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RESULTS OF THE CATHERWOOD FOUNDATION PERUVIAN AMAZON EXPEDITION

The Distribution of *Acetes paraguayensis* Hansen (Crustacea; Decapoda)

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ABSTRACT.—The sergestid *Acetes paraguayensis* Hansen is here reported for the first time from the Amazon Basin, specifically from the rivers Amazonas and Nanay. The species was well established in a lagoon off the Río Nanay, while the two specimens collected from the Amazonas were probably washed in from the Nanay. The current velocity of the Amazonas accounts for the inability of the species to be well established. Some of the chemical and physical characteristics of the environment, where *A. paraguayensis* was collected, is discussed.

The sergestid *Acetes paraguayensis* Hansen 1919 is here reported for the first time from the Amazon Basin. The genus *Acetes* was established in 1830 by Milne-Edwards. The first record from the Americas was that of Ortmann (1893) in his description of *Acetes americanus* from the mouth of the Tocantins, Baia de Marajo, in Brazil's Amazon delta. *Acetes brasiliensis* Hansen 1919 was later put in synonymy with this species (Burkenroad, 1934 a, b).

Hansen (1919) described a second South American species, *A. paraguayensis*, collected in large numbers by Sörenson from southwestern Paraguay. The type locality is a lagoon in the Río Paraguay near its junction with the Río Paraná. Sörenson collected this species also from "the outlet of the Riacho del Oro in Río de la Plata" (Hansen, 1919). As was true of Ringuelet (1949) and Holthuis (1959), I was unable to locate the Riacho del Oro so that this locale is still in question.

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Subsequently *Acetes paraguayensis* was reported from the Río Paraná Mini near La Isla Invernada, Provincia de Santa Fe, in Argentina (Ringuelet, 1949) and from a canal at Paramaribo, Suriname (Holthuis, 1959). The latter record represents the only one outside of the Paraná river-system. The locations of these records are presented in Figure 1.

