; 403/2		
<i>Protoficus saportai</i> Principi	Type 245/1a; 245/1b	245/2-245/5	
<i>Protoficus sezannensis</i> (Watelet) Saporta	figured 246/1	246/2	

<i>Prunus antiqua</i> Principi	Type 122/1		
<i>Pterocarpus fischeri</i> Gaudin	figured 136/1		
<i>Pterocarya denticulata</i> (Weber) Heer = <i>Platanus neptuni</i> mf. <i>fraxinifolia</i> (Johnson & Gilmore) Kvaček & Manchester	figured 224/1		
<i>Pterocarya massalongoi</i> Gaudin			225
<i>Pterospermites incertus</i> Principi = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	Type 311/1		
<i>Quercus artocarpites</i> Ettingshausen = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably		200/; 200/2 (= SG 17)	
<i>Quercus aucubaefolia</i> Ettingshausen			201
<i>Quercus brongniarti</i> Sismonda		202/1	
<i>Quercus charpentieri</i> Heer = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 203/1 (= SG 20)	203/2-203/3	
<i>Quercus chlorophylla</i> Unger = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 204/1; 204/7	204/2-204/4; 204/5a; 204/5b; 204/6; 204/8; 204/9 (2a Perrando Collection original label); 204/10	
<i>Quercus cyri</i> Unger = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček		205/1	
<i>Quercus devisianii</i> Principi = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček			206
<i>Quercus drymeya</i> Unger = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček		230/1-230/5 (2a Perrando Collection original label)	
<i>Quercus etymodrys</i> Unger = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček			207
<i>Quercus furcinervis</i> Heer = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček	figured 208/4; 208/5	208/1-208/3; 208/6-208/43; 208/44 (2a Perrando Collection original label); 208/45	
<i>Quercus hamadryadum</i> Unger = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably		209/1	
<i>Quercus laharpai</i> Gaudin	figured 210/1		
<i>Quercus lonchitis</i> Unger = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček		211/1-211/3	
<i>Quercus mediterranea</i> Unger = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček		212/1	
<i>Quercus nerifolia</i> Al. Brongniart			213
<i>Quercus proteifolia</i> Paolucci = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček	figured 214/1		
<i>Quercus pseudolonchitis</i> Ettingshausen = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček			215
<i>Quercus salicina</i> Saporta = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably (not in synonymy but in Hably, 2007, pl. 3 fig. 1)		216/1 (= SG 19)	
<i>Quercus similis</i> Göppert		217/1; 217/2	
<i>Quercus undulata</i> Weber			218
<i>Quercus urophylla</i> Unger = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček			219
<i>Quercus</i> sp.		1350/2-1350/6; 1350/8-1350/9; 1350/11-1350/13	
<i>Rhamnus acuminatifolius</i> Weber = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably			343
<i>Rhamnus acuminatus</i> (Ettingshausen) Principi = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably		344/1 (= SG 14)	
<i>Rhamnus decheni</i> Weber			345
<i>Rhamnus deletus</i> Heer = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably			346
<i>Rhamnus heerii</i> Ettingshausen			376
<i>Rhamnus lancifolius</i> Principi = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably			247
<i>Rhamnus peolai</i> Principi = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably		348/1 (= SG 15)	
<i>Rhamnus perrandoi</i> Principi			349
<i>Rhamnus plurinervis</i> Principi			350
<i>Rhamnus rectinervis</i> Heer = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably		351/1-351/2	
<i>Rhamnus roessleri</i> Ettingshausen = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably			352
<i>Rhamnus rosmässleri</i> Unger			353
<i>Rhododendron haueri</i> Ettingshausen	figured 319/1		
<i>Robinia regeli</i> Heer			135
<i>Salix angusta</i> Al. Brongniart			165
<i>Salix elongata</i> Weber			166
<i>Salix lavateri</i> Al. Brongniart			167
<i>Salix longa</i> Al. Brongniart ?		168/1	
<i>Salix</i> cf. <i>tenera</i> Al. Brongniart		169/1	
<i>Salix varians</i> Göppert		170/1-170/6; 170/7 (cfr.)	

