

**Zeitschrift:** Asiatische Studien : Zeitschrift der Schweizerischen Asiengesellschaft = Études asiatiques : revue de la Société Suisse-Asie

**Herausgeber:** Schweizerische Asiengesellschaft

**Band:** 69 (2015)

**Heft:** 3-4

**Artikel:** Preserving identity or promoting safety? : The issue of the mercury in Siddha medicine : a brake on the crossing of frontiers

**Autor:** Sébastia, Brigitte

**DOI:** <https://doi.org/10.5169/seals-696821>

### **Nutzungsbedingungen**

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. [Siehe Rechtliche Hinweise.](#)

### **Conditions d'utilisation**

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. [Voir Informations légales.](#)

### **Terms of use**

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. [See Legal notice.](#)

**Download PDF:** 17.03.2025

**ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>**

Brigitte Sébastia\*

# Preserving Identity or Promoting Safety? The Issue of Mercury in Siddha Medicine: A Brake on the Crossing of Frontiers

DOI 10.1515/asia-2015-1043

**Abstract:** Since the publication of a sanitary alert on the toxicity of ayurvedic products by Robert B. Saper and colleagues in the *Journal of the American Medical Association* (JAMA) in 2004, the image of ayurveda as a safe alternative or complement to biomedicine has sharply deteriorated in North America and Europe. In reaction, some western countries have forbidden the import of the herbal products denounced by Saper and colleagues' warning, and the Government of India has taken measures to implement its rules on their production to ensure the full safety of the products intended for both export and national markets. This seriously hinders the export of siddha remedies as they may contain metals, mercury being one of their iconic ingredients. It has also created problems for their production, as the companies that manufacture siddha products are, in general, less developed than their ayurvedic counterparts. I will discuss this event and its impact on regulations in Europe, the United States and Canada and in India in the first part of this chapter. In the second part, I will explore the ideological and spiritual position of siddha medicine and its relation to iatrochemistry in order to comprehend why it has the reputation of a metal- and mineral-based medicine, and in particular, a mercury-based medicine. The third part, based on research conducted in 2007 on private and governmental siddha firms and the traditional siddha milieu throughout Tamil Nadu, will focus on the production of siddha medicaments and their marketing, as well as on the diverse means by which they cross frontiers for consumption abroad.

Traditional medicines have been repeatedly criticized in scientific literature<sup>1</sup> for causing poisoning due to high levels of heavy metals such as lead, arsenic and

---

<sup>1</sup> See, for example, Dasgupta and Mammatt-Stabler 2011; Ernst 2002, 2003; Sallon et al. 2006; Kamath et al. 2012; Rao et al. 2011; Raviraja et al. 2010; and Srivastava 2005.

mercury. Although all traditional medicines are under scrutiny, ayurvedic products are among the most frequently mentioned due to their great popularity in the West (i.e. Europe, the United States, Canada), their consumption by large diasporic Indian communities, and their easy accessibility on the Internet. Sold as herbal products, dietary supplements or nutraceuticals, ayurvedic remedies are not considered dangerous by consumers. On the one hand, the term “herbal” suggests nature, well-being, and safety, representations strongly supported by the abundant popular literature on ayurveda. On the other hand, the public is rarely informed that herbal or ayurvedic medicines may contain heavy metals (including mercury), as the components listed on labels are either not decipherable by lay people or poorly presented on the internet.

In 2008, an extensive survey conducted by Robert B. Saper and his colleagues on the high levels of heavy metals in ayurvedic herbal medicine products (HMPs) manufactured in India and the US and sold on the US market and on the internet in 2005 was published in the *Journal of the American Medical Association* (JAMA). It concluded that of one hundred and ninety-three products, 20.7% presented a high level of heavy metals with a prevalence higher in products from US (21.7%) than those from India (19.5%); the level of heavy metals was also higher in metal-based medicines (*rasaśāstra*) (40.6%) than in herbal-based ones (non-*rasaśāstra*) (17.1%), concentrations of lead and mercury being respectively 11.5 µg/g versus 7.0 µg/g and 20,800 µg/g versus 34.5 µg/g.<sup>2</sup> This survey followed a primary study by Saper and colleagues conducted on ayurvedic HMPs sold on the US market which had revealed that of seventy ayurvedic medicines, fourteen contained a higher level of heavy metals (mercury, lead, arsenic, cadmium) than the permitted limit. The researchers carried out these surveys with regard to the number of intoxications reported in medical literature: “Since 1978, at least 55 cases of intoxication by heavy metal associated with ayurvedic HMPs in adults and children have been reported in the United States and abroad”.<sup>3</sup> However, compared to the high incidence of heavy metals detected by Saper and his colleagues, it is surprising that the number of reported intoxication cases was so small, around 2 cases per year. One reason may be that not all cases were reported in medical literature or were not identified as caused by herbal medicines. But another reason may be the

---

<sup>2</sup> According to the American National Standard Institute (ANSI 173) mentioned by Robert B. Saper et al. (2008: 918): “the dietary supplements should not contain undeclared metals that would cause intakes greater than 20 µg/day of mercury, 20 µg/day of lead, and 10 µg/day of arsenic.” Concerning mercury, WHO (2007) estimates that its tolerable intake per day is 2 µg/kg body weight.

<sup>3</sup> Saper et al. 2004: 2868.

limitation of the 2004 and 2008 studies by Saper et al., which did not test or even discuss the bioavailability of the heavy metals detected in the examined herbal medicines. However, neglecting this fundamental criterion for measuring the toxicity of products, they concluded:

The presence of heavy metals in Ayurvedic HMPs and the numerous reports of associated toxicity may have important public health, clinical, and policy implications in the United States and abroad. Although the prevalence of heavy metal – containing Ayurvedic HMP use is unknown, the number of individuals at potential risk is substantial. Recent analysis of the US National Health Interview Survey 2002 Alternative Medicine Supplement estimates 750000 adults consulted an Ayurvedic practitioner in the past.<sup>4</sup>

In other words, the authors adopted a zero-risk stance in regard to any ayurvedic HMP and encouraged their non-consumption. They also advised that the Dietary Supplement Health Education Act 1994 (DSHEA) be reformed. However, given that some HMPs should not be commercialised as dietary supplements but as medicines, which would therefore be regulated by the Food and Drug Act (FDA) that controls the quality and safety of products before and during their commercialisation, the American Herbal Products Association (AHPA) opposed the reform of the DSHEA: “No change in the law is required, though manufacturers, importers and retailers need to assure that the products they manufacture, import and sell are free of adulteration.”<sup>5</sup> The DSHEA, in contrast to the FDA, defines the manufacturers as responsible for the quality of their dietary supplements.

Eight years after his initial survey, Saper participated in research that aimed to assess the bioavailability of lead and arsenic in the ayurvedic HMPs tested positive in the first studies.<sup>6</sup> The research revealed that only one tier of the sample, i.e. 7% of ayurvedic HMPs presented a soluble form of lead and arsenic, and was possibly toxic. Unfortunately, they did not conduct research on the bioavailability of various forms of mercury. Some articles, however, have explored this subject.<sup>7</sup> They conclude that mercuric sulphide (cinnabar or *ilīṅkam*), the most commonly used mercurial complex in siddha medicine, is the most insoluble mercuric compound and thus less toxic than mercuric chloride (calomel or *pūram*), mercuric perchloride (*vīram*), or liquid mercury (*iracam*), but that the long-term ingestion of drugs made from it may cause renal failure by

---

<sup>4</sup> Saper et al. 2004: 2872. The survey mentioned is by Barnes P.M. et al. (2004): *Complementary and Alternative Medicine Use Among Adults: United States, 2002*. Rockville, Md: Advance Data From Vital and Health Statistics, US Dept of Health and Human Services.

<sup>5</sup> <http://www.nutraingredients-usa.com/Research/Ayurvedic-herbals-heavy-in-metals-or-not> (retrieved 11.06.2014)

<sup>6</sup> Koch et al. 2011.

<sup>7</sup> Liu et al. 2008; Kumar 2006; Sushant 2012.

accumulation. These studies, which call for increasing research on the bioavailability of mercury and other heavy metals, seem to moderate the initial statements concerning the risk of intoxication intrinsic to HMPs. But the newer research has had less of an impact than the first articles by Saper and colleagues, which continue to be referred to in discussions on heavy metals in herbal medicines. The bioavailability of heavy metals in the organism remains little explored.

