

DISSEMINATION OF AMERICAN ECONOMIC PLANTS ON PRECOLUMBIAN SEA ROUTES BY AMERINDIANS

by

Dr. Bruno Wolters
Düsseldorfer Institut für amerikanische Völkerkunde e.V.

Summary

In the past, evidence of a dissemination of economic plants on sea routes by Amerindians since the beginning of the first millennium AD was already found in the Caribbean area. Since it has become obvious in the last decades that the early formative Indian cultures of western Ecuador (Valdivia culture and successors) had in many respects higher developed skills as compared to their contemporaries in Peru and Mesoamerica starting from about 4000 – 1200 BC, there is growing evidence that they influenced the cultural development in these areas by sea, due to coastal shipping.

An exchange between South America and Mesoamerica on these sea trade routes can be equally assumed for useful plants. The transfer of peanut (*Arachis hypogaea*), sweet manioc (varieties of *Manihot esculenta*), cacao tree (*Theobroma cacao*), tobacco (*Nicotiana tabacum* and *N. rustica*), great-grained corn (*Zea mays*) and cherimoya (*Annona cherimola*) by sea from Ecuador to Mesoamerica and Mexico as well as the dissemination of avocado pear (*Persea americana*), paprika (*Capsicum annuum*) and jimsonweed (*Datura stramonium* as a narcotic and a medicinal plant) in the opposite direction seem as plausible according to archaeological evidence as a corresponding exchange of these economic plants (with the exception of cacao) between Ecuador and Peru. Most of these data apply to the time of the Chorrera culture (1200 – 500 BC), which was certainly in contact with tradespeople of the Olmecs in Mesoamerica.

The Precolumbian Sea Routes:

THERE IS AN equal possibility of a dissemination of useful plants by Man overland as via sea routes. In the beginning of cultivation, seeds, fruit, roots or tubers were certainly mainly passed on overland: from one village to the next and from one people to the other, or taken along on migrations, whereas a transport by sea was only effected on very short distances. With the beginning of maritime trade along the

coasts and the migration of peoples on sea routes, circumstances changed, as they did, for instance, in the Mediterranean area for the Phoenicians and the Greek.

In Precolumbian America, too, trade relations and migrations of peoples on sea routes existed. The route along the Pacific coast had been known since the third millennium BC (SOLÍS and CARMONA MACIAS, 1997). The most ancient evidence of a cultural influence transmitted on sea routes exists

from 2200 BC, when pottery in Valdivia style initiated by Western Ecuador (Valdivia culture, c.4000 – 1600 BC) appeared in Central America, and later influences were also indicated in clothing, the construction of burial shafts, in terrace cultivation and by copper axes (COE et al., 1991).

FROM 1450 BC, the very characteristic “stirrup vessels”, developed in Ecuador’s Machalilla culture (1600 –1200 BC) from Upper Amazonian preliminary stages, suddenly appear in western Mexico, without any preliminary stages in Mexico itself. They are vessels with a hollow carrying handle and a beak at the upper end, and their model can only have been imported (BAUMANN, 1978). At the same time, from 1500 BC in Michoacán and from 1450 BC in Colima, the Burial shaft culture begins in western Mexico with the burial of the dead in subterranean burial shafts, which did not exist in any other part of Mesoamerica at the time. The construction of these graves shows the greatest similarity with the one in Ecuador (DEIMEL and RUHNAU, 2000).

According to JACQUES SOUSTELLE (1968), clay figures and stamps for vessel ornaments in southern Mexico bear an astonishing resemblance to those from Ecuador, too; and a number of ceramic figures in western Mexico (Colima, 300 BC – AD 300) also show an influence from South America (LEYENAAR et al., 1992), namely with distinct reminiscences of the tradition of the preceding Chorrera culture of western Ecuador from a stylistic point of view and in the technique of their making. Around the same time, there are also burial shafts in Costa Rica for the first time, similar to those existing in western Mexico and in the northern part of the region of the Andes (DEIMEL and RUHNAU, 2000), which also suggests an influence from Ecuador. Numerous further examples of cultural and trade relations between Ecuador on the one hand and Central America/Mexico and Peru on the other hand have been compiled by

LAVALLÉE and LUMBRERAS (1986), these examples also indicating a mutual exchange.

It is noticeable that in Mexico the metal technique first developed along the south coast (SOUSTELLE, 1968). The knowledge of metallurgic techniques first reached Mesoamerica about AD 900. It first spread only in the current Federal States of Oaxaca, Guerrero and Michoacán. Coming from the northern part of the region of the Andes, where metals were processed for the first time in America thousands of years ago, long-distance merchants presumably also brought along technical procedures for the use of metals besides merchandise on sea routes (DEIMEL and RUHNAU, 2000); before, only a simple working of solid metals existed.

INDEED THE metallurgy of the Tarascans (Purépecha) in Michoacán rather corresponds to that of Ecuador and Peru than to that of Central America. And the metallurgic products in the western region of Mexico in the early Postclassical period (AD 800 – 1300) are comparable to goldsmith’s work in the south of Ecuador (SOLÍS and CARMONA MACIAS, 1997).

In the same way, there is evidence of Ecuador’s trade relations with Peru and its cultural influence on this region; for the first time in the form of brand engraving motives on calabash bottles in Huaca Prieta c.1950 BC, which resemble the models on the Valdivia pottery of western Ecuador from 2400 BC (STIERLIN, 1983). The stirrup vessels invented in western Ecuador (see above) had found great favor in Peru since the Vicús culture from 650 BC, and the pottery of the Vicús culture shows unmistakable reminiscences of that of the Chorrera culture in western Ecuador (STIERLIN, 1983). The mass import of Spondylus shells, which were made into nacre jewelry and only exist on the coast from Ecuador to Central America, proves that

there were intensive trade relations with Peru (OBEREM and HARTMANN, 1982). For a map of the intercultural and trade relations via Precolumbian sea routes see WOLTERS (1999 a).

During the Chorrera culture, the cultures of the Olmecs in Mexico (1200 – 200 BC) and the ones of Cerro Sechín (1500 – 300 BC) and Chavín de Huantar (900 – 300 BC) in Peru then began to prosper, outstripping western Ecuador by the high standard of their civilization. But the sea trade from Ecuador was continued until the arrival of the Spaniards.

There are descriptions of the Amerindian sea vessels of western Ecuador and Peru from the early 16th century and later; the balsa rafts had also been taken over by the Chinchá in Peru (OBEREM and HARTMANN, 1982): One of the types of vessels were big balsa rafts up to 20 m length made of a double layer of balsa trunks, where the trunk in the middle was the longest and the trunks on the sides were the shortest ("cork wood" from *Ochroma lagopus* with a specific gravity of only 0.2). The rafts had a cabin and a bipedal (!) mast for the rectangular sail. They were not steered by means of a stern rudder, but by means of boards, which were vertically put down into the water between the balsa trunks in different places of the raft and then pulled out again, when necessary. They were also sped up with the help of single-bladed paddles. The second type were piraguas; dugouts up to 20 m long with boards set lengthwise into the outer sides as stabilizers against capsizing.

BOTH TYPES were original Amerindian inventions, which neither exist nor existed in any other part of the world, with the exception of piraguas on the south coast of Mexico (OBEREM and HARTMANN, 1982), where they had certainly been taken over from the Amerindian long-distance merchants, however – in the same way as stirrup vessels, burial shafts, and metallurgy.

No cultural influence from Polynesia at all can be recognized in these Amerindian sea vessels. If there had been an intensive cultural contact, the Indians of western Ecuador, and later also the Chinchá in Peru (see below), would have taken over the technically more perfect cantilever boats and catamarans and the triangular Polynesian sails, which permitted tacking against the wind because they had a simple mast, not a "bipedal" one. And besides they would have given the Polynesians the Amerindian basic food plants, corn and beans, and not only sweet potato (see below). In spite of their lower perfection, balsa rafts and piraguas were yet suitable for long-distance trade over 4,000 km as far as western Mexico.

