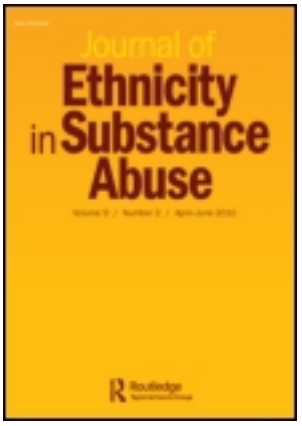

Journal of Ethnicity in Substance Abuse
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/wesa20

The Use of Coca: Prehistory, History, and Ethnography

Victor B. Stolberg [a]
[a] Essex County College, Newark, New Jersey
Version of record first published: 14 Jun 2011.

To cite this article: Victor B. Stolberg (2011): The Use of Coca: Prehistory, History, and Ethnography, Journal of Ethnicity in Substance Abuse, 10:2, 126-146

To link to this article: http://dx.doi.org/10.1080/15332640.2011.573310

Journal of Ethnicity in Substance Abuse, 10:126–146, 2011

ISSN: 1533-2640 print/1533-2659 online
DOI: 10.1080/15332640.2011.573310

Routledge
Taylor & Francis Group

The Use of Coca: Prehistory, History, and Ethnography

VICTOR B. STOLBERG
Essex County College, Newark, New Jersey

The purpose of this article is to review the use of the natural mild stimulant coca, which is a story that originates with the prehistory of coca, evolves through its following historical uses, and leads up to the eventual development of cocaine. This discussion will begin with the botanical background of the coca plant, followed by a review of some of the prehistoric, historic and ethnographic evidence of coca use, which indicates the extensive antiquity and pervasiveness of coca use in South and Central America. The diverse roles that coca played among the Inca and other indigenous peoples led to the early adoption of coca in the West and, in turn, to the resultant discovery of cocaine and its assorted early applications, particularly for medicinal purposes.

KEYWORDS coca, cocaine, culture, history, substance use

INTRODUCTION

The purpose of this article is to provide an historical overview of coca and its role in the introduction of cocaine. The discussion begins with a brief examination of the botanical background of the coca plant, the source of cocaine as well as of coca leaves. This information provides the environmental context permitting at least the possibility for the indigenous use of coca. This section is followed by a cursory review of some of the prehistoric evidence relating to the use of coca, particularly as documented in the archaeological record. The prehistory of coca use indicates the extensive antiquity and pervasiveness of coca use in South and Central America. The next section is concerned with the era of the Inca and the roles that coca played among them. Attention is then devoted to some of the ethnographic material

Address correspondence to Victor B. Stolberg, Essex County College, Counseling Services, 303 University Avenue, Newark, NJ 07102. E-mail: stolberg@essex.edu

concerned with the use of coca, which is supported by studies in related areas. This body of evidence leads to the early adoption of coca in the West and to the resultant discovery of cocaine and its assorted early applications, particularly for medicinal purposes.

BOTANICAL BACKGROUND

Cocaine is the product of a natural plant, the coca shrub (*Erythroxylum* Spp.), of which there are several varieties (Plowman, 1986a). Two main species of coca bush native to western South America provide the coca leaves of commercial value: *Erythroxylum coca* and *Erythroxylum novogranatense*, which are cultivated over a wide area. There are numerous other coca species, most of which grow wild across the region. Cocaine has also been extracted from the leaves of wild *Erythroxylum* species from Bolivia, Brazil, Ecuador, Paraguay, Peru, Mexico, the United States, Venezuela, and Mauritius (Bieri, Brachet, Veuthey, & Christen, 2006; Plowman, 1988).

Europeans quickly learned of the plant and its uses after initial contact. In describing coca, many of the early Spanish explorers related that the coca plant was similar to sumac (Parkerson, 1983). There is a considerable history of the scientific identification of different species of *Erythroxylum* (Plowman, 1982), which began in 1756 when the name of the genus was first published (Plowman, 1976). The diversity of the *Erythroxylum* species is at least partly related to differences of topography, climate, and soil types. For example, it has been estimated that there are at least 45 different *Erythroxylum* species in just one state of Brazil (Plowman, 1986b, 1987). Approximately 250 species of the genus *Erythroxylum* have been identified, many of which produce cocaine (Streatfeild, 2001).

Chemical analysis of coca leaves has led to the identification of several (ca. 18) different alkaloids (Novak, Salemink, & Khan, 1984), the two most important being cocaine and cinnamoylcocaine (Rivier, 1981). Varying levels of these alkaloids and of methylsalycilate and other essential oils impart differing aromas and flavors to various sources of coca leaves. Coca leaf chewers have their personal preferences and report this as a discernible difference.

Contrary to assertions that coca chewing leads to malnutrition, it can actually satisfy recommended daily nutritional requirements for calcium, phosphorus, riboflavin, and vitamin A (Plowman, 1986a). The nutritional value of coca is actually well established (Duke, Aulik, & Plowman, 1975), as are its metabolic effects (Bolton, 1976). In fact, there appears to be little evidence to support the widely cited assumption that coca chewing produces a loss of appetite that, in turn, leads to a reduced consumption of food (Burchard, 1992). Coca chewing has also been suggested to be a cultural response to high altitude stress (Fuchs, 1978); however, there is little

physiological evidence to support this contention (Bray & Dollery, 1983). On the other hand, one study matched habitual coca chewers from Peru with controls and found that the coca chewers had a greater incidence of certain health problems, including hookworm anemia, and a greater number of days of incapacitating illness (Buck, Sasaki, Hewitt, & Macrae, 1968). More directly, the use of homeopathic coca has been shown to significantly reduce the effects of high altitude mountain sickness (Shackelton, Tondora, Whiting, & Whitney, 2000). Considerable research has been conducted on the biological aspects of coca use (Bittmann, 1983; Hanna, 1970, 1971, 1974).

PREHISTORIC EVIDENCE

Coca was used for millennia by indigenous peoples of the New World as a general stimulant, as well as for medicinal and other varied purposes (Grinspoon & Bakalar, 1981; Martin, 1970). The origins, evolution, diffusion, and use of coca thus have a long tradition in Central and South America (Plowman, 1984). As discussed above, coca grows wild across the region; however, it has been cultivated as well. Archaeological evidence from central Peru, for instance, has indicated the cultivation of coca around 1900 to 1750 B.C. (Patterson, 1971).

The antiquity of coca use is well established through archaeological studies in South and Central America. For example, analysis of mummified human remains from the Alto Ramirez culture of northern Chile, dated circa 1000 B.C., have indicated the use of coca (Rivera, Aufderheide, Cartmell, Torres, & Langsjoen, 2005). Two thousand year old mummies from the region around Nazca, Peru, have been found with *chuspas*, or small bags of coca leaves (Cartmell, Aufderheide, Springfield, Weems, & Arriaza, 1991).

Archaeological indicators of coca use are manifold from sites across the Andean region of South America and in parts of Central America. For example, small ceramic, gourd-like lime containers have been found in archaeological contexts; these specimens are analogous to small gourds used contemporaneously as lime containers by coca chewers. Samples of these ceramic lime containers from the Valdivia culture have been excavated at sites on the Santa Elena Peninsula of Ecuador and date to approximately 2100 B.C. (Plowman, 1984). Earlier (circa 8850 to 4650 B.C.) lime containers made of shell have been found in burials at the site of Las Vegas, Nevada, and on the Santa Elena Peninsula of Ecuador (Stothert, 1988; Stothert & Freire, 1997). Other objects have been recovered from archaeological contexts that also indicate the prehistoric practice of coca chewing. One of the best known and well documented categories of such objects is that of figurines of coca chewers known as *coqueros* (Vidart, 1991). Ceramic *coqueros* dated circa 500 B.C. have been found at Carchi sites in Ecuador (Myers, 1976).