The sanitary alert launched by Saper et al. rapidly spread. On March 3, 2005, the journal of *Health Canada* published a “report of concern” stating that:

*Health Canada* has reviewed the findings of the JAMA study and is currently determining the availability in Canada of the products named in the study. A Customs Alert to the Canada Border Services Agency has been issued to monitor importation of these products. Further action will be taken if any of the remaining products are confirmed to be sold in Canada, and if laboratory testing determines that heavy metal levels exceed Canadian exposure limits.<sup>8</sup>

On July 14, a second article in the same journal claimed that some ayurvedic products with high levels of mercury and lead had been detected in Singapore. It advised customers to be cautious when purchasing health products from outside Canada or over the Internet and to buy only authorised health products bearing an eight-digit Drug Identification Number (DIN), or a Natural Product Number (NPN).<sup>9</sup> Health Canada took measures to ban the marketing of products incriminated by Saper and colleagues and by other studies, and alerted the population to the dangers of consuming them.<sup>10</sup> Other governmental agencies, such as the Medicines and Health Products Regulatory Agency, U.K (MHPRA) August 19, 2005 and Swissmedic in a press statement on August 17, 2006 followed suit, issuing statements in August 2005 and August 2006, respectively.<sup>11</sup>

---

**8** <http://www.healthycanadians.gc.ca/recall-alert-rappel-avis/hc-sc/2005/13387a-eng.php> (retrieved 11.06.2014)

**9** <http://www.healthycanadians.gc.ca/recall-alert-rappel-avis/hc-sc/2006/13117a-eng.php#!prettyPhoto> (retrieved 11.06.2014)

**10** The products mentioned by Saper et al. are: Karela, Bala Guti, Bala Sogathi, Bal Chamcha, Balguti Kesaria, Gesari, Safi, Navratna Rasa, Swarna Mahayograj Guggulu with gold, Mahayograj Guggulu with silver and Makardhwaj, Mahalakshmi Vilas Ras with gold; Maha Sudarshan churna, and Shilajit; not all of these are prepared with metals. The journal of Health Canada added four contaminated products from Singapore mentioned in the study: Annai Aravindh Herbals Rheuma-7 capsules (siddha), Himalaya Diabecon Tablets, Laurel’s Diabecs Capsules and Goodcare Diabet Guard Granules.

**11** See the MHPRA statement of August 19, 2005: <http://www.nutraingredients.com/Regulation/Ayurvedic-heavy-metal-warning-hits-UK> (retrieved 11.06.2014) and the Swissmedic press statement of August 17, 2006: [www.swissmedic.ch/Archiv/Asiatische\\_Arzneimittel\\_F.pdf](http://www.swissmedic.ch/Archiv/Asiatische_Arzneimittel_F.pdf) (retrieved 08.07.2007).

The publicity about adverse drug reactions to ayurvedic medicines forced the Indian government to react as medicinal plants and ayurvedic products represent an important export that the government cannot neglect. According to the Ministry of Commerce and Industry, the export of medicinal herbs and of AYUSH medicines (ayurveda, yoga and naturopathy, unani, siddha, homeopathy) in 2012–2013 represented 232.14 and 163.44 millions USD, respectively.<sup>12</sup> On September 24, 2005, an article in *The Hindu Business Line* said: “Following the warnings issued by health regulators in the UK and Canada, the Health Ministry is putting in place basic parameters for companies manufacturing ayurvedic and unani products”.<sup>13</sup> The Health Ministry announced that: “The manufacturing facilities would have to be GMP (Good Manufacturing Practices) compliant, though this has been notified in the Drugs and Cosmetics Act,” and that “Companies will have to list out all the inputs, including the metals present.” On 13 October 2005, the department of AYUSH made Schedule T compulsory, which amended the Drugs and Cosmetics Act 1940 and Rules 1945 on June 23, 2000.<sup>14</sup> The manufacturers have to obtain the GMP certificate in order to commercialise their products. The certificate takes into account several laws that regulate the protocols of fabrication, equipment, installations and quality controls of pharmaceutical, veterinary and cosmetic products, as well as of medical equipment and food. It guarantees the respect of norms with regard to the hygiene of staff, places of fabrication and their management, stages of fabrication, packaging, labelling and storage, and quality control from raw materials to finished products. On October 14, 2005, the Drugs and Cosmetics Act 1940 and Rules 1945 were again amended. From January 1, 2006 they stated:

The partially modified order requires all exporters of purely Herbal Ayurvedic, Siddha & Unani medicines to either display on the container of such medicines to be exported, the words Heavy Metals within permissible limit or submit to the authorities batch wise testing report (in respect of every such medicine to be exported) from any approved laboratory stating that the medicine contains. It will be the responsibility of the representative of DCG (I) deployed at the Airport/port of shipment to examine and ensure that all exporters of purely Herbal Ayurvedic, Siddha & Unani medicines comply with this order.<sup>15</sup>

---

<sup>12</sup> <http://pib.nic.in/newsite/erelease.aspx?relid=101153> (December 9, 2013, retrieved 11.06.2014). The website presents the values of herbs and AYUSH products in the years 2010–2011, 2011–2012 and 2012–2013. It is worth pointing out that the values of AYUSH products between 2010–2011 and 2012–2013 have increased by only 4% while those of herbs have dramatically increased by 63.86%.

<sup>13</sup> Subramanian 2005.

<sup>14</sup> See Schedule T in Arora 2007: 457–466)

<sup>15</sup> *Pharmexil* 2005. The amended texts may be consulted at: [http://www.choksilab.com/AyurvedicMeds\\_HeavyMetals\\_Orders\\_%20D&C\\_%20Act.pdf](http://www.choksilab.com/AyurvedicMeds_HeavyMetals_Orders_%20D&C_%20Act.pdf) (retrieved 18.06.2014)

The medicaments sold in India that incorporate ingredients listed in Schedule E (1) of the Drugs and Cosmetic Rules 1945<sup>16</sup> have to be labelled “Caution: to be taken under medical supervision.” This notification is important in India because self-medication is very common, whatever the type of medicine. Self-medication is also a cause of intoxication by herbal medicines and its variants in developed countries as they are easily accessible over the counter. The implementation of the compulsory rules, with the risk of losing the license, was fixed for 1<sup>st</sup> July 2006, in order to allow manufacturers to clear their stock and reorganise their firms to fit in with the rules.<sup>17</sup> The companies with the GMP certificate are large and well represented in India as well as abroad. The certificate does not, however, prevent them from selling products with high levels of heavy metals as shown by Vikas Gupta and colleagues.<sup>18</sup> The rules of the GMP require such high expenditure that many smaller manufacturers do not have the means to respect them. This weakens the sector of siddha manufacturing as this medical system is much less widely spread than ayurveda in India and virtually unknown abroad.

## 1 Siddha medicine: a combination of esotericism and alchemy

Articles on heavy metals in Indian medicines always focus on ayurvedic (or what they interpret as ayurvedic) products. However, the products from the other traditional Indian medicinal systems should also be scrutinized, as they are heavily consumed by South Asians: unani drugs by Muslim communities in India, Pakistan and Bangladesh, and siddha drugs by Tamils in India and Sri Lanka, and also, by South Asian migrants. Indeed, one ayurvedic HMP cited by

---

<sup>16</sup> See the list in Arora 2007: 267–269. The lists of poisonous substances are mentioned in Schedule T for ayurvedic, siddha and unani systems. Surprisingly, while the lists of ayurvedic and unani systems are composed of drugs of vegetable, animal and mineral ingredients, that of the siddha system refers only to vegetable ones and poisons such as arsenic, mercury and their salts and other metallic salts specified for the ayurvedic system, are not mentioned for siddha (Arora 2007). It is worth noting that a law on poisons has existed in India since January 22, 1904. It was revised in 1919 under the name of *Poisons Act 1919*. However, except for white arsenic which was especially focused on in the 1904 regulation, the act of 1919 does not mention any poisons in medicines (see *Poisons Act 1919* in Arora 2007: 780–784 and *Poisons Act 1904* at: <http://lawmin.nic.in/legislative/textofcentralacts/1904.pdf>).

<sup>17</sup> *Ayurveda and Health Tourism*, March 13, 2008. URL: <http://ayurvedamagazine.org/ayush-to-enforce-label-rules-from-july-2006> (retrieved 20.03.2015).

<sup>18</sup> Gupta at al. 2013.

Saper et al. is a unani drug and one mentioned by the journal of Health Canada is from a siddha firm. However, ayurvedic products are more heavily represented on the global market than siddha or unani ones, due to the more established reputation of ayurveda, the extent of its pharmaceutical sector in India and abroad, the significant development of medical tourism in India and spas abroad, and the more copious offer of its products on the Internet.