THE CLIMATIC conditions differed depending on the season and the direction of the journey (DIERCKE-Weltatlas, 1971; WELTKARTE der Naturgefahren, 1980). During trade journeys along the coast of Peru, one always had to row against the Humboldt Current and the southeast trade wind on the way there, whereas the journey back was furthered by both. Since the Humboldt Current is stronger during the south winter off the Peruvian south coast than it is during the south summer, and streams out into the open Pacific in the north, it was certainly useful to stay near the coast, particularly so since the supply of drinking water in this extremely dry region was only possible on the sparse estuaries. In the relatively rare El Niño years full of storms, merchant shipping was certainly stopped.

During northward journeys to Costa Rica, the zone of the all-year tropical rains had to be passed by; since the frequency of thunderstorms exceeds 100 per year in the Gulf of Panama, it was presumably better to steer directly for Costa Rica from Ecuador across the open sea. If only trade in Panama was concerned, the ocean current on the way there was favorable during the whole year, however. On the second leg of the journey from Costa Rica to western Mexico, one got

caught in a region of tropical whirlwinds during late summer and autumn, and during the north winter, the cold "Norte" blew in Mexico to the Pacific coast, during the dry period. A short time after the conquest of Mexico, Indians in Zacatula on the mouth of the Rio Balsas in the Pacific told the Spaniards that during the time of their forefathers merchants from the south would sometimes come in piraguas; if the storm period began too early, these would have to stay with them for 5 – 6 months before they could return (OBEREM and HARTMANN, 1982). Since Mexican coast merchants could profit by more favorable seasons because of the much shorter traveling distance they had to cover with their piraguas, the merchants in question can only have been long-distance merchants from western Ecuador.

LATE SUMMER, autumn and winter had to be avoided on the coasts of Mesoamerica and especially on those of Mexico. In the northern summer, the sea currents were favorable for the journeys there, for, coming from the west, the equatorial counter-current then bends along the coast of Central America to the west of Mexico before its water meets that of the California Current and flows out west into the open Pacific as northern equatorial current. And since the current along the Pacific coast of Central America and southern Mexico is not very strong and not completely continuous, and the wind, blowing from different directions, is interrupted by calms, even a journey back against the current was not difficult. However, the rains on the Pacific side of Central America and southern Mexico occur in the northern summer, too (in southern Mexico from April/May to October) (SOMMERHOFF and WEBER, 1999). But if one stayed near the coast, one could look for shelter from thunderstorms there for a short time.

Shorter journeys to Panama or Costa Rica were possible in any season; beyond Costa Rica in the direction of Mexico and back,

only from spring (still dry season) till late summer (rains). Later in the year, journeys became too risky.

ABOUT 2,000 years ago, the migration of the Arawak began from the Orinoco region in boats to the Lesser and Greater Antilles, where they reached Cuba about AD 700 (HABERLAND, 1991). They obviously took bitter manioc (*Manihot esculenta*) and peanut (*Arachis hypogaea*) with them from South America to the West Indies. A Mexican influence among the Arawak in the Antilles becomes apparent not only in the construction of ritual ball courts (COE et al., 1991; WILKERSON, 1997 b; DEIMEL and RUHNAU, 2000), but also through some Mexican cultural plants: paprika (*Capsicum annum*), pumpkin (*Cucurbita pepo*), and cotton (the Mexican cultural species *Gossypium hirsutum*) (BRÜCHER, 1989), which must have been obtained from Yucatan (Map 1).

THE AZTEC legend of the early immigration of Nahua peoples from the north in boats across the Gulf of Mexico into the land of the Huastecs and to Teotihuacán and Guatemala more than 2,000 years ago is now considered as basically authentic (WILKERSON, 1997 c). It is true that in the process no economic plants were disseminated, but it is a proof of an early navigation on the Gulf of Mexico. A merchant shipping of the Maya cannot be proved before AD 1000; it reached from the land of the Huastecs on the Gulf of Mexico to Honduras, possibly even to Panama (OBEREM and HARTMANN, 1982). According to chemical analysis, however, gold, or tumbaga (a gold-copper alloy), does not come only from Costa Rica and Panama, but also from Colombia, whose route of transport is unknown (OBEREM and HARTMANN, 1982). Maybe the navigation of the Maya – or of other peoples in the Caribbean Sea – started earlier, after all.

The distinct influence of the Veracruz culture (AD 300 – 1100) on the Mississippi culture

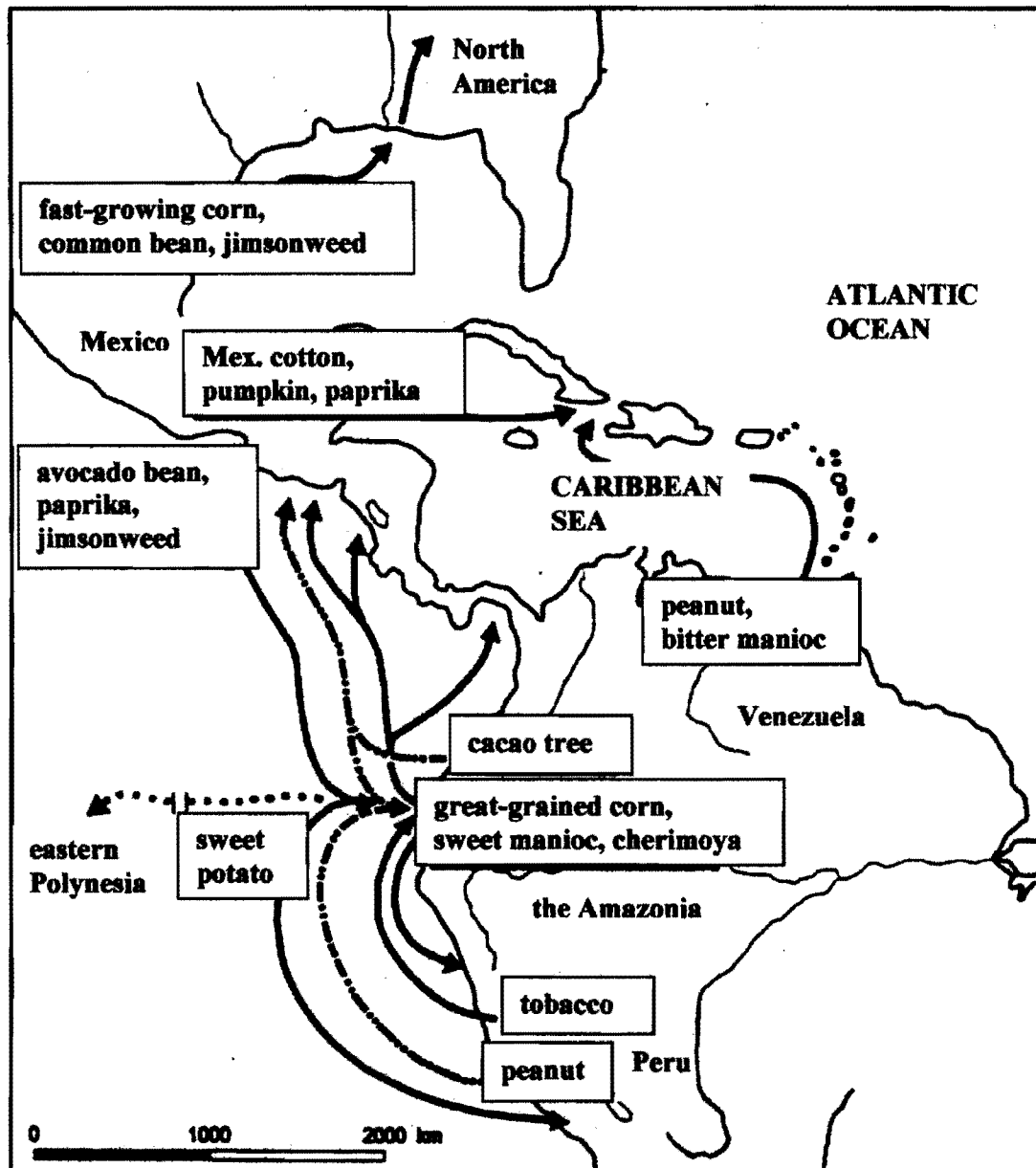


Figure 1: Dissemination of economic plants on Precolumbian sea routes by Amerindians