The frequency of coca use appears to have varied among prehistoric populations. Radioimmunoassay of hair samples from mummified human remains found in northern Chile suggests that coca use was well established in that area approximately 2000 years ago and that in at least among one group, the Maitas Chiribaya culture, the majority of adults regularly used coca leaves (Cartmell, Aufderheide, Springfield, et al., 1991). Cocaine metabolites have been found in many South American mummified human remains, such as a group of eight mummies from Chile dated between 2000 B.C. to 1500 A.D. (Cartmell, Aufderheide, & Weems, 1991). Similarly, two metabolites of cocaine—benzoylecgonine and ecognine methyl ester—have been found in gas chromatography/mass spectrometry analysis of hair from ancient Peruvian mummies dated to 1000 A.D.; the metabolite levels detected were well below those of modern cocaine abusers and there was no significant difference found between the remains of males and those of females (Springfield, Cartmell, Aufderheide, Buikstra, & Ho, 1993). On the other hand, there is also evidence indicating that some of the prehistoric Andean mummified individuals who were found to have coca quids in their mouths were not necessarily coca leaf chewers prior to interment (Cartmell, Aufderheide, Springfield, et al., 1991).

Habitual coca chewing has also been indicated by dental analysis of ancient human remains, including specimens from coastal Peru (Indriati & Buikstra, 2001) and from northern Chile (Langsjoen, 1996). It has been demonstrated through dental evidence from archaeological samples that the custom of chewing coca leaves is an effective predictor of periodontitis, which results in considerable tooth loss prior to death (Langsjoen, 1996).

Archaeological evidence other than mummies and dentition has also indicated the prehistoric use of coca. For example, remains of coca and various plant hallucinogens have been found in studies of Nazca ceramics (Dobkin & Cardenas, 1980). Mochica ceramics that depict coca chewers have also been found (Sawyer, 1966). A painting found on a Moche ceramic vessel depicts the entire process of extracting lime from a small vessel by means of a thin spatula for use with a quid of chewed coca leaves (Moseley, 2004, p. 45). Among the Chavin, evidence indicates that the first leaves of the coca harvest had to be offered to the gods before they could be chewed by humans (Burger, 1988; Rostworowski, 1988).

There are archaeological indications that pre-Inca use of coca was primarily a prerogative of the upper social classes (Fierns, 1991). There is also evidence indicating that coca was transported considerable distances and available, at least in elite status contexts, in highland zones where it was not cultivated (Hastorf, 1987). The Quimbaya of Columbia made containers of gold to hold the lime they used with the chewed coca leaves (Karch, 2006). There are also ethnohistorical accounts of its use in religious ceremonies by elite rulers and priests in the Andes region (Appelboom, 1991). In this regard, wooden animal figures (*illas*) have been identified as being used to

burn coca leaves in various Andean ceremonies (Cortella, Pochettino, Manzo, & Ravina, 2001).

INCA AND COLONIAL ERAS

The Inca held sway over the fastest growing empire of the fifteenth century, which consisted of environmentally diverse regions in South America, including coca producing areas (Fernandez-Armesto, 2007). The organization of economic activities in the Inca empire reflected the pronounced biodiversity of the Andes region, of which coca was an important component (Zimmerer, 1993). Agricultural production, including that of coca, was mobilized to finance the expansion of the Inca empire (La Lone & La Lone, 1987). Thus, after the conquest of new lands, the Inca would establish coca plantations in physically suitable areas as part of their land-use strategy (Kelly, 1965). The Inca empire used coca leaves as both a staple and wealth product to help meet the economic needs of running the empire (D'Altroy & Earle, 1985). In fact, a complex system of storehouses, including those for coca, was developed and maintained to support the running of the Inca empire (D'Altroy & Hastorf, 1984). Control over coca trade routes was an important factor in the Inca empire (Bauer, 2004). The coca trade itself was conducted by specialized long distance traders (*mindales*) who enjoyed special privileges, like the right to travel more widely than others and the right to pay their tribute in gold instead of labor (Alchon, 2002).

Under Inca rule, coca was regarded as a sacred substance and its use was a privilege of social status (Rogers, 1963). Coca was declared by Inca priests to be a gift of the Sun God and was considered a divine plant (Gay, Inaba, Sheppard, Newmeyer, & Rappolt, 1975). Accordingly, chewing coca leaves was restricted to elite members of Inca society, such as the priests and members of the ruling classes. There were, of course, exceptions. In fact, there is debate as to how widespread or enforced such restrictions on coca use actually were throughout the Inca empire (Parkerson, 1983). For instance, Incan court orators (known as *yaravecs*) were permitted to use coca, purportedly to aid their memory as they recited Incan history as recorded on *quipo*, knotted string records (Julien, 1988). Under the Inca empire, relocated colonists (known as *mitmaqcura*) were allowed to chew the sacred coca leaves normally reserved for the Inca elite (MacQuarrie, 2007). A bag of coca was given as part of the award of Inca royal recognition for a minor accomplishment (Brundage, 1963). Coca leaves were used for assorted religious ceremonies and other special rituals by the Inca. For example, coca was used as an aid to divination by pre-Columbian Andean diviners (Silbverblatt, 1987). Coca leaves were among the ritual offerings thrown into a river by Inca priests attempting to wash away illness (Murra, 1980). The mascot of the royal Incas was a white llama, who represented

the first animal to appear after the flood; this sacred animal was trained to chew coca leaves (Brundage, 1963).

Coca was actually a pervasive phenomenon of Inca society. It was a standard social obligation for a high status member of Inca society to provide ritual goods, principally coca, any time a request for assistance was made (Murra, 1980). Offerings of coca and other goods were made during the beginning of the initiation ceremony of young men (Bauer, 1998). Merchants about to go on a business journey would make offerings for their good fortune (Bauer, 1998). Coca was widely used for medicinal purposes, such as "to allay cold, fatigue, pain, and hunger" (Rostworowski, 1988, p. 6). Offerings of coca were made to major and minor deities (Spalding, 1984). Inca messengers used coca to assist with their running long distances at high altitudes (Chowdhury, 1995). The Inca dead were buried with coca leaves as a ritual grave offering. It was believed that if, at the moment of death, "the moribund person was able to perceive that taste of the coca leaves pressed against his mouth, his soul would go to paradise" (Blejer, 1965, p. 701). Mummified remains were sometimes brought out of tombs to celebrate ceremonies and festivals with the community, and they had to be propitiated with coca and other offerings (Spalding, 1984).

In 1532, Francisco Pizarro led an expeditionary force into Peru and conquered the Inca (Prescott, 1851). Tribute was paid to Pizarro and other *conquistadores* by work, typically in coca or corn fields (Varon Gabai, 1997). This custom continued in the subsequent colonial period. For example, the sustenance of priests was generally provided for by the proceeds of their coca and corn fields (Varon Gabai, 1997); this is attested to in a 1539 letter to Charles V, King of Spain, from Bishop Valverde of Peru who asserted that coca was "the main income from tithes" (Varon Gabai, 1997, p. 249). Father Bernabe Cobo published his first-hand account of the Inca in 1653, which included noting the role of coca as a trade item (Cobo, 1979), its cultivation on plantations (Cobo, 1979), its transport (Cobo, 1990), its sacrificial uses (Cobo, 1990), and, its role as an offering to the dead (Cobo, 1990).