Ayurveda, siddha and unani medicines are defined as Indian systems of medicine and financially supported by the Government of India. Together with two other medical systems, yoga/naturopathy and homeopathy, they have been managed by the department of AYUSH of the Ministry of Health and Family Welfare since 2003; Tibetan medicine (sowa-rigpa) was added to the department in September 2009. In 2014, the AYUSH department was made a ministry in its own right. While unani is available in towns where there are substantial Muslim communities, siddha medicine, the traditional medical system of Tamil Nadu, is commonly assimilated to ayurveda. The subsumption of siddha to ayurveda goes back to the beginning of the twentieth century when the institutionalisation of Indian medicines was debated in India.<sup>19</sup> In the reports of committees ruling on the creation of the school of Indian medicine at Madras for ayurveda, siddha and unani systems, siddha medicine is seldom mentioned. The report of Khan Bahadur Muhammad Usman explains: “It is well known that the Siddha and the Ayurveda have very many things in common including the Tridhatu Physiology and the Tridosha Pathology.”<sup>20</sup>

Siddha and ayurvedic medicines share many theoretical concepts.<sup>21</sup> Siddha medicine possesses, however, some distinctive diagnostic methods: elaborated readings of pulse, and of urine using one drop of sesame oil for quantifying the imbalance of the three *doṣakkaḷ* and determining the disease.<sup>22</sup> But its determining difference from ayurveda is its anchorage in Tamil culture and in esoteric alchemy and tantrism. In the Usman report, siddha medicine is called Tamil medicine or Tamil ayurveda. The term siddha seems to have emerged at the beginning of the twentieth century under the influence of the Dravidian movement, an anti-brahmanical movement supported by a strong consciousness of

---

<sup>19</sup> Hausman 1996; Sébastia 2010.

<sup>20</sup> Usman 1923: 1.

<sup>21</sup> These include, for example, the concepts of *pañcabūtaṅkaḷ* (five basic elements), *doṣakkaḷ* (*vātam-pittam-kapam*: the three humours, “wind” – “bile” – “phlegm”), *tatukkaḷ* (seven body constituents) and *kuṇaṅkaḷ* (the three properties *sattva-rajas-tamas*), some diagnostic and therapeutic techniques and materia medica. Scharfe 1999; Weiss 2008, 2009.

<sup>22</sup> Kutumbiah 1973. Urine reading is currently practised in siddha colleges but I have never seen it practised in the traditional milieu. By contrast, pulse reading, which is an essential diagnostic tool in traditional healing, is negligently practised and taught in colleges.



Tamil identity.<sup>23</sup> While ayurvedic literature is predominantly written in Sanskrit and is associated with brahmanical learning, the siddha medical corpus was written in Tamil and today, training (even in siddha colleges) and practice are in Tamil. There are also differences in each tradition's presentation of its origins: The transmission of ayurveda is associated with brahmanical gods who passed their knowledge to demi-gods, saints, and doctors, while that of siddha is associated with a category of yogis called *cittarkaḷ* (accomplished, perfect, the Tamil equivalent to the Sanskrit word *siddha*). These *cittarkaḷ* are thought to have acquired great powers (*karmamurai*) through asceticism which gave them the ability to transcend the materiality of the sensory world. They are considered the authors of texts on medicine and related subjects: botany, pharmacopeia, diagnosis, treatment, yoga, astrology, spirituality, magic and, especially, alchemy and iatrochemistry, the knowledge of which they developed through extreme ascetic practice. According to the Tamil tradition, there are eighteen *cittarkaḷ*, but their number reaches more than ninety if the various lists presented in siddha literature<sup>24</sup> and in the inventory of manuscripts<sup>25</sup> are taken into account. This increase in the number of *cittarkaḷ* results from the term *cittar*, which signifies “who has acquired omniscient wisdom” and has been attributed to individuals who led an outstanding, spiritually-oriented life. Historians have underlined the fact that many siddha texts were written under the name of famous *cittarkaḷ* such as Agattiyar,<sup>26</sup> Tēraiyyar, Irāmatāvar or Pōkar,<sup>27</sup> blurring the chronology and authorship of siddha texts and making it difficult to trace the evolution of siddha knowledge and philosophy. Attempts by K. Meenakshi (2001) and, especially by R. Venkatraman (1990), have sought to establish the chronology of some *cittarkaḷ* and to explore their ideological position with regard to politics, religion and spirituality. These authors as well as other historians<sup>28</sup> have asserted that the *cittarkaḷ* were anti-brahmanical, anti-orthodox, anti-ritualistic, anti-conformist and firmly opposed to the caste system imposed by brahmanical culture. The philosophical orientation of the Tamil

---

**23** Sébastia 2012; Weiss 2009.

**24** See Ganapathy 1993: 24–26; Shanmugavelan 1963: 16–17; Venkatraman 1990: appendix 2, 198–208; White 2004: 87.

**25** See Madhavan 1984: 20–26; Palanichamy 1973: 3.2: 74–75 and 3.3: 132–134; Samuel 1998: xvi.

**26** Agattiyar (Agastiyar in Sanskrit) is considered as the founder of Tamil medicine. In several occurrences in the poem *Cilappatikāram* (third century B.C.E.), he is presented as the great sage of the Potiyai hills (in the Pandya kingdom). There is no mention of his supposed great knowledge of grammar or medical subjects (Parthasarathy 1993).

**27** Kutumbiah 1973: 21; Venkatraman 1990: 49–75.

**28** Ganapathy 1993; Zvelebil 1973.

*cittarkaḷ* is tantrism, a heterodox movement based on non-dualism and the principle of the unity of Śiva-Śakti.<sup>29</sup> Representations of Śiva-Śakti are found in the homes of some traditional siddha practitioners, in the room where medicines are prepared or in domestic shrines where medicines are placed before being given to the patients.

Today, Siddha medicine is more strongly associated with alchemical processes and with the use of mercury in particular than ayurveda. We already find this association asserted in the Usman report of 1923:

There is clear evidence that this [iatrochemistry] was pursued with special interest by the Siddhas; it is claimed that their achievement in chemistry was greater, and dated from a much earlier period than that indicated by Sir P.C. Ray, in his monumental work on The History of Hindu Chemistry (...) However this may be, there is no denying the fact that, even in modern days, the practitioners of Siddha system know the secret of using mercury, arsenic, and other powerful “poisons” in such forms as eliminate, so to speak; their “poisonous” properties but as the same time concentrate their beneficial ones.<sup>30</sup>

However, a comparative study of these two medical systems does not confirm this specific association: The mineral and metallic components are common to the ayurvedic and siddha *materia medica*, and ayurvedic literature heavily borrows from *rasaśāstra* (the Sanskrit tradition of alchemy and iatrochemistry) treatises. However, a detailed comparison of iatrochemical elements in siddha and ayurvedic literature is at present hampered by the paucity of available editions and translations of siddha texts. Only few siddha manuscripts have been examined so far. Our very limited knowledge of (and access to) siddha literature makes it difficult to discriminate the alchemical elements which belong to the siddha tradition from those which belong to ayurveda, and more widely, to Chinese, Middle East and western traditions.<sup>31</sup> Asian alchemical traditions have focused specifically on mercury, perhaps to a higher degree than the Arabic and European

<sup>29</sup> The Śiva-Śakti principle is the union of Śiva with Śakti which, through *kuṇḍalinī* yoga, allows for attaining the state where “all consciousness of duality and fear of falling again into the bond of samsara are removed forever” (Ganapathy 1993: 87). This yoga is performed to develop eight supernatural powers (*karmamurai*; *siddhi*): *aṇimā* (power of becoming very small), *laghimā* (of becoming very light), *prāpti* (of obtaining everything), *prākāmya* (of having irresistible will), *mahimā* (of increasing one’s size), *iśitva* (of becoming superior, great), *vaśitva* (of bringing others under one’s control) and *kāmāvasāyitā* (of suppressing passion) (Banerji 1992: 628). The names of the supernatural powers are in Sanskrit, even in the Tamil siddha tradition.

<sup>30</sup> Usman 1923: 87.

<sup>31</sup> David Gordon White (2004: 2) argues that Indian tantrism was “influenced by cultural interactions with China, Tibet, Central Asia, Persia and Europe, interactions which had the Silk Road and medieval maritime routes and ports as their venue”. Books I consulted for the comparison are: for ayurveda, Vaidya Bhagwan Dash (2003), Jean Filliozat (1979), S. Mahdihassan (2002), G. Jan Meulenbeld (Volume II A and B, 2000), Rasacharya Bhudeb Mookerji (2006), Himasagara P.

alchemical traditions. *Cittar* alchemists developed numerous elaborate processes for extracting mercury from cinnabar (see Figures 1–6), these products becoming then either medicaments or miraculous substances for increasing the eight kinds of supernatural power (*aṭṭa karmamurai*). Some of these processes are also described in ayurvedic literature.<sup>32</sup> Venkatraman points out that nothing in *Caṅkam* literature<sup>33</sup> “makes reference to metallic or mercurial medicine or salts or mineral poisons.”<sup>34</sup> He asserts, from evidence from the Cola period (9<sup>th</sup>–13<sup>th</sup>), that the type of medicine practised in this region was simply ayurveda; metal and metallic substances having been borrowed from Buddhist tantrists, among them Nagārjuna (tenth century C.E.).<sup>35</sup> The fact that a large part of terminology of Tamil alchemy and medicine is predominantly from Sanskrit may confirm this.<sup>36</sup>



**Figure 1:** Grinding cinnabar and curcuma.

---

Chandra Murthy (2008), Prafulla Chandra Ray (1925), P.K. Sanyal (1964); for Occident and Middle East, Frank Greiner (1998), Serge Hutin (1995); for China, Kristofer Schipper (1997), Frédérique Obringer (1997).