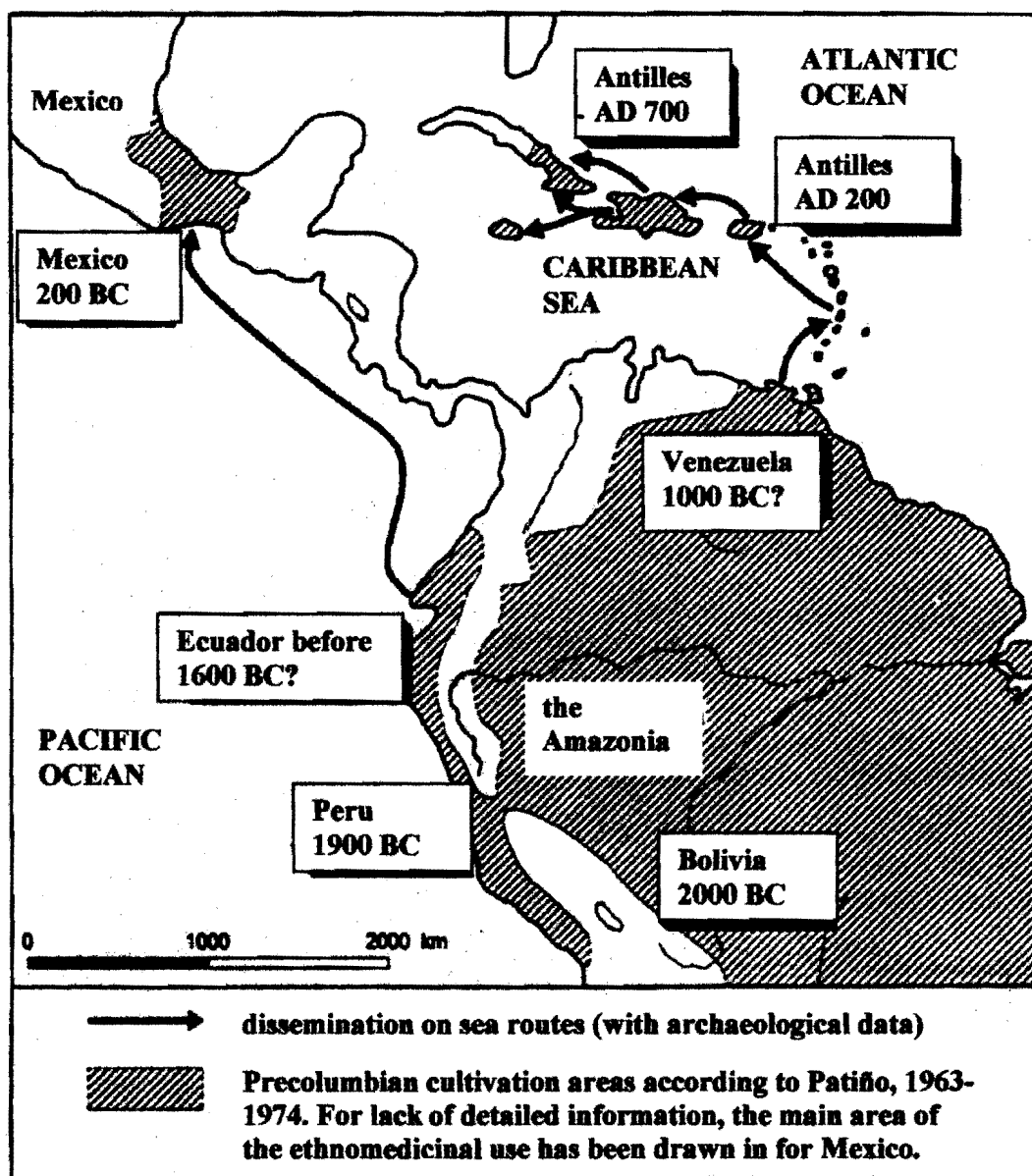


Figure 2: Precolumbian dissemination of peanut (*Arachis hypogaea*)

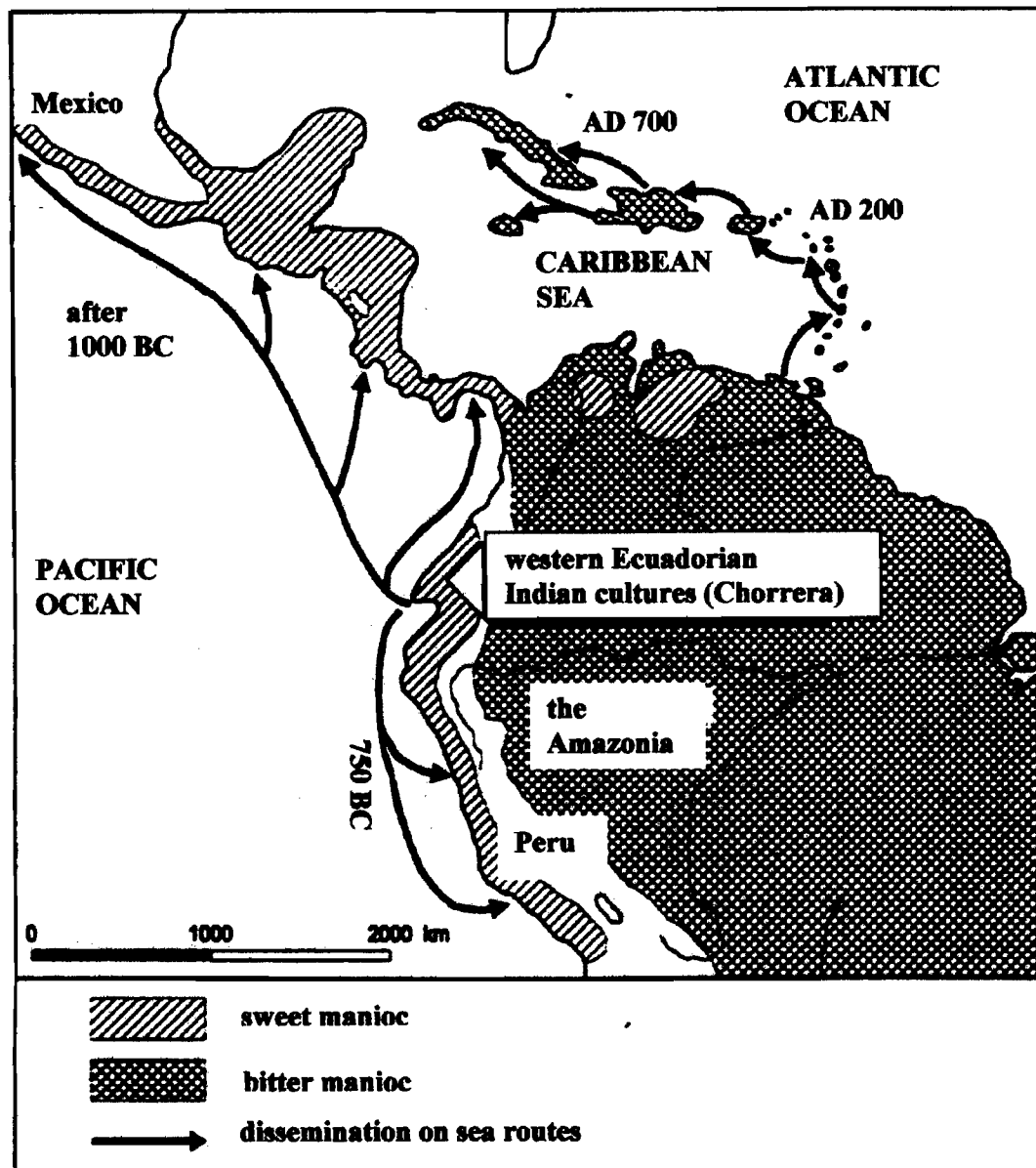


Figure 3: Precolumbian dissemination of manioc

(AD 800 – 1200) and the southeast of North America (WILKERSON, 1997 b) suggests that in the process also fast-growing corn varieties (*Zea mays*) and common bean (*Phaseolus vulgaris*), which appear in the same period of time in central and eastern North America, were taken along the Gulf coast via sea route at least as far as Louisiana (Map 1). Since only hunter-gatherer peoples lived in Texas, the route overland is improbable. According to M. COE et al. (1991), the cultural development and the high density of the population are based exactly on this productive food basis.