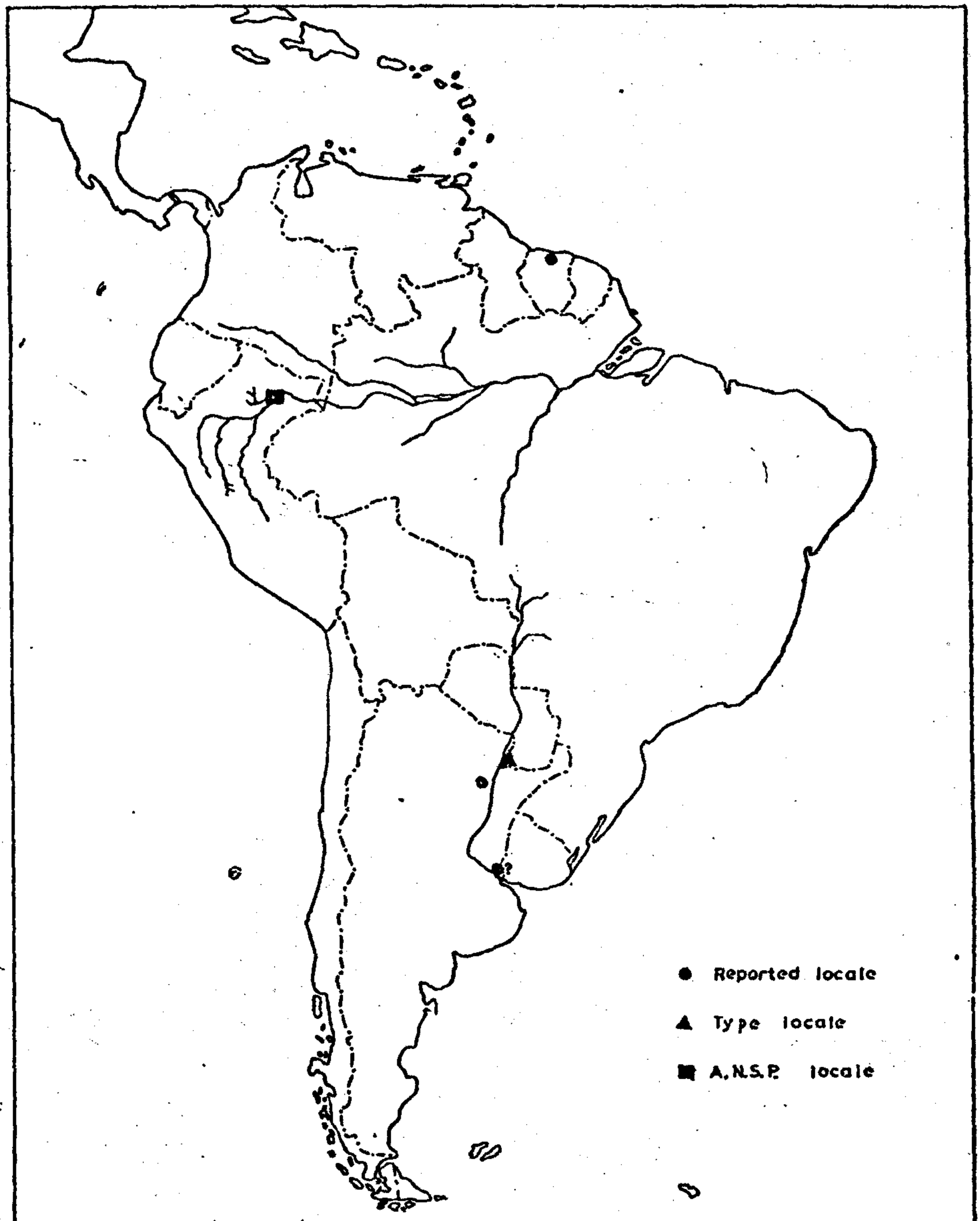

FIGURE 1. Distribution of *Acetes paraguayensis* Hansen.

Easily the most numerous invertebrate organism collected from the Río Nanay (Departamento de Loreto, Peru) during the Catherwood Foundation Peruvian Amazon Expedition in September and October, 1955, was a sergestid of the genus *Acetes*. A total of 473 males and 491 females was collected in the course of seining for fish in a backwater of the Nanay, opposite the navy base in the vicinity of Iquitos. Two further specimens were taken from debris and fallen trees on the right bank of the Río Amazonas at Iquitos.[1]

The Río Nanay specimens were sent to Dr. Fenner A. Chace, Jr., of the U. S. National Museum for identification. Dr. Chace identified them as "*Acetes* near *paraguayensis* Hansen 1919." A gift of co-types from Hansen's series was then arranged with the Zoological Museum of Copenhagen through the courtesy of Dr. Torben Wolff. On the basis of a comparison with these co-types (now A.N.S.P. Number 5768, Plate 1A) I determined the Peruvian collections to be *A. paraguayensis*. The petasma of male specimens (Figure 2) from both the co-types and the Amazon-Nanay are