**32** Mookerji 2006: v. 1, 49–51; Murthy 2008: 174–175.

**33** *Caṅkam* literature refers to a collection of Tamil poems whose the date is uncertain (second century B.C.E. to 5<sup>th</sup> C.E.). The poems describe the life of Tamils before the brahmanisation of South India (Tieken 2003).

**34** Venkatraman 1990: 116.

**35** Ray 1925; Kutumbiah 1973; and Roy/Subbarayappa 1976 wrongly considered Nāgarjuna the author of the *Rasaratnākara*. See David Gordon White for the lists of alchemical works, their authors and period of writing (2004: 78 et sq.). According to him, the *Rasaratnākara* was written by Nityanātha Siddha in thirteenth to fourteenth century and not by Nagārjuna. This is also supported by Jean Filliozat (1979), G. Jan Meulenbeld (2000 Volume II A), and Dominik Wujastyk (1983).

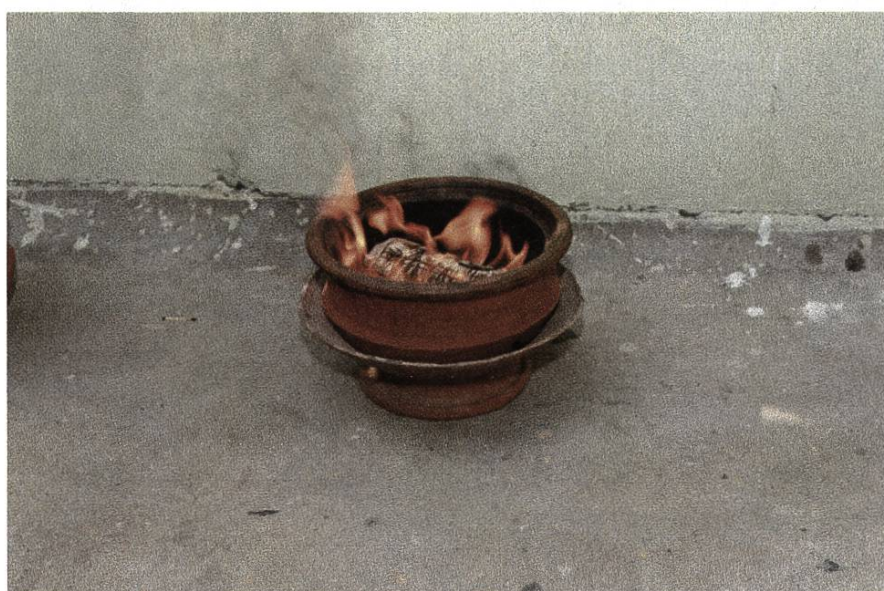
**36** It is worth mentioning, however, that alchemy in siddha medicine is called *vātam* while *iracam* is restricted to mercury (Tamil lexicon).



**Figure 2:** Laying the powdered mixture on a cloth.



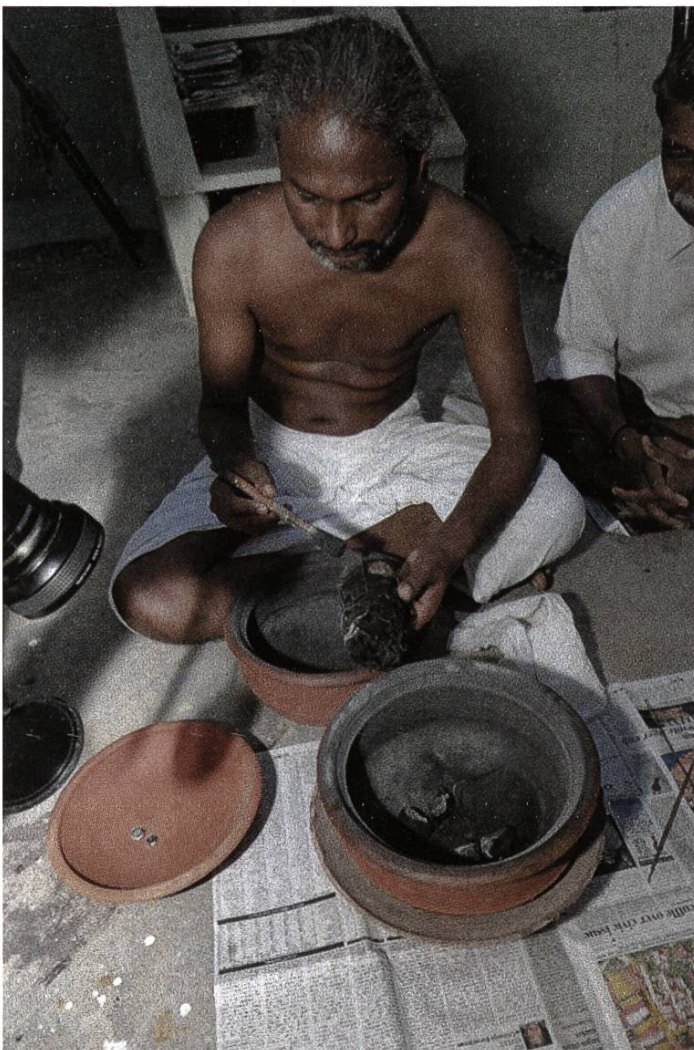
**Figure 3:** Putting the rolled up cloth into a pot scrubbed with a plant juice.



**Figure 4:** Putting fire to the cloth with camphor.



**Figure 5:** Closing the pot for the process of sublimation.



**Figure 6:** Collection of mercury drops after the process of sublimation.

**Figures 1–6:** Extraction of mercury from cinnabar (*ilinkam*): Photos of a traditional siddha practitioner involved in yoga and siddha medicine preparation courses ©Christian Sébastia.

A comparison of the siddha and ayurvedic formularies<sup>37</sup> shows that more siddha preparations are based on mercury (32.3%) than ayurvedic ones (26.6%), cinnabar or *ilīṅkam* being the most used component from which mercury is extracted.<sup>38</sup> While the formulary of ayurvedic medicines has a large category of medicines mostly based on mercury called *rasauśadhi* (mercury-medicinal herbs), the formulary of siddha medicines lists several specific groups of metal/mineral-based preparations that quite often include mercury and mercurial components. These groups are: *cunṇam*<sup>39</sup>; *kalaṅku*<sup>40</sup>; *kaṭṭu*<sup>41</sup>; *karuppu*<sup>42</sup>; *pantaṅkam*,<sup>43</sup> *kulampu*.<sup>44</sup> Moreover, the siddha tradition possesses four specific substances which do not exist in ayurvedic alchemy and whose formulations are unknown:

---

**37** These statistics have been calculated from the siddha and ayurveda formularies of IMPCOPS (Indian Medical Practitioners' Cooperative Pharmacy and Store) which are compilations of formulas current in these two medical systems. See *Formulary of Siddha Medicines* (2000) and *Vaidya Yoga Ratnavali (Formulary of Ayurvedic Medicines)* (2000). The analysis of the siddha formulary used in the Siddha Government Medical College of Palayamkottai shows that of 245 formulas, 75 contain a form of mercury often associated with arsenic or sulphur (30.6%), 8 are based on arsenic (3.3%), 16 on iron, zinc or lead (6.5%) and 56 on one or several minerals (22.9%), the 90 other formulas being composed of plants (37.7%).

**38** A few metals and minerals have a Tamil name in Siddha medicine that is different from their Sanskrit name used in ayurveda. Let us mention: *vīram* (mercuric chloride); *vellai pāśāṅgam* (arsenic trioxide); *annapēti* (ferrous sulphate); *turucu* (copper sulphate); *ayam* (iron); *nākam* (zinc); *karuvaṅkam* (lead); *velvankam* (tin); *taṅkam* (gold); *velli* (silver); *paṭikāram* (alum); *veṅkāram* (borax); *vetiyuppu* (saltpetre); *cōruppu* (sea salt); *intuppu* (rock salt). This list is derived from a comparison of the formularies of ayurveda of IMPCOPS (*Vaidya Yoga Ratnavali* 2000) and of siddha medicine of IMPCOPS (*Formulary of Siddha Medicines* 2000) and of the Government of India (*The Siddha Formulary of India* 1992; *The Siddha Pharmacopoeia of India* 2008). However, in siddha manuscripts many metal or mineral ingredients are specified in metaphorical terminology that only specialists are able to decipher, *ilīṅkam*, a reference to the phallic representation of Śiva, being the best example.

**39** White powder obtained from an intensely calcined form of mercury or mineral ground with plant juices or extracts which turn red with turmeric.

**40** Mercury or mercurial or arsenical salts moderately heated and melted in plant juice, and then intensely heated for forming a solid mass, and lastly highly calcined.