The early Spanish colonial administrators of Peru quickly usurped the sources of revenue the initial conquerors had seized, including the lucrative coca fields (Varon Gabai, 1997). In fact, the highly lucrative nature of the coca trade resulted in the harsh exploitation and death of innumerable natives during the Spanish colonial period (Hemming, 1973). Local European merchants would make coca and other items available on credit at inflated prices (Graubark, 2007, p. 202); although it was soon realized that the introduction of credit had devastating economic consequences for the indigenous peoples (Graubark, 2007). Indigenous inhabitants continued to pay their tribute in coca (Varon Gabai, 1997). Coca plantations were expanded and sources agree that coca production "increased dramatically

after the conquest" (Varon Gabai, 1997, p. 249). The expansion of coca cultivation under the Spanish directly led to an increase in disease mortality because indigenous environmental safeguards were disregarded (Gade, 1979).

After the Spanish conquest, coca use was made available to the common class. It was recognized that coca use allowed peasants to work longer and harder, and that their appetites were substantially suppressed. Spanish colonial coca growing was closely associated with coca's use as an aid for strenuous work, such as in the silver mines (Lyon, 2004). Coca leaves became so ubiquitous in South American societies that they functioned as a medium of exchange, essentially as a form of currency within a bartering society. During both periods of Incan rule and that of the subsequent Spanish colonial administration, coca was grown and used to deal with endemic disease in the region (Gade, 1979). It continued to be a critical economic resource for some time. In fact, under early Spanish administrators, some taxes "had to be paid in coca leaves, a commodity in which the administration had a very profitable turnover" (Mortimer, 1901, p. 28). Nevertheless, debate raged during the early colonial period in Peru between the clergy and the colonial bureaucrats as to the desirability of prohibiting the use of coca (Gagliano, 1963), as the clergy argued that it served as an impediment to Christianization, labeling it the "Devil's leaf" (Parkerson, 1983, p. 107). In this regard, Pedro Sarmiento de Gamboa wrote in his 1572 report to Philip II, King of Spain, that offerings of coca were made by the natives for various purposes, such as when visiting a shrine (Sarmiento, 1572/1907) or when an Inca divine ruler passed by (Sarmiento, 1572/1907). Furthermore, African diasporic individuals were absorbed into colonial societies; Afro-Peruvian ritual specialists, in particular, helped facilitate a gradual and progressive shift from indigenous customs to a hybridized colonial Andean culture, which included a prominent role for coca and associated ritual practices (Garofalo, 2006). Admittedly, coca chewing is an acquired habit and one that was not readily adopted by many Spanish colonists, although they had no qualms about employing it as an assist with the exploitation of the indigenous inhabitants (cf., Arzan de Orsua y Vela, 1737/1962). At any rate, coca use was a firmly established custom within many South American cultures, particularly those within the Andean region.

ETHNOGRAPHIC LESSONS AND SUPPORTING STUDIES

Coca leaf chewing is most common among peoples living in Bolivia (Johnsson, 1986) and Peru (Gutierrez Noriega, 1949; Zapata-Ortiz, 1970), but it is also practiced by populations in Argentina, Brazil, Chile, Columbia, Ecuador, and Venezuela. The practice of coca chewing serves as a marker of cultural identity

for many residents of Andean communities (Allen, 1986, 1988). In fact, the "handling, sharing, and consumption of coca leaves is governed by clearly defined rules of etiquette" (Allen, 1981, p. 157). Across the Andean region, social greetings and most "activities are initiated with an exchange of coca, and contracts are sealed with it" (Bastien, 1978, p. 19).

In actuality, the "chewing" of coca leaves is more of a sucking process. A wad of dried coca leaves is placed between the cheek and gums and is then gradually moistened by salivation; a pinch of lime or similar agent is inserted into the center of the coca wad to promote the separation of the leaf's alkaloids, among which is cocaine.

Ethnographers have reported that "coca's effect is similar to that produced by a cup of coffee and an aspirin tablet" (Allen, 1988, p. 221) among Andean peoples. Ethnographic reports suggest that although some women may chew coca leaves, it is a more common practice among men. This difference was explained by one informant "that coca was an 'invention' originally intended for men, not women" (Urton, 1981, p. 19).

The two main indigenous Andean ethnic populations that have been found to use coca leaves are groups of the Aymara and of the Quechua. As discussed above, there is evidence indicating that coca has been used in this region for a considerable period of time. These two indigenous ethnic populations have experienced similar patterns of social and economic development. They, as well as other indigenous South American peoples, continue to use coca in manifold ways. For example, the smoking and snorting of coca leaves has been reported.

Today, coca continues to be used; usually the coca leaves are chewed as a quid or brewed as a tea. Coca is generally regarded as a mild stimulant, which also has religious and medicinal uses. The coca quid (*cocada*) is usually chewed along with an alkali, typically lime, to increase the amount and the rate at which the alkaloids are released. This lime can be produced by burning seashells, limestone, or plants, some *metizo,* or White chewers, may use bicarbonate of soda or baking powder as the alkali. The lime is often stored and carried in carved gourds. Among the Quechua, the lime is referred to as *ishku* and the gourd container as *ishkupuru*, which is dispensed by use of a small bone or wooded spatula. Among the Aymara, men and women use a *wistalla*, a small bag used for holding coca leaves (Dransart, 1997).

The chewing of coca leaves is an important symbol of cultural identity among many Andean peoples. Among the Quechua, chewing coca leaves within the appropriate rules of etiquette is a visible demonstration that one shares in the Quechua cultural traditions. Thus, when two or more Quechua adults participate in the *hallpay* ceremony, there is a reciprocal sharing of coca leaves along with a set of prescribed phrases of thanking and of invocations to spiritual beings (Allen, 1981). In fact, friendship and affection for someone is shown among the Quechua by "chewing coca with them in their

houses" (Harvey, 1997, p. 33). Accordingly, refusal to chew coca is sufficient to have one labeled as asocial among the Quechua. Furthermore, the chewing of a *cocada* is used as a commonly understood measure of both time and distance in the Andes; one *cocada* lasts approximately 45 minutes and walking at a comfortable pace for one *cocada* is understood to cover about 2 km of steep terrain or 3 km of level ground (Streatfeild, 2001).

Coca is an important part of most rituals performed by the Quechua (Allen, 1982). For example, for a shaman to reach the "pitch of spiritual susceptibility, he must chew quantities of coca leaf, smoke tobacco, drink neat alcohol and grape spirit" (Platt, 1997, p. 200). Some Andean shamans have also been reported to smoke coca leaves for magical purposes. Furthermore, to make any supplication or plea for divine assistance, a Quechua adult might offer perfect coca leaflets (Platt, 1997). Special leaves of coca can be venerated as Mothers of Coca (Silverblatt, 1987).

Coca, along with *chicha* beer and black and white ground corn, is part of the standard offering made to Andean gods (Silverblatt, 1987). Coca leaves are traditional offerings made to the mountain gods, known as *Wamanis*, of south-central Peru, and it is understood that the sacred shrines where these ritual offerings are made "are dangerous places for women to be. A woman might become deathly ill, or be swallowed into the mountain's interior, if she should approach one of these shrines" (Silverblatt, 1987, p. 24). Coca is also among the traditional offerings made to *Pachamama*, the Earth Mother and goddess of fertility (Menzel, 1996; Silverblatt, 1987), as well as to her daughter, *Cocamama* (Silverblatt, 1987).