Linguistic and technological features (copper as material) indicate an immigration of the Tarascans (Purépecha) from Pacific South America to Michoacán in Mexico (SOTO NUÑEZ and SOUSA, 1995) – on the old maritime trade route to western Mexico. The resemblance of metallurgical products of the Tarascans and their neighbors to those in the south of Ecuador (see above; SOLÍS and CARMONA MACIAS, 1997) can be a geographic hint to the provenience of the Tarascans; yet unfortunately, none of the Amerindian languages of that region has been preserved.

IN NORTHERN Peru there were stories about a ruler who came from the north on balsa rafts in the company of a numerous entourage and took over the rule in the valley of Lambayeque (Ñaymlap tradition; KUTSCHER, 1950). The Chimú, whose dynasty had also come from the north, told similar stories; according to an early Spanish statement, the language of this people resembled the one spoken in the western Ecuadorian province of Manabí. And the highly developed pottery of the western Ecuadorian Chorrera culture (1200 – 500 BC) was obviously scarcely continued in Ecuador, but in northern Peru (Vicús; later Mochica, 200 BC – AD 600; STIERLIN, 1984). An immigration of at least those

classes of the population who were the upholders of civilization – and who, according to Amerindian accounts, arrived on sea routes – can be assumed.

A DISSEMINATION of economic plants on sea routes in the Pacific Ocean between Peru and Mexico as well as in the Caribbean Sea and in the Gulf of Mexico can be assumed – via trade or via immigration; for peoples living on the coasts certainly have not only given their cultural, technical and agrarian achievements to their neighbors on the mainland but have also exchanged them with the partners accessible on sea routes, and they also have taken along with them their achievements and knowledge in case of an emigration. Wherever a sea route was available – on the Pacific Ocean, from 2200 BC – the parallel overland route was unnecessary and not competitive on account of its slowness. Only a few economic plants were probably disseminated across Central America in the direction of Mexico or South America on an overland route after the beginning of coastal shipping.

The most distinct examples of a dissemination on the Pacific sea route are peanut (*Arachis hypogaea*), cacao tree (*Theobroma cacao*), sweet manioc (varieties of *Manihot esculenta*) and – as a ritual and medicinal plant – jimsonweed (*Datura stramonium*); for comparison, see Map 1. The conspicuous gaps in the dissemination of these economic plants – in the case of sweet manioc, in Pacific Colombia, in the case of peanut and cacao tree, from Colombia to Guatemala or Mexico, in the case of jimsonweed, a missing medicinal use in Colombia and Panama – are real proofs of the existence of Precolumbian coastal shipping by Indians of western Ecuador (compare Maps 2 and 3). And sweet potato (*Ipomoea batatas*; compare below) can only have arrived in eastern Polynesia from South America by sea.

The Dissemination of Peanut:

Peanut (*Arachis hypogaea*) is native to Brazil and Paraguay as a cultural plant (BRÜCHER, 1989). The oldest archaeological evidence is dated 2000 BC in Bolivia (FRANKE, 1997) and 1900 BC in the coastal area of Peru (HABERLAND, 1991). Although its evidence in Ecuador is disputed (FEEST and KAMM, 1992), it was probably soon planted in the Valdivia culture before 1600 BC, due to the trade relations with Peru.

THE FURTHER dissemination of peanut then obviously stopped on the overland route. It was missing in northwest Colombia and large parts of Central America on the arrival of the Spaniards (Map 2; PATIÑO, 1963-1974). In Pacific Colombia, to the north of the coastal area of the Province of Nariño, which was influenced from western Ecuador, there was a region with Indians who obviously did little plant cultivation. Here, apart from peanut, also manioc (the sweet variety as well as the bitter one; compare Map 3) and common bean were missing – to the Spaniards' amazement (PATIÑO, 1963-1974). And on the Caribbean coast, north-west Venezuela is a relatively dry region with thornbush and succulent savanna forest (SEIBERT, 1996) and therefore an obstacle for the dissemination of certain economic plants, like the Cordilleras, for geographical as well as climatic reasons.

However, there is evidence of the existence of peanut about 200 BC in the valley of Tehuacán in Mexico (HABERLAND, 1991), where it can only have arrived via the Pacific sea route because of the dissemination gap in Colombia and Central America. It was taken to the Antilles only later by the Arawak and can therefore not have arrived that early in Mexico from there (for data, see Map 2). In Mexico, it also served as a medicinal plant by the Amerindian name of "cacahuatl" (not "maní", as in large parts of Atlantic South America) (SAHAGÚN, 1569).

Peanut is a classical example of the fact that obstacles of any kind (geographic, climatic, or cultural) can block the dissemination of a cultural plant on the overland route – in the case of peanut, for 2,000 – 3,000 years (!); compare Map 2. However, these obstacles have been avoided comfortably on sea routes, in the case of the 3,000-km distance Ecuador – Mexico, by balsa raft or piragua, with a sea journey taking only about 4 – 5 months (!).

The Route of the Cacao Tree:

The dissemination of the cacao tree (*Theobroma cacao*; for maps showing this, see KRUMBACH, 1997; WOLTERS, 1999 a) is a case parallel to that of the peanut. Besides potato, corn, peanut and other useful plants, cacao is said to be a cultivated plant which benefits world agricultural and food industries through the rediscovery of America (KRUMBACH, 2000). Its original homes are the Amazonia and Guyana, where its wild form, the "forastero" (*T. cacao* ssp. *sphaerocarpum*), still exists. It is from this form that the "criollo" cacao tree cultivated in Mesoamerica in Precolumbian time comes from; for genetically this cacao tree is closely related to the forastero (CRUZ et al., 1996). In the Ecuadorian part of the upper Amazon region there are cacao trees of the criollo type (BARTLEY, personal information) and fruits with white instead of violet germ layers in the seeds (PATIÑO, 1963-1974), which is also a feature of the criollo type. The Spaniards already saw "cacao like in New Spain" (= Mexico/Central America) in the upper Amazon region, certainly criollo-type forms like those.

AT THE SAME time, in 1531, conquistador Diego de Trujillo relates the fact that the Amer-indians near Puerto Viejo in western Ecuador had "cacao like they have in Mexico" (PATIÑO, 1963-1974). In western Ecuador, in the Rio Repartidero region between Salango - to the north of Valdivia, the site of discovery of the Valdivia culture, which was named after it – and the island of

Muisne, a type of cacao exists which seems to be rather ancient (BARTLEY, personal information). Indians of the Valdivia culture, but not later than those of the Chorrera culture, could have transported criollo-type forastero mutants over the Andes and planted them in silviculture. Plants of this type also occur near Lake Maracaibo in Venezuela (BARTLEY, personal information). However, a Precolumbian cultivation in this area has been contested (PATIÑO, 1963-1974).