**41** *Kaṭṭu* is defined as a poisonous compound like cinnabar and arsenic hardened under the long-term action of plant juices absorbed by the compounds while they are kept over fire. According to the category of *kaṭṭu*, gems may be included as components.

**42** Mixing of mercury and mercurial components with sulphur or arsenic intensively ground and moderately calcined and of black colour.

**43** Organic and inorganic substances, notably mercurial and arsenical salts, sublimated in a high temperature and then finely powdered.

**44** Medicine prepared by grinding diverse plants with mercury or cinnabar and camphor until obtaining a waxy consistence.



**Figure 7:** Traditional siddha practitioner's family's *kattuka!*  
©Christian Sébastia.

*navapāṣāṇam*,<sup>45</sup> *iracamaṇi*,<sup>46</sup> *kattu*<sup>47</sup> (Figure 7), and *muppū*.<sup>48</sup> These substances, half alchemical products, half medicines, are considered highly valuable by *cittamaruttuvarka!*, acting either as panacea, as *kāyakarpam* (substances for rejuvenating the body), or as catalysts for increasing the efficacy of the medicament.

Among the four substances, *iracamaṇi* is quite commonly prepared by *cittamaruttuvarka!* interested in alchemy, following processes described in texts by *cittarka!* and ayurvedic alchemists. These texts delineate the mixing of mercury and sulphur, metaphorically designated as the combination of the male and female principles and processed with plants and/or other metals.<sup>49</sup> The high

**45** In Sanskrit, *pāṣāṇam* means “stone” and in Tamil “stone, poison, arsenic”. Arsenic is of two categories: *piravippāṣāṇam* (natural) and *vaippuppāṣāṇam* (artificial), each category comprising thirty-two kinds. According to the siddha practitioners, *navapāṣāṇam* is a material made of nine poisons, mostly of arsenic and mercuric components triturated with plant juice. The colour of products claimed to be *navapāṣāṇam* is brown.

**46** *Iracamaṇi* means “pearl of mercury”. It is made from solidified or coagulated mercury. It is not specific to siddha alchemy as it is found in all alchemical traditions, but *iracamaṇi* is commonly presented by traditional siddha practitioners as a symbol of their profession.

**47** *Kattu* are extremely potent stones made of metallic components including mercurial salts that the *cittamaruntuvar* rubs on a mortar stone to obtain some fine particles that he mixes with honey or milk and gives to the patient to swallow. While several practitioners showed me some products which they had themselves produced and which they called *muppū* and *navapāṣāṇam*, none had succeeded in making *kattu*. These stones are different that the *kattukka!* of the Siddha Formulary of India.

**48** *Muppū*, a term of Tamil origin, is a combination of three salts, among them one, *pūnīr* (water of the earth), is collected during the full moons of summer (from April to June) in certain dry areas kept secret (See for example the Akattiyar's texts in G. John Samuel 1998).

**49** See Mookerji 2006, volume 1 and Samuel 1998.

value attributed to such substances has favoured their mythologization so that some *cittamaruttuvarkaḷ*, deeply involved in esotericism and alchemy, tirelessly conduct experiments in order to create these magical products which will raise them to the rank of master in siddha medicine (*ācān*, *avarkaḷ*). These particular *cittamaruttuvarkaḷ* follow the tradition of some famous *cittarkaḷ* such as the t̄antric-chemist Iramatēvar<sup>50</sup> or Pōkar. The latter is attributed with the creation of a statue of Murukaṅ made of *navapāṣāṅam* at Palani.<sup>51</sup> Both of these alchemists are regarded as having been proficient in the transformation of mercury. Rattinammal, a ninety-year-old traditional practitioner from Madurai I interviewed in 2007, for example, explained to me that, when she was psychologically disturbed after her husband's death, she decided to test her medical capacity by making *iracamaṅi* (Figure 8). She consulted several books of Pōkar, and after several attempts, she succeeded. She fixed her *iracamaṅi* to her silver finger ring. But, unlike Iramatevar who would suck the *iracamaṅi* to increase his alchemical knowledge or to attain *camāti* through the acquisition of the eight supernatural powers (*karmamuraikkaḷ*), Rattinammal uses hers for the benefit of her patients. To those with severe diseases, she gives some drops of milk in which she has rubbed her *iracamaṅi*. She has also produced a *muppu* for



Figure 8: Rattinammal's *iracamaṅi* ©Christian Sébastia.

<sup>50</sup> Kanchana Natarajan (2004) has devoted an extensive study to Iramatēvar.

<sup>51</sup> The statue is known as Taṅṭayutapāṅi and is supposed to have medicinal value. The tradition tells us that devotees used to scratch the statue to get some material that they swallowed. To protect it from more degradation, it was removed to a secret place. According to Venkatraman (1990), the statue's story, for which he has found no evidence, is partly responsible for the reputation of this Murukaṅ site.



replacing that of her mother. She is no longer able to prepare one because her great age does not allow her to search for *punīr*.<sup>52</sup> In contrast with *iracamaṇi*, the other substances are more difficult to produce because their recipes are untraceable or expressed in an obscure metaphorical language. For example, differing lists of ingredients circulate for the production of *navapāṣāṇam*.<sup>53</sup> Nevertheless, some practitioners such as P.M. Selvarasu, manager of the 250 year old Kollimalai Siddhar Siddha Ashramam, claim to be able to produce it. Selvarasu sells Śiva *iliṅkam* and pills made of *navapāṣāṇam* and of *iracamaṇi* at this ashram or during his monthly medical camps throughout Tamil Nadu. Devotees and patients buy these as amulets or protection (Figure 9). This class of siddha practitioners contributes to the reputation of siddha as metal and mineral-based medicine in opposition to ayurveda as herb-based. However, despite the great knowledge and high skills of some practitioners, the future of their medicine is jeopardized by the increasing criticism of the perceived lack of safety of traditional medicines.



**Figure 9:** *Navapāṣāṇam*, *iliṅkam*, *iracaliṅkam* and *iracamaṇi* sold by P.M. Selvarasu ©Christian Sébastia.

<sup>52</sup> Sébastia (2015).

<sup>53</sup> Lists of ingredients from websites on Palani and in some siddha books are: 1 – *vīram* (mercuric chloride or corrosive sublimate), 2 – *raca karpūram* or *pūram* (calomel or mercurous chloride), 3 – *rasam* (mercury), 4 – *cātiliṅkam* (a sort of arsenic), 5 – *maṅōcilai* (red orpiment or arsenic disulphide), 6 – *kaurippāṣāṇam* (yellow orpiment or arsenic pentasulphide), 7 – *vellai pāṣāṇam* (white arsenic or arsenic trioxide), 8 – *kantakam* (sulphur), 9 – *muritarciṅki* (lead monoxide), 10 – *cilācattu* (gypsum).

## 2 Production of medicaments legitimized by traditional knowledge

The number of siddha firms in Tamil Nadu is not insignificant as, according to the report of the department of AYUSH, May 1, 2011, there exist three hundred and forty-six of them.<sup>54</sup> They are mostly small companies with limited production in terms of volume and variety of medicaments. Around twenty companies produce a hundred different kinds of medicaments, possess their own shops and commercialise their medicines on a large scale through pharmaceutical representatives and the internet. Those that hold the ISO certificate (which ensures international quality) and the GMP certificate export their medicines.

Ayurvedic firms are more numerous (7,699 according to AYUSH), although of variable size, and their products are distributed all over India. Except for R.S. Pathy, founded in 1909 at Madurai,<sup>55</sup> factories for siddha medicines were developed only in the 1960s. Most of them were established by traditional practitioners who, preparing drugs for their clientele, aspired to commercialise them on a large scale.<sup>56</sup> Despite becoming businessmen, these practitioners have not always broken with their medical practice and some of them divide their time between production and the clinic. The continuation of the examination of patients, which is always free of cost – only drugs are sold – is a way for them to fulfil their duty to the people (*cēvai*) according to the ethical code recommended by the *cittarkaḷ* which stressed that medical knowledge and therapeutic proficiency<sup>57</sup> ought not be used for

---

<sup>54</sup> <http://www.similima.com/ayush-2011-final-report-by-planning-evaluation-cell> (retrieved 15.06.2014)

<sup>55</sup> This firm was supervised by the founder's two grandsons. At the beginning, the factory produced fifty kinds of medicines which were exported to Sri Lanka, Singapore and Malaysia from the 1950s. Nowadays it produces only one, which is still exported, a medicinal oil designed to treat headache, joint pain, etc. Umapathy, one of the grandsons, explains the situation by his father's lack of ambition for, and interest in, the firm. In 2007, he confided that he sought to revive the firm by reproducing the discontinued medicines, but met with a refusal from his father who did not want to reveal the family formulations. The children of traditional practitioners do not always inherit the medical knowledge jealously kept by their relatives and these failures of transmission are quite often the reflection or the source of familial conflicts.