Coca leaves are also used for divination purposes. Among the Quechua, it is believed that *kuka willan* ("coca tells"), and one might routinely ask assistance of coca in making decisions of daily life. One can ask coca questions on their own or they can consult a *chrajchrakuj* ("one who knows how to chew"), of which it is recognized that there are both casual and professional practitioners. In seeking an answer on their own, a Quechua adult might hold a few coca leaves cupped in his or her hands and quietly ask a question and then spread his or her hands out. The dark upper surface of each leaf is felt to be *kara alli* ("the face is good," meaning a good omen and an affirmative response), whereas the underside of a leaf is *chapa* (indicating a bad omen and a negative response). A friend or kinsmen may be solicited as a casual *chrajchrakuj* and requested to ask a question of coca, while for more serious inquiries one would more likely consult an expert *chrajchrakuj* who is known to be more proficient at chewing and listening to coca leaves. Among the Quechua of modern Peru, divination with coca leaves is part of the complex ritual activities performed before a bullfight (Harvey, 1997).

The use of coca leaves is also an integral part of traditional Andean medical practices. Coca aids in diagnosing and treating various ailments. Actually, approximately 70 different Andean folk medicines are based on

the use of coca leaves (Menzel, 1996). In fact, it is estimated that approximately 80% of the high Andean rural population rely on the medicinal use of coca for an array of health purposes (Menzel, 1996).

Coca plays an integral role in many other aspects of everyday life among Andean peoples. For instance, when a young man wishes to marry, he might offer coca leaves to the potential bride's father. When about to give birth, Andean women sometimes still use coca to hasten labor and to ease the pain of childbirth. After the child is born, relatives and friends of the family can celebrate by chewing coca leaves together. The decision of when to cultivate a field is determined by a *Chakrakamayuq* among the Quechua; this individual is generally a well-respected diviner (*paqus*) who is a ritual specialist able to read the movement of certain stars by means of using coca leaves (Condori Mamani & Quispe Huaman, 1996). Coca also plays a part in carnival and other special celebrations among the Quechua (Gifford, Hoggarth, Flores, & Valeriano, 1976). Among the Quechua, a person or animal killed by a lightening strike is "buried on the spot, and thereafter are revered with offerings of coca and alcohol" (Allen, 1997, p. 78). When someone has died, mate de coca is often drank during the wake and a small bundle of coca leaves is routinely placed beside the body in the coffin prior to burial. Coca is also relied on as a source of inspiration. For example, among the Aymara most "women chew coca as they contemplate their weaving forms, colours, and designs" (Arnold, 1997, p. 107).

Coca tea, in addition to chewing coca leaves, is a common way to consume coca in many South American countries. The tea can be brewed from loose coca leaves or be packaged for individual servings in tea bags. Analysis of samples of coca tea bags from Bolivia and Peru indicated that 4 to 5 mg of cocaine is generally yielded per cup of coca tea (Jenkins, Llosa, Montoya, & Cone, 1996). Other alkaloids besides cocaine are also usually present in coca tea, including benzoylecogine, ecognine methyl ester, and cinnamoylcocaine (Jenkins et al., 1996). Analysis of urine specimens colleted after the ingestion of coca tea indicated the presence of cocaine metabolites, such as benzoylecogine (Jackson, Saady, & Poklis, 1991). Thus, the interpretation of urinary benzoylecogine concentrations should consider coca tea consumption. In fact, coca tea ingestion has been demonstrated to result in a positive urine toxicology screen for cocaine (Mazor et al., 2006).

Analysis of hair samples from modern coca leaf chewers in South America has yielded additional evidence of the pervasiveness of contemporary coca use, as well as of its pharmacological properties. For example, a study of hair samples from indigenous populations of daily coca chewers noted high concentrations of cocaine in their hair (Henderson, Harkey, Zhou, & Jones, 1992). Hair samples from Bolivian mine workers, who tend to be regular chewers of coca, likewise showed evidence of cocaine and associated metabolites, including benzoylecgonone and ecogine methyl ester (Moller, Fey, & Rimbach, 1992).

EARLY INTRODUCTION AND MODERN DEVELOPMENTS

Early European explorers of the New World provided firsthand accounts of coca and its use among indigenous peoples. Amerigo Vespucci, an Italian explorer, provided the first European account of people chewing coca leaves based on his 1499 visit to a small island off the coast of Venezuela (Vespucci, 1505-06/1885). Vespucci described it thus: "they all had their cheeks stuffed full of a green herb, which they were continually chewing, as beasts chew the cud" (Lester & Foster, 1846, p. 181). He stated that he was "surprised at their conduct, and could not understand for what purpose they indulged in the filthy practice" (Lester & Foster, 1846, p. 182). Vespucci further noted that: "The women did not chew the herb as the men did, but carried a gourd with water in it, of which they drank" (Lester & Foster, 1846, pp. 182–183). In 1526, Gonzalo Fernandez de Oviedo, a Spanish courtier, explorer, and historian, described the effects of coca use (de Oviedo, 1526/2002). Nicholas Monardes of Seville, Spain, was a physician who published the first European printed description of the coca plant in 1565 (Monardes, 1577). These types of early reports stimulated widespread interest across Europe in the coca plant and its use.

As with many other psychoactive substances, like tobacco (Stolberg, 2007), a commonly held initial appraisal of coca was that its application for medicinal purposes was nearly limitless; that it could, in fact, serve as a general panacea. This fascination with the uses of coca fueled general interest in the plant. In 1708, Herman Boerhaave, a Dutch botanist and physician, published his *Institutiones Medicae*; this was the first *materia medica* that included coca (Boerhaave, 1713). In 1835, Sir William Hooker, the director of Kew Gardens, published his *Companion to the Botanical Magazine*, which contained the first accurate drawing of the coca plant, *Erthroxylum coca* (Karch, 2003).

Reports of coca and its varied effects were made from time to time. For instance, in 1794, Jose Hipolito Unanue (1794) alluded to the aphrodisiacal properties of coca (de la Mata, 2000). In 1859, Dr. Paolo Mantegazza, an Italian neurologist, who had practiced for years in Peru, published a report recommending the medicinal uses of coca, including its purported ability to reduce fatigue, increase mood, ands support sexual activity (Mantegazza, 1859). Mantegazza, who personally experimented with the use of coca, was pleased with its effects and forcefully advocated for its use as an internal medicine (Tricot, 1991).

In the late nineteenth century, coca continued to be widely cultivated, with "extensive plantations" (Anon, 1885b, p. 10) particularly across Peru and Bolivia. In fact, it was then lamented "that the natives who cultivate the coca plant themselves absorb so much of the products of their own cultivation" (Anon, 1886, p. 11), which was cited as a contributing factor behind the "costliness" of cocaine and other coca products.

The chewing of coca leaves was prescribed by many physicians in the late nineteenth century. For example, a patient who chewed coca leaves as prescribed by Dr. William S. Searle exclaimed: "Coca has a magical effect upon me. It seems to act as a nerve tonic" (Searle, 1881, p. 89). In fact, it was generally believed that coca use was not only safe, but that it was possibly even conducive to good health (Searle, 1881). In 1870, Dr. Gazeau reported that coca stimulated nutrition, increased pulse, respiration, and urinary excretion, aided digestion, and strengthened the nervous system (Mariani, 1896).