<i>Santalum osyrium</i> Ettingshausen			336
<i>Santalum salicinum</i> Ettingshausen			337
<i>Sapindus cassioides</i> Ettingshausen = <i>Engelhardia orsbergensis</i> (Wessel & Weber) Jänichen, Mai & Walther			369
<i>Sapindus cupanioides</i> Ettingshausen			370
<i>Sapindus dubius</i> Unger	figured 371/1		
<i>Sapindus ephialtae</i> (Ettingshausen) Visiani			372
<i>Sapindus falcifolius</i> Al. Brongniart			373
<i>Sapindus oligocenicus</i> Principi		374/1-374/3	
<i>Sapindus pythii</i> Unger = <i>Engelhardia orsbergensis</i> (Wessel & Weber) Jänichen, Mai & Walther			375
<i>Sapindus undulatus</i> Al. Brongniart = <i>Eotrigonobalanus furcinervis</i> (Rossmässler) Walther & Kvaček			376
<i>Sapotacites angustifolius</i> Ettingshausen			366
<i>Sapotacites mimusops</i> Ettingshausen		367/1-367/4	
<i>Sapotacites sideroxyloides</i> Ettingshausen		368/1	
<i>Sassafras aesculapi</i> Heer	figured 95/1 (?)		
<i>Sassafras ferrettianum</i> Massalongo	figured 96/1		
<i>Sophora europaea</i> Unger			143
<i>Sterculia gaudini</i> Principi			304
<i>Sterculia spectabilis</i> Principi		305/1-305/3	
<i>Sterculia trilobata</i> Principi	Type 306/1		
<i>Sterculia variabilis</i> Saporta = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	figured 307/1	307/2-307/3	
<i>Strychnos europaea</i> Ettingshausen		380/1	
<i>Terminalia italica</i> Principi	figured 324/2	324/1	
<i>Terminalia miocenica</i> Unger			325
<i>Terminalia pannonica</i> Unger = Lauraceae gen. et sp.	figured 326/1a; 326/1b		
<i>Terminalia radobojensis</i> Unger	figured 327/1; 327/2; 327/4 (counterpart of the figured specimen)	327/3; 327/5-327/21	
<i>Viburnum attenuatum</i> Principi	Type 157/1		
<i>Viburnum sismondai</i> Principi = <i>Sloanea olmediaefolia</i> (Unger) Kvaček & Hably	Types 158/1; 158/2	158/3-158/9	
<i>Zizyphus ungeri</i> Heer = <i>Zizyphus zizyphoides</i> (Unger) Weyland			341
Liliopsida			
<i>Agave antiqua</i> Squinabol			421
<i>Arecites longus</i> Principi			429
<i>Arecites rarifolius</i> (De Visiani) Squinabol	figured 430/1	430/2; 430/3	
<i>Arecites trabuccoi</i> Squinabol			431
<i>Arundo göpperti</i> (Munster) Heer			465
<i>Asteliaephyllum italicum</i> Squinabol	Type 425		
<i>Calamus beccarii</i> Squinabol			427
<i>Calamus nervosus</i> Squinabol	Type 428		
<i>Cannophyllites antiquus</i> Unger			412
<i>Carex diffusa</i> Saporta			463
<i>Carex tertiaria</i> (Unger) Heer			464
<i>Caulinities loipopytis</i> Massalongo			410
<i>Caulinities mirabilis</i> Squinabol			411
<i>Chamaerops ligustica</i> (Squinabol) Principi			426
<i>Cocos robustifolia</i> Squinabol	Type 434/1		
<i>Cyperacites paucinervis</i> Heer		462	
<i>Cyperus antiquus</i> Principi			451
<i>Cyperus assimilis</i> Saporta			452
<i>Cyperus chavannesi</i> Heer			453
<i>Cyperus custeri</i> Heer			454
<i>Cyperus effossus</i> Saporta			455
<i>Cyperus margarum</i> Heer			456
<i>Cyperus meschinellii</i> Squinabol			457
<i>Cyperus multinervosus</i> Heer			458
<i>Cyperus novus</i> Squinabol			459
<i>Cyperus reticulatus</i> Heer (not present in Squinabol and Principi; cited by Squinabol fide Sismonda, 1865)			460

<i>Cyperus zeilleri</i> Squinabol	Tuype 461/2 (a)	461/1 Perrando Collection's original label - N. 1416)	
<i>Dracaenites (Yuccites?) cartieri</i> (Heer) Principi	figured 424		
<i>Flabellaria mediterranea</i> Squinabol	Type 435		
<i>Geonoma italicum</i> Squinabol		432/1a; 432/1b (not counterpart of 432/1a); 432/1c; 432/1f (partial counterpart of 432/1b); 432/1d ; 432/1e (probably counterpart of 432/1d)	
<i>Geonoma steigeri</i> Heer			433
<i>Hedychiophyllum speciosum</i> (Squinabol) Principi	Type 413/1		
<i>Hemiphoenicitis crebrinervis</i> Squinabol	Type 445		
<i>Hemiphoenicitis</i> sp.			446
<i>Irites grandifolium</i> Principi			423
<i>Irites latius</i> (Saporta) Principi			422
<i>Isselia primaeva</i> Squinabol	Type 449/1 (b)		
<i>Najadopsis ramosa</i> Squinabol			471
<i>Palaeospathe de visianii</i> Principi	Types 438/1; 438/40		
<i>Palaeospathe</i> sp.			447
<i>Palaeothalia sanctae-justinae</i> Squinabol	Types 440/1a-2a-3a; 440/2b (partial counterpart); 440/3b (partial counterpart)	440/4a; 440/4b; 440/5; 440/6a; 440/6b; 440/7-440/8; 440/10-440/15; 440/16a; 440/16b; 440/17; 440/18a; 440/18b	
<i>Palmophyllum engelhardti</i> Principi			439
<i>Pandanus ettingshauseni</i> Squinabol			450
<i>Panicum miocenicum</i> Ettingshausen			467
<i>Perrandoa protogaea</i> Squinabol		448/1	
<i>Phoenicites isseli</i> Principi	Type 441		
<i>Phoenicites pallavicinii</i> Sismonda			442
<i>Phoenicites recentior</i> Squinabol			443
<i>Phoenicites spectabilis</i> Unger		444/1	
<i>Phragmites oeningensis</i> (Al. Brongniart) Heer			466
<i>Sabal haeringiana</i> (Unger) Heer			436
<i>Sabal major</i> (Unger) Heer			437
? <i>Smilax coquandi</i> Saporta			414
<i>Smilax grandifolia</i> Unger = <i>Smilax weberi</i> Wessel		415/1	
<i>Sparganium strictum</i> Saporta			417
<i>Sparganium stygium</i> Heer			416
<i>Sparganium valdense</i> Heer			418
<i>Typha angustior</i> Saporta	figured 419		
<i>Typha latissima</i> Al. Brongniart			420
Palmae sp.		468/1	