<sup>56</sup> TAMPCOL was founded by the government of Tamil Nadu, SKM has used a siddha practitioner to develop his pharmaceutical company, and siddha medicine at Santhigiri Ayurveda and Siddha Vaidyasala was inspired by the guru, founder of the ashram.

<sup>57</sup> Therapeutic proficiency means the ability of siddha practitioners to heal through their knowledge and expertise in pharmacopoeia, but also through the use of mantras for disorders they deem to have magical causes. Most siddha practitioners refuse to employ mantras today, although some of them saw their father or grandfather using the mantras to which they

personal enrichment.<sup>58</sup> The price of medicines typically covers the cost of production but does not allow for much profit. Many practitioners therefore have other sources of income from agriculture or local political positions. It is not rare for manufacturers to organize medical camps<sup>59</sup> during which they provide free medicines, combining thus their duty to the people (*cēvai*) with the means of making their medicaments known, and attracting customers from biomedicine or ayurveda. Their medical practice is also a way to carry on the work of their ancestors from whom they inherited the knowledge. This anchorage in the family tradition guarantees the authenticity of the drugs, even though they are made industrially, and helps the manufacturers to expand their reputation (Sébastien 2015).

To promote the standardisation of Indian medicines, the government invested in the compilation and publication of formulas and pharmacopoeia specific to each Indian medical system with the intention of encouraging practitioners and pharmaceutical companies to use them. For siddha medicine, it has published two volumes of *The Siddha Pharmacopoeia of India*. Some of its formulas have been used by the pharmacies of governmental siddha colleges since 1956.<sup>60</sup> IMPCOPS (Indian Medical Practitioners' Cooperative Pharmacy and Store), a pharmaceutical cooperative formed of ayurvedic, siddha and unani practitioners,<sup>61</sup> also publishes formulas of medicinal preparations for practitioners and pharmaceutical firms. Though some manufacturers draw on these books, they pre-eminently opt for the recipes inherited from their ancestors or gurus (proprietary medicines) from which they acquire their reputation, as well as for the recipes they have developed by consulting manuscripts and texts of the *cittarkaḷ*. Unlike the *śāstric* medicines whose formulas may be known to all practitioners, the formulations of the proprietary medicines are kept secret. The manufacturers and traditional practitioners have to maintain the competition by distinguishing themselves

---

attributed a psychological effect. They consider the use of mantras anachronistic and incompatible with the scientificity they claim for their medicine.

**58** Pillai 1968: 89–95.

**59** The medical camps consist of occasional events organised by the Ministry of Health and Family Welfare or by private hospitals with the aim of treating rural populations or peri-urban underprivileged communities for free. These camps are oriented towards specific treatments such as cataract surgery or vaccination. Concerning siddha medicine, the camps aim to treat all diseases or, exceptionally, epidemics such as chikungunya for which siddha medicine has proved its efficacy.

**60** Uthamaroyan 1995.

**61** This cooperative was created in Madras in 1944 by Srinivasa Murti, secretary to the Usman Committee, who was appointed by the British government to establish the School of Indian Medicines at Madras, to which he was appointed Principal.

from one another.<sup>62</sup> The usage of formulations inherited from the tradition is of such importance that manufacturers of siddha medicine who have no siddha background seek the cooperation of a famous *cittamaruttuvar* (siddha practitioner) who will produce and commercialise his own formulas. The association with the *cittamaruttuvar* allows the firm to exploit his expertise in the matter of formulations and fabrication, and to acquire renown very rapidly and to compete with other companies, siddha as much as ayurveda. This is the strategy chosen by SKM, a large pharmaceutical company at Erode, whose owner built his fortune by producing and exporting powdered egg and milk. The formulas of its products come from the *cittamaruttuvar* Vetathiri Maharishi who founded the Temple of Consciousness and initiated the siddha medical activities of SKM, and the *cittamaruttuvar* Muttusamy who was employed to manage the siddha clinic of SKM.

A change of scale in the commercialisation of medicines is possible only insofar as the practitioners possess a patent for every product and the GMP certificate. Patents, defined by the Drugs and Cosmetics Act 1940 (section 18 (c)) and Rules 1945 (rules 151–160), are obtained from the office of Drugs Control, on the presentation of documents listing the ingredients of the medicines, and giving the name of the text in the case of *śāstric* medicines, the process of fabrication, and the results of the quality test. In order to qualify for GMP, the firm has to be big enough to have rooms for the storage of raw materials, for each process of fabrication, and for packaging, in order to avoid the risk of contamination. Due to the high cost of production and of the quality controls demanded for each batch of medicine, few small manufacturers are able to respect the GMP norms, and therefore either continue to trade illegally on the open market, or limit their production to their private clients. There is no doubt that these regulations are necessary to ensure the quality and safety of the products, but they impede the expansion of the siddha sector. Moreover, since the competition between practitioners and between manufacturers is based on the efficacy of the formulas, and thus on the importance of keeping them secret, these norms constitute a serious obstacle for proprietary medicines as it is compulsory to list the ingredients on labels.<sup>63</sup>

---

**62** A practitioner in the region of Kanniyakumari, whose ancestors were renowned for the efficacy of their medicines, possesses a leaflet by his father that denounces the use of his name by some dishonest peers. This echoes the use of the names of reputed *cittarkaḷ* of the past.

**63** The question of maintaining secrecy has long been part of the debates on the integration of Indian traditional medicines and their institutionalisation. I thank one of the reviewers for attracting my attention to the fact that the British Medical Association published a book in 1909 on this subject (*British Medical Association* 1909) and that secrecy runs counter to the Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 and rules 1955 (texts in Arora 2007:

### 3 The export of siddha medicines: mixing siddha and ayurveda

A means to make the production of siddha medicines feasible and to develop their marketing is to produce them conjointly with ayurvedic ones.<sup>64</sup> This is the strategy used by many siddha manufacturers.<sup>65</sup> It is facilitated by the fact that the two systems share a large part of their *materia medica*, preparations such as *curaṇam*, *centūram*, *parpam* and formulations such as *tiripala curaṇam* and *tirikaṭu curaṇam*.<sup>66</sup> Admittedly, in Tamil Nadu, patients resort to siddha as well as to ayurveda so that the associated production of medicaments is justified.<sup>67</sup> Having products of both systems facilitates the commercialising of drugs beyond the

---

555–564). This act and these rules which forbid the use of magic in medical practice may have limited the practice of mantra and astrology which were used in the clinic for diagnosing and treating patients (Sébastien 2012).

**64** Some siddha manufacturers, such as Aravindh Herbal Labs, also produce homeopathic remedies. Regarding medical practice, homeopathy may be used conjointly with siddha and ayurvedic medicines. This is facilitated by the fact that homeopathic degrees are easily obtained by correspondence courses. Such graduates may open a hospital or a clinic in which only siddha is practised (Sébastien 2010, 2012).

**65** The most important companies (in chronological order of foundation) are: MSS Asan Export/Zigma Herbal Remedies (1940, Nagerkovil); IMPCOPS (1944, Chennai); VKS Raja Sidhaa Marundagam (1961, Tirumangalam); Solaimalai Indian Herbals Drugs (1965, Paramakudi); TAMPCOL (1983, Chennai); Santhigiri Ayurveda and Siddha Vaidyasala (1988, Koliyacode); Dr JRK's Siddha Research and Pharmaceuticals (1990, Chennai); Aravindh Herbal Labs (1992, Rajapalayam); SKM Siddha and Ayurveda (1993, Erode). TAMPCOL was founded in 1983 by the government of Tamil Nadu to provide ASU medicaments to Anna Hospital (where it is sited), and to siddha wards in hospitals and Primary Health Centres located in North Tamil Nadu, South Tamil Nadu being supplied by the pharmacy of the Government Siddha Medical College at Palaiyamkottai. The commercial activities of TAMPCOL began in 1985.

**66** *Curaṇam* (Sanskrit: *cūrṇa*) is a powder of dry plants, *centūram* (Sanskrit: (*rasa*) *sindūra*) is a red powder resulting from the calcination of metals or mercury and mercurial salts preparations, *parpam* (Sanskrit: *bhasman*) meaning “ashes”, is a calcinated preparation based on mineral and/or metallic components mixed with plants, and *tirikaṭu curaṇam* (Sanskrit: *trikaṭucūrṇa*) and *tiripala curaṇam* (Sanskrit: *triphalacūrṇa*) are powders composed of equal parts of three ingredients: the former of pepper, long pepper and dried ginger, and the latter of emblic, chebulic and belleric myrobalans (*Phyllanthus emblica* L.; *Terminalia chebula* Retz.; *Terminalia bellirica* (Gaertn.) Roxb.). These two products are used for treating various diseases and are added to many other drugs. Ayurveda and siddha have, however, some classes of medicaments that are specific to their formularies such as *ariṣṭa* (alcoholic herb-based preparation) in ayurveda, and *cunṇam* (preparation based on the calcification of metals) in siddha.