In 1855, German chemist Friedrich Gaedcke separated the alkaloid cocaine, which he called erythroxyline, from coca leaves (Zaunick, 1956). In 1858–1859, the Austrian frigate *Novarra* carried an expedition to circumnavigate the globe; it returned with a supply of coca leaves requested by the German chemist Friedrich Wohler, who passed them on to his student Albert Niemann (Streatfeild, 2001). In 1859, Niemann, studying at Gottingen University, developed a process to isolate and purify cocaine from coca leaves (Friman, 1999; Streatfeild, 2001). The availability of the purified form of the drug cocaine led to a spate of research on its effects.

During the late nineteenth and early twentieth centuries, coca was widely considered "a most valuable adjunct to the practice of medicine" (Anon, 1884a, p. 2). For example, on December 22, 1884, Dr. William Oliver Moore delivered a paper titled "The Physiological and Therapeutical Effects of the Coca Leaf and its Alkaloid" to a county medical society (Anon, 1884b). Coca chewing, for instance, was acclaimed to be "one of the best remedies for cholera" (Anon, 1887a, p. 2). It was also recommended for a vast array of other ailments. Consequently, coca and its derivative cocaine were readily available, from sources such as the local drug store (Anon, 1887b). However, concerns were expressed at the time that the quality of the coca leaves was suspect and that some of the cocaine on the market was adulterated (Anon, 1887c). Nevertheless, coca continued to be commonly prescribed and used. For example, athletes, such as bicycle racers (Anon, 1893) and race walkers, were regularly administered servings of coca wine.

The most ardent proponent for the therapeutic use of coca was probably Angelo Mariani, a Corsican pharmacist who in 1863 launched his Vin Mariani (Streatfeild, 2001). Mariani imported coca leaves to his native Corsica, where he concocted an extract that he added to wine, which he then sold as "Vin Coca Mariani" (Inciardi, 1992, p. 6). It was purported to cure fatigue and create a feeling of well-being. Mariani actually claimed that his preparation "is pronounced the most efficacious of tonics" (Mariani, 1896, p. 52). Vin Coca Mariani was awarded a Vatican medal of achievement by Pope Leo XIII, who endorsed the drink and used it liberally during his retirement (Inciardi, 1992). In fact, Mariani touted "the numerous honorable mentions and indorsements by the members of the medical profession and those who have occasion to use" his product (Mariani, 1896, p. 67). He further

asserted that "the so-called unhappy consequences of the abuse of Coca are really much more rare than those produced even by tobacco, alcohol or opium" (Mariani, 1896, p. 35).

The use of Vin Mariani, of course, was not without its detractors (e.g., Anon, 1894) and there were also many competing coca products. In fact, coca wine was, in all its variations, immensely popular. After the success of Vin Mariani and similar coca wines was apparent, and as Temperance campaigns were gaining ground, druggist John S. Pemberton of Atlanta, Georgia, substituted a kola nut extract for the wine, but retained the coca extract, which he patented and marketed as "Vin francais cola," later renamed Coca-Cola (Appelboom, 1991). By the early twentieth century, popular concern was mounting over the use of coca and other substances, particularly in assorted patent medicines. This resulted in various regulatory measures, particularly the Pure Food and Drug Act and the Harrison Anti-Narcotic Act. Public media and other estimates of coca use were somewhat exaggerated. For instance, in 1915, Martin Wilbert, Technical Assistant, Division of Pharmacology, Hygienic Laboratory, of the U.S. Public Health Service, admitted that the use of coca, although exceeding that needed for actual medical purposes, was "overestimated" (Anon, 1915, p. 12). Nevertheless, reform efforts were generally successful and coca use declined substantially, at least in Euro-American contexts.

Coca, in various forms, continues to be used routinely in South America. Mate de coca, for instance, continues to be recommended for its possible antidepressant effects (Lozano & Santillan, 2004). Furthermore, modern anecdotal evidence suggests that habitual coca leaf chewing does not necessarily result in chemical dependence. For example, army recruits in Peru, who had previously been regular coca leaf chewers, have been reported to have no apparent difficulty in ceasing use, nor has any difficulty been reported among those who migrated from rural areas in the Andes to urban centers where coca was difficult to obtain (McLaughlin, 1973).

Coca paste, an initial residue formed during the extraction process of getting cocaine from coca leaves, is sometimes smoked in combination with either tobacco or marijuana (El Sohly, Brenneisen, & Jones, 1991). Before the 1970s, coca paste was relatively rare in South America; however, after its establishment serious addiction problems were regularly being reported (Negrete, 1980). The use of coca paste and cocaine has become recognized as a growing public health problem in countries of the Andean region, including Bolivia, Columbia, Ecuador, Peru, and Venezuela (Montoya & Chilcoat, 1996).

Market demand for cocaine, as well as political pressure to restrict cocaine distribution, has significantly changed traditional coca production (Well, 1980). The United States "has pressured Latin American countries to prosecute producers as criminals and to destroy coca cultivation" (Brungardt, 2006, p. 417). Unfortunately, there has been "limited investment in crop

substitution and eradication programs" (Morales, 1990, p. 295). Furthermore, most coca growers assume no responsibility for the dissemination and use of coca paste or other coca products, but simply see coca cultivation as an opportunity to improve the quality of their life (Rojas, 2002). On the other hand, peasant communities growing coca, such as those in Bolivia (Sanabria, 1993), have progressively been incorporated into the international cocaine market, with all of the socioeconomic ramifications accompanying such a transformation. In fact, the political power structure in nations affected by this trade, particularly Bolivia and Peru, has been radically altered (Lee, 1991).

CONCLUSION

Coca, the source of cocaine, has a long and rich history, beginning with a substantial prehistory. An understanding of coca the plant, as well as its varying uses in the Inca culture, through the Spanish colonial period, and as it continues into the ethnographic present, gives a deeper and better appreciation of the place of its chief offspring, cocaine (Gay, Sheppard, Inaba, & Newmeyer, 1973). In particular, the chewing of coca leaves is a practice that is long and venerated, specifically among the indigenous populations of the Andean region. After its introduction to the West, coca enjoyed an era of enthusiastic reception, particularly with respect to its purported medicinal properties, although Euro-America reactions considerably cooled by the early twentieth century. This change in attitude was largely the result of the effects observed by those using the alkaloid of coca—cocaine. Nevertheless, coca continues to play a vital role among many traditional South American groups. Coca has accordingly been used by human societies for millennia, and this tradition appears likely to continue for some time.

REFERENCES

Allen, C. J. (1981a). To be Quechua: The symbolism of coca chewing in highland Peru. *American Ethnologist*, *8*, 157–171.

Allen, C. J. (1982). Body and soul in Quechua thought. *Journal of Latin American Lore*, *8*, 179–196.

Allen, C. J. (1986). Coca and cultural identity in Andean communities. In D. Pacine & C. Franquemont (Eds.), *Coca and cocaine, effects on people and policy in Latin America* (pp. 35–48). Cultural Survival Report, 23. Cambridge: Cultural Survival.

Allen, C. J. (1988). *The hold life has: Coca and cultural identity in an Andean community*. Washington, DC: Smithsonian Institution Press.

Allen, C. J. (1997). When pebbles move mountains: Iconoicity and symbolism in Quechua ritual. In R. Howard-Malverde (Ed.), *Creating context in Andean cultures* (pp. 73–84). Oxford: Oxford University Press.