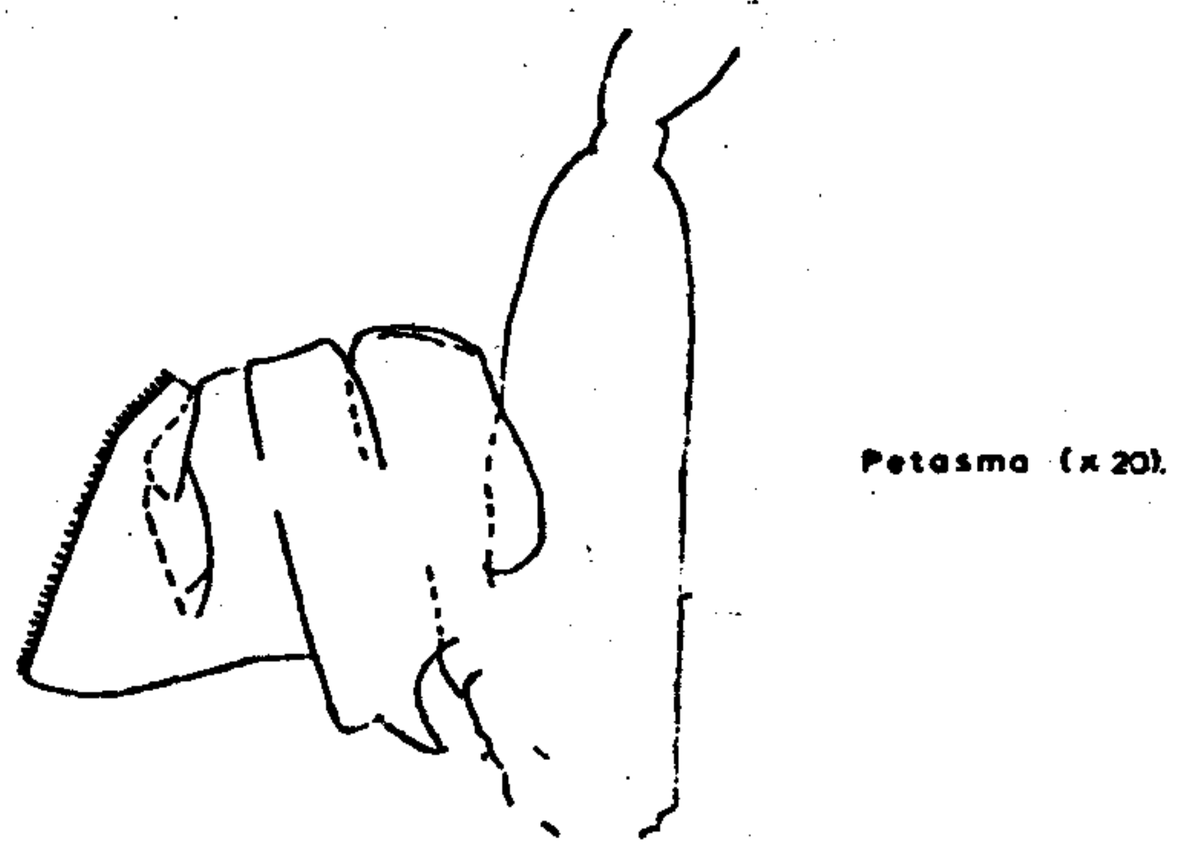

FIGURE 2. *Acetes paraguayensis* Hansen. (After Holthuis, 1959). ♂.

remarkably similar and there is agreement on most other points of recognized diagnostic value. *Acetes paraguayensis* is easily distinguished from *A. americanus*, the species earlier reported from the Amazon system. The form in our collections agrees favorably with that of the Copenhagen material and variations are not sufficiently great to warrant doubt of the validity of the identification. The Nanay specimens are, however, superficially different in gross appearance from the Paraguayan co-types and the Amazonian specimens. These latter have characteristically curved abdomens (Plate 1, A and C), whereas those from the Nanay are more linear, with relaxed appendages (Plate 1B). The differences are probably due to the methods employed in handling. As was noted earlier, the Río Nanay specimens were taken by seining then preserved several hours later. These sergestid specimens assumed the elongated configuration upon relaxation and

[1] These areas are described fully in Patrick and Swabey (in press).

ultimate death in the interim before preservation. Those from the Amazon were dip-netted and preserved alive.

Amazonian Records

Holthuis (1959), in his discussion of the distribution of *A. paraguayensis*, concluded that this was the species designated "*Acetes* sp. near *paraguayensis*" by Burkenroad (1945) from the "Amazon basin," on the basis of Burkenroad's statement that the "*Acetes paraguayensis* group" is found in both the Paraná and Amazon systems.

Since Burkenroad's (1945) "group 3" of *Acetes* could only include *paraguayensis* of described species (all other species referable to others of his groups), he may have known of some material of this group from the Amazon (perhaps the "*A.* sp. near *paraguayensis*" of p. 563). If he did, we have only his hints as to its existence, for he never listed, described, or gave locality data for any Amazon specimens. Regardless of what "river *Acetes*" from the Amazon Burkenroad might have seen, the present series from Peru is the first documented series of the *paraguayensis* group to be recorded from the Amazon and whose characteristics are discussed.

Ecological Observations

Hansen (1919) spoke of *A. paraguayensis* occurring in large numbers at the type locality in Paraguay. Again, Ringuelet (1949) referred to this species as being the most common shrimp in the Río Paraná and some small tributaries, forming an important constituent in the diet of various species of fishes. Our collections indicate that the species was well established in the Río Nanay. Other species which have been observed to exhibit similar swarming and gregariousness are *A. carolinae* Hansen, at Beaufort, North Carolina (Hansen, 1933), and *A. erythraeus* Nobili, an Indo-Pacific species (Menon, 1933).

The ability of *A. paraguayensis* to maintain itself in fast-flowing freshwater rivers warrants some comment. The velocity of both the Amazon and the Nanay was relatively high, with that of the Amazon greater by far (Table 1). In view of the rapid current in the Amazon, I believe that the two specimens of *A. paraguayensis* collected there had been washed in from the Río Nanay.