**67** However, I have never noticed siddha practitioners providing their patients with the ayurvedic alcoholic liquid called *ariṣṭa*.

frontiers of Tamil Nadu, and even of India. At the national level, siddha drugs are mostly distributed in the neighbouring states of Tamil Nadu, Kerala, Karnataka and Andhra Pradesh, and in some major cities. The sale of medicines is conducted mainly by visiting siddha and ayurveda clinics, bio-pharmacies, and *nāṭṭu maruntu kaṭai* (“store of country medicines”), which specialise in raw materials that practitioners and individuals buy for medical and ritual purposes (*homa*). Some siddha practitioners who belong to the traditional milieu and prepare their own medicines as a part of their practice – a significant difference from siddha doctors trained in colleges where medicinal preparation is poorly taught – are also approached by pharmaceutical representatives. In regions such as the southern districts of Tamil Nadu, where there exists a significant community of traditional siddha practitioners, the development of manufactured siddha products has been limited, as patients have more confidence in traditional practitioners and their renowned family remedies than in university- or college-trained siddha practitioners and the industrialised products they prescribe.<sup>68</sup> However, even these traditional practitioners quite often have to complement their own remedies with some manufactured ones as they are increasingly consulted for new diseases for which they have no family remedies.<sup>69</sup> In brief, siddha medicines manufactured by private companies are distributed through siddha practitioners via representatives and through some shops which generally belong to the financially strong companies. Those manufactured by the government are delivered to governmental hospitals and primary health centres. Patients can buy products not available at the hospital pharmacy from siddha medical shops, notably IMPCOPS, situated in the vicinity of the hospitals.

The export market for siddha medicines is limited to a few Asian (Sri Lanka, Singapore, Malaysia, Japan) and Gulf countries, though there are significant Tamil communities from India and Sri Lanka in the United States, Canada, Europe and Australia. The recourse to the internet for buying medicines being on the increase, some siddha medicines do enter western countries. Manufacturers have created sites or rent space on commercial sites that specialise in traditional or alternative medicine. When siddha products are intended for the western market, they are labelled “herbal products” or “dietary supplements” in order to fit in with the authorized nomenclature. Exported products include cosmetics (capillary oils against alopecia, dandruff and whitening of

---

<sup>68</sup> Sébastia 2012, 2015.

<sup>69</sup> Traditional practitioners who have a large clientele receive more than ten sales representatives a week. They buy medicines mostly for treating metabolic disorders and their associated diseases, cholesterol, hypertension, etc., as well as medicines whose galenic form (capsules, syrup and tablet) favours their intake by the patient (Sébastien 2015).

hair, dental powders), dietary powders for boosting appetite or immunity or for facilitating hepatic functions or memory, and various oils for treating allergies. By contrast, products for treating disorders such as skin disease, headache, joint and body pains, arthritis or ulcers, which are quite often based on metallic and mineral materials, are much less represented on the internet.

Manufacturers do not always differentiate between products to be sold in India or abroad. K.K. Pharmaceuticals is a small unit of siddha medicines primarily destined for a private clientele. Its owner, a traditional practitioner from a family that specialises in *varmakalai*<sup>70</sup> from the Nagerkoil district has created an institute for developing the knowledge of *varmaṅkaḷ*. Via his website, he offers correspondence diploma courses in *varmaṅkaḷ* and siddha medicine, his booklets and a quarterly journal, as well as siddha medicines. The latter are not listed on the site but are obtainable by clients who contact him. He claims to have inherited his formulas from his maternal uncle. Many of them are made from mercury to which he attributes high potency. Having no license to export medicines, he slips them inside booklets or advertisements that he sends by courier. The export of siddha products by Dr. JRK's Siddha Research and Pharmaceuticals is, conversely, entirely legal. However, the labelling of its medicines underlines certain limitations of the legislation of GMP. For example, its medicinal packages for treating skin diseases such as vitiligo, eczema or psoriasis, contain an oil for external application and a box of capsules made of a mixture of plants and *iliṅkam centūram* (calcination of purified cinnabar.) The "overseas" order form on the company's website lists all the plants under their Tamil and botanical names, but *iliṅkam centūram* is not translated so that only informed people are able to identify that it is cinnabar (mercury sulphide). This labelling conforms to the GMP as there is no obligation to translate the vernacular terms of non-herbal ingredients. In this way, some manufacturers may challenge the prohibitions which restrict exportation.

## 4 Suitcase export: a blooming market for traditional medicines

While western countries seek to protect themselves from contaminated herbal products exported by Indian companies, they are powerless to regulate informal

---

<sup>70</sup> *Varmakkalai* is the art (*kalai*) of *varmaṅkaḷ* or energy points of the body. It is composed of two antinomial arts: *varmaṅkaḷ*, treating a disorder by pressure on, and massage of, the points, and the martial art which aims to counteract the enemy by injuring the *varmaṅkaḷ*. See <http://varmam.com> (retrieved 20.06.2014) and also Roman Sieler (2015) who has recently conducted his thesis on this speciality.

export. The poisoning by drugs purchased directly in the country of production is considered significant and growing. For example, a report on twelve cases of poisoning linked to lead contained in ayurvedic products, diagnosed between 2000 and 2003 in five U.S. states, states that the medicaments were bought from a practitioner in India and that the patients were natives of India (MMWR 2004). The report points out that the increase in travel abroad, especially in Asian countries, and the pervasiveness of self-medication, favour the risk of poisoning. While the focus of this report was on lead intoxication from ayurvedic medicines bought in India, the increase of mercury poisoning is also a concern, as some Indian medical studies have shown.<sup>71</sup>

The increased purchasing of drugs during visits to India is seen by western countries as a cause of worry. This form of export is called “suitcase export.” Its volume is not quantifiable, but it is considered a public health issue, as medical tourism is blooming and Indian diasporic communities increasingly circulate between their host and native countries. People who turn to siddha practitioners are mainly Tamils established in the Gulf and in western countries. They benefit from their stay in India to buy medicines unobtainable in their host countries, to consult a practitioner or to stay in one of the few pleasantly appointed siddha hospitals.<sup>72</sup> In the Kanniyakumari district where I conducted a large part of my fieldwork, because there is a great tradition of siddha medicine and *varmakalai*, I frequently met women who visit practitioners to buy drugs for their husbands working abroad, especially in Gulf countries. The drugs, bought in large quantities, are sent to their husbands through a peer who is on vacation. This is a way for Tamil migrants to continue their treatment started in India, especially to treat chronic disorders such as body pain, digestive disturbances or blood pressure. Sjaak van der Geest and colleagues (1996) emphasize that migrants are extremely motivated to get the drugs from their native country because the drugs constitute a cultural component with which they can identify. It is, indeed, not uncommon for Tamil migrants who never used siddha medicine before to turn to it when they visit India. They consult either a siddha practitioner recommended by their neighbours, or one of those who tout the benefits of their drugs on Tamil TV channels broadcast abroad or in

---

<sup>71</sup> Dasgupta/Mammatt-Stabler 2011; Gogtay et al. 2002.

<sup>72</sup> This point is extremely important as self-medication is very common both in India and Western countries and is certainly the main cause of poisoning by traditional medicines due to the accumulation of heavy metals in organs. Surprisingly, articles on intoxication by heavy metals rarely pinpoint self-medication; this is a lacuna particularly in the articles of Saper et al. (2004, 2008). On the matter of self-medication, see Trisha Greenhalgh (1987), Sjaak van der Geest (1987), Sjaak van der Geest et al. (1996), and Kamat/Nichter (1998).



Tamil magazines and newspapers distributed in host countries. These often use the iconic figures of Akattiyar, Tirumular or Hanuman to attract a clientele.<sup>73</sup> Foreigners, more familiar with ayurvedic medicine, rarely approach a *cittamaruttuvar*, but when they do, it is often to find a cure for a debilitating disease for which they get no improvement from biomedicine or ayurveda. They usually take the address of a siddha practitioner from a Tamil friend and quite often consult with an interpreter, as siddha practitioners are rarely proficient in the English language. The language barrier also constitutes an obstacle to making siddha medicine better known.