Anon. (1884a). A.- Prof. C. H. Wilkinson, Editor. *The New York Times* (Wed., Jul. 13, 1884), 2.
Anon. (1884b). The anaesthetic cocaine. *The New York Times* (Wed., Dec. 23, 1884), 3.
Anon. (1885a). Coca. *The New York Times* (Wed., Mar. 13, 1893), 3.
Anon. (1885b). Coca. *The New York Times* (Wed., Dec. 27, 1885), 10.
Anon. (1886). Coca. *The New York Times* (Wed., Apr. 18, 1886), 11.
Anon. (1887a). A cure for cholera. *The New York Times* (Wed., Feb. 4, 1887), 2.
Anon. (1887b). Where first-class drugs are made. *The New York Times* (Wed., Oct. 19, 1887), 8.
Anon. (1887c). Adulterated cocaine. *The New York Times* (Wed., Dec. 11, 1887), 12.
Anon. (1893). Food for bicycle racers. *The New York Times* (Wed., Mar. 13, 1893), 3.
Anon. (1894). Vin Mariani's case; What Prof. Fennel of Cincinnati said in vindication of this tonic. *The New York Times* (Wed., Oct. 28, 1894), 9.
Anon. (1915). 200,000 Drug users in United States; government report says the number of addicts has been overestimated. Figures based on the tax enforcement of Harrison Anti-Narcotic law has been a big success. *The New York Times* (Sun., Aug. 29, 1915), 12.
Appelboom, T. (1991). La consommation de coca dans l'Histoire. *Verhandelingen-Koninklijke Academie voor Geneeskunde van Belgie*, *53*, 497–505.
Arnold, D. (1997). Making men in her own image: Gender, text, and textile in Qaqachaka. In R. Howard-Malverde (Ed.), *Creating context in Andean cultures* (pp. 99–133). Oxford: Oxford University Press.
Arzan de Orsua y Vela, B. (1737/1962). In L. Hanke & G. Mendoza (Eds.), *Historia de la villa imperial de Potosi*. Providence, RI: Brown University Press.
Austin, S. (2002). *Native society and disease in colonial Ecuador*. Cambridge Latin American Studies, 71. Cambridge: Cambridge University Press.
Bastien, J. W. (1978). *Mountains of the condor: Metaphor and ritual in an Andean ayllu*. St. Paul, MN: West.
Bauer, B. S. (1998). *The sacred landscape of the Inca: The Cusco caque system*. Austin, TX: University of Texas Press.
Bauer, B. S. (2004). *Ancient Cusco: Heartland of the Inca*. Austin, TX: University of Texas Press.
Bieri, S., Brachet, A., Veuthey, J. L., & Christen, P. (2006). Cocaine distribution in wild *Erythroxylum* species. *Journal of Ethnopharmacology*, *103*, 439–447.
Bittmann, B. (1983). On coca chewing and high-altitude stress. *Current Anthropology*, *24*, 527–529.
Blejer, H. P. (1965). Coca leaf and cocaine addiction- Some historical notes. *Canadian Medical Association Journal*, *93*, 701.
Boerhaave, H. (1713). *Institutiones medicae, in usus annuae exercitationis domesticos Digestae. Editio altera prima longe auctior*. Leiden: Lugduni Batavorum.
Bolton, R. (1976). Andean coca chewing: A metabolic perspective. *American Anthropologist*, *78*, 630–634.
Bray, W., & Dollery, C. (1983). Coca chewing and high-altitude stress: A spurious correlation. *Current Anthropology*, *24*, 269–282.
Brundage, B. C. (1963). *Empire of the Inca*. Norman, OK: University of Oklahoma Press.

Brungardt, M. P. (2006). Drugs. In J. M. Francis (Ed.), *Iberia and the Americas: Culture, politics, and history: A multidisciplinary encyclopedia* (pp. 414–419). Santa Barbara, CA: ABC-CLIO.

Buck, A. A., Sasaki, T. T., Hewitt, J. J., & Macrae, A. A. (1968). Coca chewing and health: An epidemiologic study among residents of a Peruvian village. *American Journal of Epidemiology*, *88*, 159–177.

Burchard, R. E. (1992). Coca chewing and diet. *Current Anthropology*, *33*, 1–24.

Burger, R. L. (1988). Unity and heterogeneity within the Chavin horizon. In R. W. Keatinge (Ed.), *Peruvian prehistory: An overview of pre-Inca and Inca society* (pp. 99–144). Cambridge: Cambridge University Press.

Cartmell, L. W., Aufderheide, A. C., Springfield, A., Weems, C., & Arriaza, B. (1991). The frequency and antiquity of prehistoric coca-leaf-chewing practices in northern Chile: Radioimmunoassay of a cocaine metabolite in human-mummy hair. *Latin American Antiquity*, *2*, 260–268.

Cartmell, L. W., Aufderheide, A., & Weems, C. (1991). Cocaine metabolites in pre-Columbian mummy hair. *Journal of the Oklahoma State Medical Association*, *84*, 11–12.

Chowdhury, A. N. (1995). Drug abuse and eco-stress adaptation. *Addiction*, *90*, 19–20.

Cobo, B. (1979). *History of the Inca empire: An account of the Indians' customs and their origin together with a treatise on Inca legends, history, and social institutions*. Austin, TX: University of Texas Press.

Condori Mamani, G., & Quispe Huaman, A. (1996). In R. Valderrams Fernandez & C. Escalante Gutierrez (Eds.), *Andean lives: Gregorio Condori Mamani and Asunta Quispe Huaman* (pp. 141–174). Austin: University of Texas Press.

Cortella, A. R., Pochettino, M. L., Manzo, A., & Ravina, G. (2001). *Erythroxylum coca*: Microscopical identification in powdered and carbonized archaeological material. *Journal of Archaeological Science*, *28*, 787–794.

D'Altroy, T. N., & Earle, T. K. (1985). Staple finance, wealth finance, and storage in the Inka political economy. *Current Anthropology*, *26*, 187–206.

D'Altroy, T. N., & Hastorf, C. A. (1984). The distribution and contents of Inca state storehouses in the Xauxa region of Peru. *American Antiquity*, *49*, 334–349.

De Oviedo, G. F. (1526/2002). *Sumario de la natural historia de les Indias*. Madrid: Les Rozas.

Dobkin, M., & Cardenas, M. (1980). Plant hallucinogens, shamanism and Nazca ceramics. *Journal of Ethnopharmacology*, *2*, 233–246.

Dransart, P. (1997). Cultural transpositions: Writing about rites in the Llama corral. In R. Howard-Malverde (Ed.), *Creating context in Andean cultures* (pp. 85–98). Oxford: Oxford University Press.

Duke, J. A., Aulik, D., & Plowman, T. (1975). Nutritional value of coca. *Botanical Museum Leaflets*, *24*, 113–119.

El Sohly, M. A., Brenneisen, R., & Jones, A. B. (1991). Coca past: Chemical analysis and smoking experiments. *Journal of Forensic Sciences*, *36*, 93–103.

Fernandez-Armesto, F. (2007). *The world: A history*. Upper Saddle River, NJ: Pearson/Prentice Hall.

Fierns, E. (1991). Sources archeologiques et artistiques de la consommation de coca dans l'Amerique Prehispanique. *Verhandelingen-Koninklijke Academie voor Geneeskunde van Belgie*, *53*, 463–485.

Friman, H. R. (1999). Germany and the transformations of cocaine, 1860–1920. In P. Gootenberg (Ed.), *Cocaine: Global histories* (pp. 83–104). New York: Routledge.

Fuchs, A. (1978). Coca chewing and high-altitude stress: Possible effects of coca alkaloids on Erythopoiesis. *Current Anthropology*, *19*, 277–291.