R.E. SCHULTES (1980) already assumed that the cacao tree "migrated over the Cordilleras with Amerindians". No archaeological evidence has been discovered so far; for cocoa beans cannot last in the soil of the humid and hot tropical region, and it is not yet certain whether a definite ceramic reproduction of the seeds or of a fruit exists. Consequently, we do not know how far the Indians of Ecuador developed their growing of criollo cacao.

The "Lacandon cacao tree", discovered by CUATRECASAS in Chiapas (CUATRECASAS, 1964) and also kept by the Maya in some places in Yucatan (GÓMEZ-POMPA et al., 1990), is said to be a special variety of *Theobroma cacao*. It is almost identical with cacao growing on the lower slopes of the Sierra Nevada de Santa Marta in northern Colombia (BARTLEY, personal information):

BETWEEN Ecuador, or northern Colombia, and Guatemala, neither wild *T. cacao* nor a primitive cultivated form exist. In the area of the pre-classical Maya culture, there has been evidence of cacao from 500 BC; linguists attribute an age of 3,000 years to the word "kakawa" for cacao in the Mixe-Zoque languages, which the Olmec language was very probably part of (COE and COE, 1996). From the Maya area, the criollo cacao tree was then disseminated to Costa Rica and western Mexico. The Maya cultivated criollo

cacao which would contain more caffeine (0.33 – 1.7 %; DUKE, 1986; HAMMERSTONE et al., 1996), whereas forastero only contains 0.1 % of caffeine, besides theobromine as main substance in both.

HELMUT KRUMBACH (1993, 1997) was the first person to postulate the Pacific sea route from Ecuador to Mesoamerica for a dissemination of the cacao tree. This is indeed the most plausible explanation for the dissemination gap between Ecuador and Guatemala (WOLTERS, 1997, 1999 a). The dissemination of peanut on this same sea route (Map 2) seems to confirm this theory.

For the variety of *T. cacao* also named "Lacandon cacao tree", B.G.D. BARTLEY (personal information) considers the sea route from northern Colombia to Guatemala, Belize and Yucatán on the Caribbean side of Central America possible. The archaeological data for this sea route occur later (at the earliest during the classical Maya culture; see above) than those for the Pacific sea route.

If cacao fruits, which become overripe after two weeks' storage, after all, were transported by sea as far as Guatemala or Mexico with germinable seeds, one or two stops with temporary cultivation were necessary on the way; for the seeds in the fruits only remain germinable for 1 to 2 months maximum (SPRECHER VON BERNEGG, 1934). If the Indians of the Chorrera culture (1200 – 500 BC) transported living seedlings on their balsa rafts as in the case of sweet manioc (see below), and as the Spaniards did in 1607 from Central America to Guayaquil in Ecuador for the criollo cultivation there (PATIÑO, 1963-1974), the sea journey along the Pacific coast was possible in one single stage (WOLTERS, 1997, 1999 a).

Wild forastero was grown as a cultivated plant only by the Spaniards and the Portuguese and has finally completely replaced pure criollo cacao on the world

market because of the greater resistance of its mutants and bastards. The Indians of the Amazonia have not cultivated it, although they have grown numerous cultivated plants (manioc, peach palm, Amazonian coca shrub and others); for reasons for this, see WOLTERS (1997, 1999 a).

Dissemination of Bitter and Sweet Manioc:

Manioc (*Manihot esculenta*) is a useful plant probably native to the Amazonia (BRÜCHER, 1989). The poisonous character of bitter manioc is caused by cyanogenic glycosides; at an early time, Amerindians invented methods of detoxification by draining the poisonous substances out of the rasped tubers. The most ancient remains of manioc rasps – small stone plates which were inserted into clay (before baking) or wood have been found in the Valdivia culture of Ecuador (4000 – 1600 BC) (BAUMANN, 1978). In the early formative phase of Mexico (2500 – 1000 BC), manioc rasps also existed (WILKERSON, 1997 a), which presumably served the treatment of *Manihot aesculifolia*, the species native to this region. Later, also “sweet”, almost non-toxic varieties were developed in some places, the non-toxic quality being partially attained through selection; it can also have been partially caused by external factors.

GONZALO FERNÁNDEZ DE OVIEDO (1526) already noticed that exclusively bitter manioc (“yuca”) was planted in the Great Antilles – it had been taken to the islands by the Arawak (compare Map 3) -, on the Central American mainland, however, sweet manioc, without exception. The analysis of the early Spanish information collected by PATIÑO (1963-1974) gives a clear picture of the Precolumbian occurrence of sweet manioc:

- a) In western Ecuador, including the warmer Andean valleys, and in the river oases of the Peruvian coastal area towards the south to Arica in the northernmost part of Chile. Here,

bitter manioc was also missing completely.

- b) In Central America, Yucatan and Mexico. Sweet manioc (from *M. esculenta*) later obviously completely replaced the early bitter manioc of Mexico (presumably from *M. aesculifolia*). The manioc rasps for bitter manioc disappear from there after 1000 BC (WILKERSON, 1997 a), and this was probably the time when sweet manioc was taken over. According to HUMBOLDT, among the Mexican Indians, sweet manioc was called “huacamote”; ALEXANDER VON HUMBOLDT discussed it in his work on Mexico (1809) among the main food plants of Mexico. In his time, its cultivation reached west to Sinaloa (compare Map 3). Today, manioc is not named among the basic food plants of Mexico any more (SOMMERHOFF and WEBER, 1999), in folk medicine, only in Quintana Roo (eastern Yucatan; ARGUETA-VILLAMAR, 1994).
- c) Only in scattered cultivation areas in western Venezuela and northeast Colombia; in addition, there are places of occurrence registered only later in Brazil, northern Argentina and Paraguay (SPRECHER VON BARNEGG, 1928).

Outside the Pacific area, bitter manioc dominates to this day almost everywhere in tropical and subtropical America. When the Spaniards arrived, only sweet manioc existed in Pacific South America and in Central America and Mexico, in one cohesive cultivation zone extending over many latitudes and interrupted only in western Colombia, which ran parallel to the maritime trade routes of the Indians of western Ecuador (WOLTERS, 1997, 1999 a; compare Map 3). This is certainly no accident!

Since manioc rasps existed in the Valdivia culture already (4000 – 1600 BC), bitter manioc was transplanted first in Ecuador (and only there!) from the Amazon side to the Pacific side of South America. From 1800 BC, there is then evidence for the existence of manioc in the Casma valley in neighboring northern Peru (UGENT et al., 1986), although the question whether it was bitter or sweet manioc remains unanswered. But it can be assumed that sweet manioc was selected by the end of the Valdivia culture, for from later times, no manioc rasps are known from Pacific South America. In Caribbean South America, they do not appear before about 700 BC (BRÜCHER, 1989). From 750 BC, manioc becomes more frequent in the Peruvian coastal area (TOWLE, 1961), without any mention of manioc rasps. Approximately at the same time, the manioc rasps disappear in Mexico (after 1000 BC, see above).

AROUND THIS time, Indians of the Chorrera culture (1200 – 500 BC) had probably disseminated sweet manioc by sea from Ecuador to Mesoamerica and Peru, certainly in the form of cuttings which had grown roots, or young plants (WOLTERS, 1997, 1999 a); for the vegetative reproduction of manioc is customary among Amerindians. They can be absolutely credited with a transport of living plants across the sea. In the Old World, the Egyptians imported living incense trees from the land of Punt (probably Somalia) across the Red Sea by ship as early as the 15th century BC (HOCHHEIMER, 1977).

Dissemination of Further American Useful Plants:

Archaeological data seem to indicate that further useful plants were disseminated along the Pacific coasts of America, although there is no geographic information as precise as there is for peanut, cacao, and manioc from the time of the Spaniards' arrival (WOLTERS, 1997, 1999 a). For a comparative chronological table of the most

ancient cultivated plants of America, see WOLTERS (1999 b).