TABLE 1. *Current velocities (feet per second) of the Río Amazonas near Iquitos, Peru, and the Río Nanay (determined by Gurley meter).*

River	Date	Velocity, feet per second		
		Maximum	Minimum	Average
Río Amazonas				
center	10/18/55	15.55	11.12	13.70
right bank	10/18/55	11.12	8.89	9.55
Río Nanay	10/17/55	2.13	1.05	1.62

PLATE 1. A. *Acetes paraguayensis* Hansen cotype from Río Paraguay, A.N.S.P. No. 5768; ×8. B. *A. paraguayensis* from Río Nanay, Peru, A.N.S.P. No. 5753; ×8. C. *A. paraguayensis* from Río Amazonas, Iquitos, Peru, A.N.S.P. No. 5761; ×10.

Dr. F. A. Chace commented [2] on the situation as follows: "I cannot help but speculate on how sergestids maintain a population so far up a fresh-water river. . . . Two possible ways for the Acetes populations to maintain themselves in the Paraguay and Nanay rivers occur to me: (1) The eggs may be attached to vegetation and the larval history abbreviated, or (2) the species may live only in partially enclosed back waters or lagoons where there is little current to sweep the eggs and larvae downstream."

There is reason to believe that Dr. Chace was close to being correct on both possibilities. I feel, however, that it is the larval stage which is able to attach to submerged vegetation. Although little is known of the larval history of *A. paraguayensis*, the larval forms of other species have been described. In 1882 Brooks referred to the free and moveable chelate exopodite of the acanthosoma stage of "an American species of *Acetes*." *Acetes erythraeus* was described by Menon (1933) as having larvae bearing prominent chelae on the walking legs. In the adult these chelae "are so minute that they easily escape notice" (Colefax, 1940). Colefax described a similar situation in the case of *A. australis* Colefax 1940. And finally, Soyejima (1926) [3] described the nauplius of *A. japonicus* Kishinouye with "big claws or jaws" on the third pair of legs. These are drastically reduced in size in subsequent stages. Such morphological characteristics would undoubtedly facilitate the maintenance of the larvae in fast-flowing streams.

This brings us to Chace's second postulation. Soyejima (1926) observed that *A. japonicus* tended to aggregate outside the areas of main current, and, as noted, the *A. paraguayensis* collected in Peru were found in a backwater of the Río Nanay. Although the water velocity of this backwater was not determined, I can safely assert that it was less than that in the river proper. It is probable that, like *A. japonicus*, *A. paraguayensis* occurs successfully only in areas removed from the main river flow.

Very little is known concerning the chemical composition of the water from which *Acetes paraguayensis* was taken prior to this report. In his type description Hansen (1919) remarked that "it is interesting that this species has been taken . . . more than a hundred geographical miles from the Atlantic." His surprise, no doubt, was due to the fact that earlier reports of the genus *Acetes* were limited to oceanic or estuarine habitats. Kemp (1917) stated that the Indo-Pacific species of *Acetes*, though commonly found in estuaries where the water was "quite fresh," penetrated "little, if at all, beyond the reach of tidal influence." Colefax (1940) likewise considered the genus to be marine, extending into low salinity in estuaries.

In the case of *Acetes paraguayensis* the restricted type locality (Hansen, 1919) was described later as being fresh water (Holthuis, 1959). The single specimen collected by Sörenson from the Río de la Plata came from

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[2] Personal communication to C. W. Hart, Jr., A.N.S.P., April 21, 1959.
[3] From translation by Mr. Jiichiro Takeo of the University of Pennsylvania.

"feebly brackish water" (Hansen, 1919). Subsequent collections by Ringuelet (1949) and Holthuis (1959) came from fresh water and "slightly brackish water," respectively. Thus, of the four previous reports of this species, two came from fresh water and two from brackish. Unfortunately, no chemical analyses of these waters are available for comparison with those made on the Amazon and Nanay during the Catherwood Foundation Expedition. The results of the latter are detailed elsewhere (Patrick and Swabey, in press). Briefly, however, the water of the Nanay in the vicinity of the backwater from which hundreds of *A. paraguayensis* were collected was fresh, acidic, very soft, turbid and deep brown in color. The Amazon at Iquitos also was fresh but slightly alkaline, turbid, yellow in color and contained moderate quantities of dissolved substances.

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