Gade, D. W. (1979). Inca and colonial settlement, coca cultivation and endemic disease in the tropical forest. *Journal of Historical Geography*, *5*, 263–280.

Gagliano, J. A. (1963). The coca debate in colonial Peru. *The Americas*, *20*, 43–63.

Garofalo, L. (2006). Conjuring the coca and the Inca: The Adeanization of Lima's Afro-Peruvian ritual specialists, 1580–1690. *The Americas*, *63*, 53–80.

Gay, G. R., Inaba, D. S., Sheppard, C. W., Newmeyer, J. A., & Rappolt, R. T. (1975). Cocaine: History, epidemiology, human pharmacology, and treatment: A perspective on a new debut for an old girl. *Clinical Toxicology*, *8*, 149–178.

Gay, G. R., Sheppard, C. W., Inaba, D. S., & Newmeyer, J. A. (1973). An old girl: Flyin' low, dyin' slow, blinded by snow: Cocaine in perspective. *Substance Use & Misuse*, *8*, 1027–1042.

Gifford, D., Hoggarth, P., Flores, A., & Valeriano, S. (1976). *Carnival and coca leaf: Some traditions of the Peruvian Quechua ayllu*. Edinburg: Scottish Academic Press.

Graubark, K. B. (2007). *With our labor and sweat: Indigenous women and the formation of colonial society in Peru, 1550–1700*. Stanford, CA: Stanford University Press.

Grinspoon, L., & Bakalar, J. B. (1981). Coca and cocaine as medicines: An historical review. *Journal of Ethnopharmacology*, *3*, 149–159.

Gutierrez Noriega, C. (1949). El habite de la coca en el Peru. *America Indigena*, *9*, 143–154.

Hanna, J. M. (1970). Further studies on the effects of coca chewing on exercise. *Human Biology*, *43*, 200–209.

Hanna, J. M. (1971). Responses of Quechua Indians to coca ingestion during cold exposure. *American Journal of Physical Anthropology*, *34*, 273–277.

Hanna, J. M. (1974). Coca leaf use in southern Peru: Some biological aspects. *American Anthropologist*, *76*, 281–296.

Harvey, P. (1997). Peruvian Independence Day: Ritual, memory, and the erasure of narrative. In R. Howard-Malverde (Ed.), *Creating context in Andean cultures* (pp. 21–44). Oxford: Oxford University Press.

Hastorf, C. A. (1987). Archaeological evidence of coca (*Erythroxylum* coca, erythroxoylaceae) in the upper Mantaro Valley, Peru. *Economic Botany*, *41*, 292–301.

Hemming, J. (1973). *The conquest of the Incas*. San Diego, CA: Harvest/Harcourt, Inc.

Henderson, G. L., Harkey, M. R., Zhou, C., & Jones, R. T. (1992). Cocaine and metabolite concentrations in the hair of South American coca chewers. *Journal of Analytical Toxicology*, *16*, 199–201.

Inciardi, J. A. (1992). *The war on drugs II: The continuing epic of heroin, cocaine, crack, crime, AIDS, and public policy*. London: University of Delaware Press.

Indriati, E., & Buikstra, J. E. (2001). Coca chewing in prehistoric coastal Peru: Dental evidence. *American Journal of Physical Anthropology*, *114*, 242–257.

Jackson, G. F., Saady, J. J., & Poklis, A. (1991). Urinary excretion of benzoylecogine following ingestion of Health Inca Tea. *Forensic Science International*, *49*, 57–64.
Jenkins, A. J., Llosa, T., Montoya, I., & Cone, E. J. (1996). Identification and quantitation of alkaloids in coca tea. *Forensic Science International*, *77*, 179–189.
Johnsson, M. (1986). *Food and culture among Bolivian Aymara: Symbolic expressions of social relations*. Stockholm: Almqvist & Wiksell International.
Julien, C. J. (1988). How Inca decimal administration worked. *Ethnohistory*, *35*, 257–279.
Karch, S. B. (2003). *A history of cocaine: The mystery of Coca Java and the Kew plant*. London: Royal Society of Medicine Press.
Karch, S. B. (2006). *A brief history of cocaine: From Inca monarchs to Cali cartels: 500 years of cocaine dealing*. Boca Raton, FL: CRC Press/Taylor & Francis.
Kelly, K. (1965). Land-use regions in the central and northern portions of the Inca Empire. *Annals of the Association of American Geographers*, *55*, 327–338.
La Lone, M. B., & La Lone, D. E. (1987). The Inca state in the southern highlands: State administrative and production enclaves. *Ethnohistory*, *34*, 47–62.
Langsjoen, O. M. (1996). Dental effects of coca chewing in antiquity. *American Journal of Physical Anthropology*, *101*, 475–489.
Lee, R. W., III (1991). *The white labyrinth: Cocaine and political power*. New Brunswick, NJ: Transaction Publishers.
Lester, C. E., & Foster, A. (1846). *The life and voyages of Americus Vespucius; with illustrations concerning the navigator; and the discovery of the New World*. New York: Baker & Scribner.
Lozano, L. A. B., & Santillan, P. O. (2004). Mate de coca y episodio depresivo. *Medicina Naturista*, *5*, 223–232.
Lyon, P. J. (2004). The more things change. *Latin American Anthropology Review*, *6*, 29–32.
MacQuarrie, K. (2007). *The last days of the Incas*. New York: Simon & Schuster.
Mantegazza, P. (1859). *Sulle virtu ignieiche e medicinali della coca*. Milan: Annali Universali de Medicina.
Mariani, A. (1896). *Coca and its therapeutic application*. New York: J. N. Jaros.
Martin, R. T. (1970). The role of coca in the history, religion, and medicine of South America. *Economic Botany*, *24*, 422–438.
de la Mata, R. C. (2000). La coca en los concilios limensis. *Psicoactiva*, *18*, 19–28.
Mazor, S. S., Mycyk, M. B., Wills, B. K., Brace, L. D., Gussow, L., & Erickson, T. (2006). Coca tea consumption causes positive urine cocaine assay. *European Journal of Emergency Medicine*, *13*, 340–341.
McLaughlin, G. T. (1973). Cocaine: The history and regulation of a dangerous drug. *Cornell Law Review*, *58*, 537–573.
Menzel, S. H. (1996). *Fire in the Andes: U.S. foreign policy and cocaine politics in Bolivia and Peru*. New York: University Press of America.
Moller, M. R., Fey, P., & Rimbach, S. (1992). Identification and quantitation of cocaine and its metabolites, benzoylecgonone and ecogine methyl ester, in hair of Bolivian coca chewers by gas chromatography/mass spectrometry. *Journal of Analytical Toxicology*, *16*, 291–296.
Monardes, N. (1577). *Joyfull newes out of the Newe Founde Worlde wherein is declared the rare and singular vertues of diverse and sundrie hearbes, trees,*

oyles, plants and stones, with their applications, as well for phisicke as chirurgerie. London: William Norton.

Montoya, I. D., & Chilcoat, H. D. (1996). Epidemiology of coca derivatives use in the Andean region: A tale of five countries. *Substance Use & Misuse*, *31*, 1227–1240.

Morales, E. (1990). Coca and cocaine in Peru: An international policy assessment. *Substance Use & Misuse*, *25*, 295–316.

Mortimer, W. G. (1901). *Peru: History of coca, "The Divine Plant" of the Incas, with an introductory account of the Incas and Andean Indians of today*. New York: J. H. Vail and Company.

Moseley, M. E. (2004). *The Incas and their ancestors*. London: Thames & Hudson, Ltd.