Corn (*Zea mays*), evidence of which exists in the Valdivia culture of Ecuador about 2450 and 2300 BC (LATHRAP et al., 1975; COE et al., 1991), probably came overland from Mexico, where varieties with small grains have existed for about 7,000 – 5,400 years (FRANKE, 1997). However, about 2300 BC, large grains are documented in the Valdivia culture. Since great-grained corn appears earlier here than in Peru (from 2000 BC; HABERLAND, 1991) and in Mexico, it was probably passed on by sea in both directions. Later, Peruvian soft-corn varieties with large grains appear in Mesoamerica (BRÜCHER, 1989), certainly brought there by Ecuadorian seafarers; for corn, like common bean, was staple food for the Amerindians, and both remain germinable during a sea journey of 4 – 5 months (compare [Map 1](#)).

Fruit varieties in the Chorrera culture of western Ecuador which have been given evidence of are cherimoya as well as pineapple, as ceramic reproductions (STIERLIN, 1984); they are the most ancient archaeological evidence of both. Cherimoya (*Annona cherimola*) was probably first planted in western Ecuador; pineapple (*Ananas sativus*), however, comes from Brazil originally (BRÜCHER, 1989). Both do not appear in Peru before the time of the Chimú, or the Inca, and probably arrived there from Ecuador, and at least cherimoya also came to Mesoamerica. Pineapple may perhaps also have been disseminated directly overland from Brazil via the Caribbean coastal areas to Central America. Papaya (*Carica papaya*), too, could be native to western Ecuador and could have taken the same route as cherimoya; for H. BRÜCHER (1989) considered a culture "west of the Andes" possible.

FOR THE TWO tobacco species, *Nicotiana tabacum* from Bolivia/northwest Argentina and *N. rustica* from central western Peru (BRÜCHER, 1989), a dissemination via the

Pacific sea routes can also be assumed (WOLTERS, 1997, 1999 a). The most ancient archaeological date for tobacco comes from Mexico (800 – 300 BC; ARNDT, 2000), yet it was certainly known there some centuries earlier already, for in the Adena culture in the Ohio region of North America, tobacco pipes were made as early as about 500 – 200 BC (COE et al., 1991). Early data from South America are missing completely to this day. The fact that Ecuadorian seafarers reached Mexico probably divided the overland route of 10,000 km from Peru to the Ohio region by half (Map 1).

AVOCADO pear and paprika are native to Mexico. Evidence of the existence of avocado pear was found in Mexico as early as between 6500 and 4800 BC (HABERLAND, 1991). From after 750 BC there are plant remains from the sites of discovery Ancón and Huaca Prieta (Cupisnique horizon) in Peru (TOWLE, 1961). Avocado pear was probably brought to Ecuador from Mexico by sea during the Chorrera period (1200 – 500 BC) and passed on to Peru, although remains from Ecuador are missing because they cannot be preserved in the humid tropics. There is an analogous situation for paprika (*Capsicum annum*), which was proved to have existed near Tehuacán and in Tamaulipas (Mexico) about 6500 – 4000 BC (BRÜCHER, 1989) and appears in Peru in Parácas about 500 BC (TOWLE, 1961). In general, the exchange of cultivated plants between South America and Mesoamerica during the Chorrera culture seems to have been most intensive in western Ecuador (cacao tree, sweet manioc, cherimoya, avocado pear, paprika, tobacco, presumably also peanut and others). The Chorrera Indians certainly had contact with the Olmecs in Mesoamerica, whose overland trade routes led from their settlement area on the Gulf of Mexico to El Salvador. – A Peruvian competition with the navigation of the Indians of Ecuador did not exist until late: The Chincha culture (from AD 1000) had

maritime trade with Ecuador (LONGHENA and ALVA, 1999); however, the Peruvians had to get the balsa wood for their rafts from Ecuador (OBEREM and HARTMANN, 1982) because it does not grow in Peru.

SWEET POTATO (*Ipomoea batatas*) is native to tropical America, although it is impossible to name its precise region of origin. There is evidence of its existence in Parácas in Peru from 2000 BC (BRÜCHER, 1989). It was presumably already planted in the Valdivia culture. Since THOR HEYERDAHL's Kon Tiki journey, the way it reached Polynesia has been discussed (YEN, 1974); for it has a second dissemination center in eastern Polynesia, where the inhabitants of the Easter Island alone have 25 names for their varieties (ZIZKA, 1989). The diversity seems to indicate a very early transfer of an original variety from South America to eastern Polynesia, not necessarily first to the Easter Island, which was not inhabited before AD 500. Since Indians of western Ecuador traveled 4,000 km to western Mexico from 1450 BC (see above), a journey by balsa raft (which can also have been unintentional) to eastern Polynesia with tubers of sweet potato on board as early as over 3,000 years ago are absolutely conceivable.

Jimsonweed (*Datura stramonium*):

Among about 20 examined medicinal plants common to Mexico and Peru, no clues for a transfer by sea could be found on the basis of their indications in folk medicine, except for jimsonweed (*Datura stramonium*), which was and still is of great interest for Amerindians as a vision drug and a narcotic.

By means of documents from the 16th century by MARTÍN DE LA CRUZ (1552), BERNAR-DINO DE SAHAGÚN (1569) and FRANCISCO HERNÁNDEZ (1577) and collections of recipes of the Maya from the last centuries (ROYS, 1931), it is possible to completely reconstruct the Precolumbian medicine of Mexico. In Peru there are data

from the Spanish colonial age, and today's Kallawaya medicine (GIRAULT, 1984) certainly goes back to the age of the Inca in its tradition, so that here, too, Precolumbian tradition can be registered. For Virginia there is evidence of the ritual use of *Datura stramonium* in the early English colonial age (MOERMAN, 1982). So it resulted that there are three areas in America, a long way apart, where *Datura stramonium* was used in the Precolumbian age (other species of *Datura* only in the sierra, in the northwest of Mexico and in the southwest of the USA):

- 1) In the area of the Mesoamerican cultures from central and western Mexico to Costa Rica. *D. stramonium* is native to Central America (FONT QUER, 1992).
- 2) In the Inca state from Ecuador to central Chile, there also among the Mapuche (Araucanians).
- 3) In eastern North America; according to recent data (MOERMAN, 1998), not only in Virginia but also in New England (Mohegan) to the southern part of the Appalachian Mountains (Cherokee).

The Indians of Mexico had 15 medical indication areas for jimsonweed (leaves, flowers, seeds, roots), which are only partly given evidence of for us through the effects of the alkaloids L-hyoscyamine and scopolamine: narcotic/hallucinogen, nervous problems/psycho-logical aid, antispasmodic/epilepsy, asthmatic aid, aphrodisiac; these applications internal, the further ones, external: analgesic for pains of different kinds, antirheumatic/gout, sleep aid (externally, on the head), febrifuge/shivering fits, colds, ulcers/pimples, hemorrhoids, anti-hemorrhagic, wound healing, ear medicine/deafness (compare ARGUETA-VILLAMAR, 1994).

Ten of these indications also existed in Peru; only the three last ones are missing, as well

as colds and the use as aphrodisiac. Today, the number of these indications in indigenous folk medicine is reduced. A congruence as far-reaching as this is not an accident (for almost 20 further medicinal plants, they do not exist, as I said). The question is whether jimsonweed came to South America from Mexico or Central America overland (it is a "weed", after all) or by sea.

THE INDIANS of Panama and Colombia do not use jimsonweed but its relatives, species of *Brugmansia* (genus *Brugmansia*), which contain the same alkaloids. In Panama (DUKE, 1986), five of the indications of these species of *Brugmansia* coincide with those of *D. stramonium* in Mexico, in Colombia (GARCÍA-BARRIGA, 1992), only three. Since *D. stramonium* is not used in Panama and Colombia and there is little congruence with the related *Brugmansia*, it cannot be assumed that the information for a multiple use came from Mexico via Colombia to Peru overland.