Murra, J. V. (1980). *Research in economic anthropology: The economic organization of the Inka state*. Greenwich, CT: JAI Press.

Myers, T. P. (1976). Formative period occupations in the highlands of northern Ecuador. *American Antiquity*, *41*, 353–360.

Negrete, J. (1980). The Andean region of South America: Indigenous coca chewing in the rural areas and coca paste smoking in the cities. In G. Edwards & A. Arif (Eds.), *Drug problems in the sociocultural context: A basis for policies and programme planning* (pp. 56–63). Geneva: World Health Organization.

Novak, M., Salemink, C. A., & Khan, I. (1984). Biological activity of the alkaloids of Erythroxylum coca and Erythroxylum novogranatense. *Journal of Ethnopharmacology*, *10*, 261–274.

Parkerson, P. T. (1983). The Inca coca monopoly: Fact or legal fiction? *Proceedings of the American Philosophical Society*, *127*, 107–123.

Patterson, T. C. (1971). Central Peru: Its population and economy. *Archaeology*, *24*, 316–321.

Platt, T. (1997). The sound of light: Emergent communication through Quechua shamanic dialogue. In R. Howard-Malverde (Ed.), *Creating context in Andean cultures* (pp. 196–226). Oxford: Oxford University Press.

Plowman, T. (1976). Orthography of Erythroxylum (Erythroxoylaceae). *Taxon*, *25*, 141–144.

Plowman, T. (1982). The identification of coca (Erythroxoylum species): 1860–1910. *Botanical Journal of the Linnean Society*, *84*, 329–353.

Plowman, T. (1984). The origin, evolution, and diffusion of coca, *Erythoxylum spp*. In South and Central America. *Papers of the Peabody Museum of Archaeology and Ethnology*, *76*, 125–163.

Plowman, T. (1986a). Coca chewing and the botanical origins of coca Erythroxylum Spp.) in South America. In D. Pacine & C. Franquemont (Eds.), *Coca and cocaine, effects on people and policy in Latin America* (pp. 5–33). Cultural Survival Report, 23. Cambridge: Cultural Survival.

Plowman, T. (1986b). Four new species of Erythroxylum (Erythroxoylaceae) from northeastern Brazil. *Brittonia*, *38*, 189–200.

Plowman, T. (1987). *Ten new species of Erythroxylum (Erythroxoylaceae) from Bahia, Brazil*. Chicago: Field Museum of Natural History.

Plowman, T. (1988). New taxa of Erythroxylum (Erythroxoylaceae) from the Venezuelan Guayana. *Brittonia*, *40*, 256–268.

Prescott, W. H. (1851). *History of the conquest of Peru; with a preliminary view of the civilization of the Incas*. New York: Harper and Brothers.

Rivera, M. A., Aufderheide, A. C., Cartmell, L. W., Torres, C. M., & Langsjoen, O. (2005). Antiquity of coca-leaf chewing in south central Andes: A 3,000 year archaeological record of coca-leaf chewing from northern Chile. *Journal of Psychoactive Drugs*, *37*, 455–458.

Rivier, L. (1981). Analysis of alkaloids in leaves of cultivated *Erythroxylum* and characterization of alkaline substances used during coca chewing. *Journal of Ethnopharmacology*, *3*, 313–335.

Rogers, D. J. (1963). 'Divine' leaves of the Incas. *Natural History*, *72*, 32–37.

Rojas, M. R. (2002). Attitudes and values of Peruvian coca growers. *Substance Use & Misuse*, *37*, 687–713.

Rostworowski, M. (1988). *Conflicts over coca fields in sixteenth-century Peru*. Memoirs of the Museum of Anthropology, 21. Ann Arbor, MI: University of Michigan Museum of Anthropology.

Sanabria, H. (1993). *The coca boom and rural change in Bolivia*. Ann Arbor, MI: The University of Michigan Press.

Sarmiento, P. (1572/1907). *History of the Incas*. Trans. C. Markham. Cambridge: Hakluyt Society.

Sawyer, A. R. (1966). *Ancient Peruvian ceramics: The Nathan Cummings Collection*. New York: The Metropolitan Museum of Art.

Searle, W. S. (1881). *A new form of nervous disease. Together with an essay on Erythroxylon coca*. New York: Fords, Howard, & Hulbert.

Shackelton, M. F., Tondora, C. M., Whiting, S., & Whitney, M. (2000). The effect of homeopathic coca on high altitude mountain sickness: Mt. Everest base camp. *Complementary Health Practice Review*, *6*, 45–55.

Silverblatt, I. (1987). *Moon, sun, and witches: Gender ideologies and class in Inca and colonial Peru*. Princeton: Princeton University Press.

Spalding, K. (1984). *Huarochiri: An Andean society under Inca and Spanish rule*. Stanford, CA: Stanford University Press.

Springfield, A. C., Cartmell, C. W., Aufderheide, A. C., Buikstra, J., & Ho, J. (1993). Cocaine metabolites in the hair of ancient Peruvian coca leaf chewers. *Forensic Science International*, *63*, 269–275.

Stolberg, V. B. (2007). A cross-cultural and historical survey of tobacco use among various ethnic groups. *Journal of Ethnicity in Substance Abuse*, *6*, 9–80.

Stothert, K. (1988). *La prehistoria temprana de la Peninsula de Santa Elena, Ecuador: Cultura Las Vegas. Miscelanea Anthropologica Ecuatoriana. Serie Momografica, 10. Quito: Museos del Baco Central del Ecuador*.

Stothert, K., & Freire, A. M. (1997). *Sumpa: Historia de la Peninsula de Santa Elena*. Guayaquil: Banco Central del Ecuador.

Streatfeild, D. (2001). *Cocaine: An unauthorized biography*. New York: Picador/St. Martin's Press.

Tricot, J. P. (1991). [Cocaine: Half a century of therapeutic use (18000-1930)]. *Verhandelingen-Koninklijke Academie voor Geneeskunde van Belgie*, *53*, 487–496.

Unanue, H. (1794). Disertacion sobre el aspecto, cultivo, comercio y virtudes de la famosa planta del Peru nombrada coca. *Mercurion Peruano*, *372–378*, 205–257.

Urton, G. (1981). *At the crossroads of the earth and sky: An Andean cosmology*. Austin, TX: University of Texas Press.

Varon Gabai, R. (1997). *Francisco Pizarro and his brothers: The illusion of power in sixteenth-century Peru*. Norman, OK: University of Oklahoma Press.

Vespucci, A. (1894). *The letters of Amerigo Vespucci and other documents illustrative of his career*. London: Hakluyt Society.

Vidart, D. (1991). *Coca, cocales y coqueros en America andina*. Bogata: Editorial Nueva America.

Well, J. (1980). Coca and tropical colonization in Bolivia: The adaptiveness of a cash crop. *Central Issues in Anthropology*, *2*, 15–25.

Zapata-Ortiz, V. (1970). The chewing of coca leaves in Peru. *Substance Use & Misuse*, *5*, 287–294.

Zaunick, R. (1956). [Early history of cocaine isolation: Domitzer pharmacist Friedrich Gaedcke (1828–1890); contribution to Mecklenburg pharmaceutical history]. *Beitrage zur Geschichte der Pharmazie und ihrer Nachbargebiete*, *7*, 5–15.

Zimmerer, K. S. (1993). Agricultural biodiversity and peasant rights to subsistence in the central Andes during Inca rule. *Journal of Historical Geography*, *19*, 15–32.