So jimsonweed (*Datura stramonium*), along with the respective medicinal information, must also have come to Peru from Mexico via Ecuador by sea.

Jimsonweed probably came to North America across the Gulf of Mexico (see Map 1), through the contact of the Veracruz culture with the Mississippi culture, but maybe as a field weed, along with corn and common bean (see above); for in eastern North America (at least today), only 4 indications of the plant coincide with those of Precolumbian Mexico.

ALL IN ALL, there are at least 13 species of economic plants which were probably or certainly disseminated in parts on sea routes by Indians within Precolumbian America (Map 1): peanut (*Arachis hypogaea*), cacao tree (*Theobroma cacao*), manioc (*Manihot esculenta*; sweet and bitter varieties), great-grained corn varieties (*Zea mays*), common bean (*Phaseolus vulgaris*), Mexican cotton (*Gossypium hirsutum*), paprika (*Capsicum*

annuum), avocado pear (*Persea americana*), cherimoya (*Annona cherimola*), pumpkin (*Cucurbita pepo*), both tobacco species (*Nicotiana tabacum*; *N. rustica*), and jimsonweed (*Datura stramonium*), as well as possibly further ones (papaya ? pineapple ?);

in addition, sweet potato (*Ipomoea batatas*), to eastern Polynesia. Precolumbian navigation of the Amerindians is part of their greatest achievements.

BIBLIOGRAPHY

- ARGUETA-VILLAMAR, A. (Ed.), 1994: Atlas de las plantas de la medicina tradicional mexicana. 3 vols., Instituto Nacional Indigenista (INI), Mexico.
- ARNDT, W., 2000: Im Land der rauchenden Götter. In: Starker Tobak. Ein Wunderkraut erobert die Welt. Hrsg. vom Museum der Kulturen, Basel; pp. 68–73.
- BARTLEY, B.G.D., 2000: Personal information.
- BAUMANN, P., 1978: Valdivia. Die Entdeckung der ältesten Kultur Amerikas. Hoffmann und Campe, Hamburg.
- BRÜCHER, H. 1989: Useful plants of neotropical origin and their world relatives. Springer Verlag, Berlin etc.
- COE, M.D. (Ed.), SNOW, D., and BENSON, E., 1991: The Cultural Atlas of Ancient America. Andromeda Oxford Ltd.
- COE, S.D., and COE, M.D., 1996: The True History of Chocolate. Thames and Hudson, London.
- CRUZ, MARTÍN de la, 1552: Libellus de medicinalibus Indorum herbis. With comments in Spanish, IMSS, Mexico, 1964.
- CRUZ, M. de la, WHITKUS, R., GÓMEZ-POMPA, A., and MOTA-BRAVO, L., 1995: Origin of cacao cultivation. *Nature* 375, pp. 542–543.
- CUATRECASAS, J., 1964: Cacao and its allies: A taxonomic revision of the Genus *Theobroma*. *Contrib. US Nat. Herbarium* 35, pp. 379–614.
- DEIMEL, C., und RUHNAU, E., 2000: Jaguar und Schlange. Der Kosmos der Indianer in Mittel- und Südamerika. Dietrich Reimer Verlag, Berlin.
- DIERCKE Weltatlas (begr. von C. DIERCKE, fortgeführt von R. DEHMEL), 1971. 159. Aufl., Georg Westermann Verlag, Braunschweig.
- DUKE, J.A., 1986: Isthmian Ethnobotanical Dictionary. 3. ed., Scientific Publ., Jodhpur (India).
- DUKE, J.A., 1988: CRC Handbook of Medicinal Herbs. 6. ed., CRC Press, Boca Raton/Fla.

- FEEST, C.F., und KAMM, P., 1992: Das Altertum der Neuen Welt. Voreuropäische Kulturen Amerikas. (Hrsg.: Museum für Völkerkunde, Wien). Dietrich Reimer Verlag, Berlin.
- FONT QUER, P., 1992: Plantas Medicinales. El Dioscórides renovado. 13. ed., Editorial Labor, Barcelona.
- FRANKE, W., 1997: Nutzpflanzenkunde. Nutzbare Gewächse der gemäßigten Breiten, Subtropen und Tropen. 6. Aufl., Georg Thieme Verlag, Stuttgart und New York.
- GALL, A. von, 1940: Medizinische Bücher (tici-amatl) der alten Azteken aus der ersten Zeit der Conquista. Studien z.Gesch. d. Naturwiss. u. Medizin, Bd.7, Berlin.
- GARCÍA-BARRIGA, H., 1992: Flora medicinal de Colombia. 3 vols., Tercer Mundo Editores, Bogotá.
- GIRAULT, L., 1984: Kallawaya. Guérisseurs itinérants des Andes. L'Orstom, Paris.
- GÓMEZ-POMPA, A., SALVADOR FLORES, G., and ALIPHAT FERNÁNDES, M., 1990: The sacred cacao groves of the Maya. *Latin American Antiquity* 1, pp. 247-257.
- HABERLAND, W., 1991: Amerikanische Archäologie. Geschichte, Theorie, Kulturentwicklung. Wiss.Buchgesellschaft, Darmstadt.
- HAMMERSTONE jr., J.F., ROMANCZYK jr., L.J., and AITKEN, W.M., 1994: Purine alkaloid distribution within *Herrania* and *Theobroma*. *Phytochemistry* 35, pp. 1237-1240.
- (HERNÁNDEZ, FRANCISCO, 1572–1577): *Rerum medicinarum Novae Hispaniae Thesaurus*. Revised by N.A. Recci; printed 1628-1651 by Mascardi in Rome. Autotype: Libreria dello Stato, Rome, 1992.
- HOCHHEIMER, A., 1977: Die Straßen der Völker. Benziger Verlag, Zürich u. Köln.
- HUMBOLDT, A. von, 1809: Mexico-Werk. Hrsg.H.BECK, Wiss.Buchgesellschaft, Darmstadt, 1991.
- KRUMBACH, H., 1993: Führungsblätter für das Imhoff-Stollwerck-Museum Köln.
- KRUMBACH, H., 1997: Kakao, Trank der Götter und Eroberer. die waage, Zeitschrift der Grünenthal GmbH, Aachen, Bd. 36, pp. 66-72.
- KRUMBACH, H.: Gedanken über transpazifische und transatlantische kulturelle Kontakte zu Zentral- und Südamerika. *Acta Ethnologica et Linguistica*, Bd.19, pp. 155-170, Nr.72, Wien, 2000.
- KUTSCHER, G., 1950: Chimú. Eine altindianische Hochkultur. Gebr.Mann, Berlin.
- LATHRAP, D.W., COLLIER, D., and CHANDRA, H., 1975: Ancient Ecuador. Culture, Clay and Creativity 3000 – 300 B.C.. Field Museum of National History, Chicago.
- LAVALLÉE, D., und LUMBRERAS, L.G., 1986: Die Andenvölker von den frühen Kulturen bis zu den Inka. Verlag C.H.Beck, München.

- LEYENAAR, T.J.J., van BUSSEL, G.W., WEBER, G., 1992: Von Küste zu Küste. Präkolumbische Skulpturen aus Meso-Amerika. Weber & Weidemeyer, Kassel.
- LONGHENA, M., und ALVA, W., 1999: Die Inka und weitere bedeutende Kulturen des Andenraumes. White Star, Vercelli. German edition (Transl. M.Pausch): Karl Müller Verlag, Erlangen.
- MOERMAN, D.E., 1981: Geraniums for the Iroquois. A field guide to American Indian medicinal plants. Reference Publ., St.Clair River Drive/Mich.
- OBEREM, U., und HARTMANN, R., 1982: Zur Seefahrt in den Hochkulturen Alt-Amerikas. Kolloquien z.Allg.u.Vergleichenden Archäologie, Bd. 2, pp. 121-157. Verlag C.H.Beck, München.
- OVIEDO, G.F. de, 1526: Sumario de la Natural Historia de las Indias. Ed.: MIRANDA, J., 1950. Fondo de Cultura Económica, Mexico.
- PATÍÑO, V.M., 1963-1974: Plantas cultivadas y animales domésticos en América Equi-noccial. Tom.I-VI, Imprenta Departamental, Cali (Colombia).
- ROYS, R.L., 1931: The Ethno-Botany of the Maya. Tulane Univ.Louisiana, New Orleans. Reprint: ISHI, Philadelphia, 1976.
- SAHAGÚN, B. de, 1569: see GALL, A. von, 1940.
- SCHULTES, R.E., 1980: The Amazonia as a source of new economic plants. Economic Bot.33, pp. 256-266.
- SEIBERT, P., 1996: Farbatlas Südamerika. Landschaften und Vegetation. Verlag Eugen Ulmer, Stuttgart.
- SOLÍS, F., und CARMONA MACIAS, M., 1997: Gold – ein heiliges Metall im Alten Mexiko. In: W.SEIPEL (Ed.): Gold und Silber aus Mexiko. Ausstellungskatalog. Kunsthistorisches Museum Wien, Wien.
- SOMMERHOFF, G., und WEBER, CH., 1999: Mexiko. Geographie, Geschichte, Wirtschaft, Politik. Wiss.Buchgesellschaft, Darmstadt.
- SOTO NUÑEZ, J.C., y SOUSA, S.M., 1995: Plantas medicinales de la cuenca de Río Balsas. Universidad Nacional Autónoma de México, México D.F.
- SOUSTELLE, J., 1968: Archaeologia Mundi: Mexiko. (German translation by R.STREIFF). Nagel Verlag, München, Genf, Paris.
- SPRECHER VON BERNEGG, A., 1928: Tropische und subtropische Weltwirtschafts-pflanzen, Bd. I. Ferd.Enke, Stuttgart.
- SPRECHER VON BERNEGG, A., 1934: Tropische und subtropische Weltwirtschafts-pflanzen, Bd. III/1: Kakao und Kola. Ferd.Enke, Stuttgart.
- STIERLIN, H., 1983: L'Art Inca et ses origines – de Valdivia à Machu Picchu. Office du Livre, Fribourg.

- TOWLE, M.A., 1961: The Ethnobotany of Pre-Columbian Peru. Aldine Publ., Chicago.
- UGENT, D., POZORSKI, SH., and POZORSKI, T., 1986: Archaeological manioc (Manihot) from coastal Peru. *Economic Bot.* 40, pp. 78-102.
- WELTKARTE der Naturgefahren. Beilage zur Naturwiss. Rundschau, 1980.
- WILKERSON, S.J.K., 1997 a: Großwild, frühe Menschen und erste Dörfer im Tiefland Ostmexikos. In: RICKENBACH, J. (Ed.), 1997: Mexiko. Präkolumbische Kulturen am Golf von Mexiko, pp. 19-23. Museum Rietberg, Zürich.
- WILKERSON, S.J.K., 1997 b: El Tajín und der Höhepunkt der klassischen Veracruz-Kultur. In: RICKENBACH, J. (Ed.), 1997 (see WILKERSON, 1997 a), pp. 61-76.
- WILKERSON, S.J.K., 1997 c: In Booten über das Meer – die Herkunft der Nahuas. In: RICKENBACH, J. (Ed.), 1997 (see WILKERSON, 1997 a), pp. 55-59.
- WOLTERS, B., 1997: Zur Verbreitungsgeschichte und Ethnobotanik indianischer Kulturpflanzen, insbesondere des Kakaobaumes. Lecture, 2.Symposium „Tropische Nutzpflanzen“, Inst.Angew.Botanik d.Univ.Hamburg, 25.-27.9.1997, Abstracts p. 28.
- WOLTERS, B., 1999 a: Zur Verbreitungsgeschichte und Ethnobotanik indianischer Kulturpflanzen, insbesondere des Kakaobaumes. *Journal of Applied Botany*, Göttingen, 73, pp. 128-137.
- WOLTERS, B., 1999 b: Zur Domestikation indianischer Nutzpflanzen seit dem späten Pleistozän. *Düsseldorfer Institut für amerikanische Völkerkunde e.V.*, Düsseldorf.
- YEN, D.E., 1974: The sweet potato and Oceania. An essay in Ethnobotany. Bernice P.Bishop Museum Bulletin 236, Honolulu, Hawaii. Bishop Museum Press.
- ZIZKA, G., 1989: Naturgeschichte der Osterinsel. In: 1500 Jahre Kultur der Osterinsel (Ausstellungskatalog). Verlag Philipp von Zabern, Mainz.

Acknowledgements

I owe thanks to Ms Edith Ronneburg (1942-1996), whose assignment to write two books about American medicinal plants led to a treatment of numerous useful plants of the Amerindians, and to Professor Helmut Krumbach, director of the *Düsseldorfer Institut für amerikanische Völkerkunde e.V.*, whose theory about a dissemination of the cacao tree by sea from Ecuador to Central America encouraged me to examine this sea route for useful plants of the tropical region in general as well as the biological implications involved in the case of the cacao tree. I thank Prof. Reinhard Lieberei for the help of his institute in drawing up the maps, and Professor B.G.D. Bartley, for the information he gave me in his letters.

Zusammenfassung

Im Bereich der Karibik sind schon früher Indizien für eine Verbreitung von Nutzpflanzen auf Seewegen durch Indianer seit dem frühen 1. Jahrtausend n. Chr. gefunden worden. Seit in den letzten Jahrzehnten klar wurde, daß die frühen formativen Indianerkulturen West-Ekuadors (Valdivia-Kultur und Nachfolger) von etwa 4000 – 1200 v. Chr. einen Vorsprung in mancher Hinsicht gegenüber ihren Zeitgenossen in Peru und Mesoamerika hatten, häufen sich die Hinweise, daß sie die kulturelle Entwicklung in diesen Räumen auf dem Seeweg per Küstenschifffahrt beeinflußt haben.

Auch für Nutzpflanzen ist ein Austausch zwischen Südamerika und Mesoamerika auf diesen Seehandelsrouten anzunehmen. Die Weitergabe von Erdnuß (*Arachis hypogaea*), Süßmanioke (Sorten von *Manihot esculenta*), Kakaobaum (*Theobroma cacao*), Tabak (*Nicotiana tabacum* und *N. rustica*), großkörnigem Mais (*Zea mays*) und Cherimoya (*Annona cherimola*) auf dem Seeweg von Ekuador nach Mittelamerika und Mexiko wie die Verbreitung von Avocado (*Persea americana*), Paprika (*Capsicum annuum*) sowie Stechapfel (*Datura stramonium* als Rauschdroge und Heilpflanze) in der Gegenrichtung erscheinen nach den archäologischen Zeitdaten ebenso plausibel wie ein entsprechender Austausch dieser Nutzpflanzen (ausgenommen Kakao) zwischen Ekuador und Peru. Die meisten dieser Daten fallen in die Zeit der Chorrera-Kultur (1200 – 500 v. Chr.), die sicherlich Kontakt mit Handelsleuten der Olmeken in Mesoamerika hatte.

Translated by Walburga Hoffmann-Gamarra, M.A., Düsseldorf.
The three maps had to be revised for translation.

Correspondence addresses:

Dr. Bruno Wolters
Heinrichstr. 29
D-38106 Braunschweig
Germany
Phone 0049 531 333854

Düsseldorfer Institut für amerikanische Völkerkunde e.V.
(DIAV)
Merowingerstr. 12
D-40223 Düsseldorf
Germany
Phone / Fax 0049 211 343118
E Mail diav @ gmx.de