According to my observations of more than twenty siddha practitioners of the Kanniyakumari district, Siddha practitioners rarely prescribe metal-based drugs for foreign clients. The drugs they provide may have been inherited from a family practice, but re-adapted to the clientele by replacing metal with plants considered to be of similar efficacy. This adaptation is based on the fact that, on the one hand, they do not want to incur the risk of poisoning their patients and tarnishing their reputation, and on the other hand, the idea that foreigners are attracted by herbal medicines. In the last decades, siddha medicines have received growing interest from the public. However, according to my observation of consultations by some traditional practitioners over five years, this trend does not mean that patients are fully confident in the efficacy of siddha medicines. Practitioners point out that it is difficult to attract new customers while it is much easier to lose them if a problem occurs. To protect their reputation as individual practitioners as well as the public perception of the efficacy of their medicines, some siddha practitioners, such as Sivabalan who runs a forty-bed hospital in Kanniyakumari district, refuse to treat patients with severe health conditions (heart problems, renal failure, etc). Sivabalan's prudence is not a marginal phenomenon as practitioners are frequently consulted when biomedicine has failed or to avoid surgery (Sébastien 2015). To protect their reputation, siddha practitioners often only provide metal-based medicines when they deem them indispensable. Jeyananda, a practitioner who run an eighty-bed hospital in Kanniyakumari district, confided in me during one of my numerous stays between 2006–2011:

---

<sup>73</sup> In the context of siddha medicine, Hanuman is considered to have brought the *cañcīvi* panacea into Tamil Nadu, when a fragment of the Himalayas that he was carrying to Sri Lanka to revive Rama, fell. *Cañcīvi* is a kind of mythical herb, the plant varying according to the practitioner. In the Nagerkovil district, a hill close to Kanniyakumari is considered a fragment of the Himalaya transported by Hanuman. It is called Maruntuvālmalai (mountain of the medicinal plants) and has at its summit a small temple dedicated to Hanuman (Parthipan/Santhanakumar 2005).

I do not prepare medicines with metals. My father and grandfather used metals but not me. This is a big issue now since there have been problems of intoxication in America. And the Indian government is very conscious of this. If a patient complains that he has had problems with our medicines, the government will immediately come and cause us problems. Only for exceptional cases, I give this kind of medicines, but they come from a company that I know well; I visited it before buying the medicines.

In fact, practitioners like Jeyananda, Sivabalan or members of the Madurai Siddha Sangham are well informed about the sanitary alert from foreign countries and the risks related to metal-based medicines. Even though their practice does not oblige them to follow the rules made for pharmaceutical marketing, they are afraid of being accused of quackery if a patient develops adverse effects. Recurrent articles in the press about governmental interventions, closing clinics and imprisoning owners accused of quackery, contribute to the precautions taken by certain practitioners, notably those who run a hospital or have an extensive clientele.

## 5 Controversy over metal-based drugs: a question of knowledge

Siddha practitioners claim that the preparations based on metal, and in particular on mercury and mercurial complexes, have higher curative properties than herbal products. They argue that siddha medicine is more efficient than ayurveda because of the prestigious *cittarkaḷ*'s expert knowledge of mercury. However, members of the Madurai Siddha Sangham emphasise that metal-based remedies must be prescribed as a last resort: "We give first herbal medicines. Only if the condition of the patient does not improve or becomes severe, we give medicines with mercury or metals, but for a few days only, not more than two weeks."<sup>74</sup> They argue that this restriction on the utilization of metallic components in therapy is mentioned in an unreferenced second-hand book entitled *Citta maruttuvaṅka curukkam* by Cannigaiper Subramaniya Uthamaroyan. Justifying changes in medicines by tradition is a way to legitimise new forms of therapy and to free siddha medicine from its reputation of an alchemical science, i.e. obscure, magical and dangerous. It is however

---

<sup>74</sup> Statement made during an open discussion with six members of the Madurai Siddha Sangham in 2007 and confirmed by several practitioners in a recent meeting.

important to underline that the *cittarkaḷ* were extremely aware of the risk of poisoning by mercury, arsenic and some plants.<sup>75</sup> The report of the Usman committee states:

In the hands of the experts of this system (siddha), the cases of ‘mercurialism, arsenic poisoning, etc. are as rare as they are common in the hands of these quacks. It is for this reason that some Ayurvedists (specially of the Malabar School) prefer to confine themselves solely to the use of the vegetable remedies (...) It is also likely that the idea prevalent among some Ayurvedists that, as a rule, recourse must first be had to vegetable remedies, and it is only when they fail or the disease has progressed too far, that Siddha treatment should be undertaken, has its origin in the belief that the potency of the Siddha remedies for good is as great in the hands of its experts, as their potency for evil, in the hands of the quacks.<sup>76</sup>

Siddha practitioners subject their iatrochemical products to long and repeated processes (grinding, pounding, calcinations) aimed at improving the efficacy of their drugs and minimizing the iatrogenic effects. Mercury and mercurial components as well as other poisons (plants and metals) are always used after a long process of purification (*cutti*) for neutralising the poisonous substances. The purification process varies according to the raw material. Cinnabar (*ilankam*) is detoxified by being soaked in lemon juice for one day (Figures 10–12) or in mother’s milk for ten days, while mercury (*iracam*) is detoxified by grinding it with a combination of turmeric, coconut ash and



Figure 10: Soaking in lemon juice.

<sup>75</sup> See Anandan 1999.

<sup>76</sup> Usman 1923: 87.



**Figure 11:** Washing and drying.



**Figure 12:** Soaking and boiling plant juice.

**Figures 10–12:** Process of detoxification of *iliṅkam* (cinnabar): Photos taken at the Government Siddha Medical College GSMC, Palayamkottai ©Christian Sébastia.

spider's web for twenty-four hours, and then, after washing, by being boiled in a plant juice and washed again<sup>77</sup> (Figure 13). Once detoxified, these products are ground with various ingredients (Figure 14) and calcinated at a temperature regulated by the quantity of cow-dung (Figure 15 and Figures 16–18).

<sup>77</sup> As a comparison with processes of purification in ayurvedic alchemy, one may consult the volume I of Mookerji (2006). Some ingredients are similar but their combination is different.



**Figure 13:** Purification of *iracam*. Photo taken at the Government Siddha Medical College GSMC, Palayamkottai ©Christian Sébastia.



**Figure 14:** Mechanisation of the long processing procedure, *iracam*-based formulation. Photo taken at the Government Siddha Medical College GSMC, Palayamkottai ©Christian Sébastia.

Siddha practitioners also developed antidotes for neutralizing iatrogenic effects. According to the *Nañcu murivu nūl* (a book of antidotes for poisons), cinnabar poisoning is treated for forty days with a decoction of nutmeg, pepper, root bark of *Gossypium arboreum* and sugar; calomel (*pūram*) poisoning is treated with a



**Figure 15:** Calcination of *ilin̄kam centūram*. Photo taken at the Government Siddha Medical College GSMC, Palayamkottai ©Christian Sébastia.

decoction of different parts of four plants called *nilappanai kilaiṅku kuṭinīr* taken for two to three weeks.<sup>78</sup>

Even though siddha practitioners seem to have preserved their iatrochemical know-how much more than their ayurvedic peers, their tendency to avoid metals, and particularly mercury, in their medicaments may ultimately lead to the decline

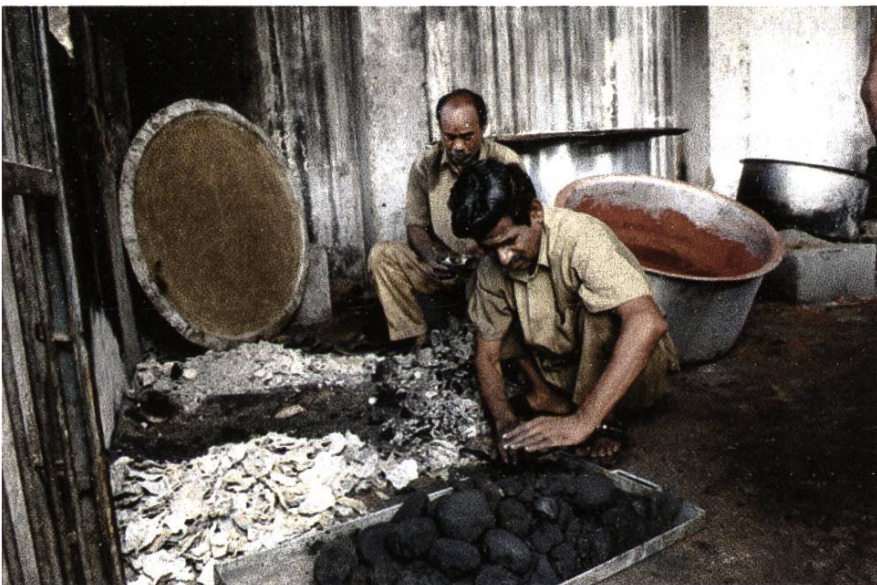


**Figure 16:** Putting the *kasturi karuppu* after into a cloth ©Christian Sébastia.

<sup>78</sup> The signs and symptoms of cinnabar poisoning described in this text are: ulceration of the digestive system from larynx to intestine; dysphasia and aphasia; bad breath; reluctance to pungent taste; and saliva like spoiled toddy or vinegar (Anandan 1999: 31).



**Figure 17:** Preparing the calcinations of *kasturi karuppu* (method of obtaining a moderate temperature).



**Figure 18:** Collecting the *kasturi karuppu* after calcination and cooling – the product will be powdered and stored.

**Figures 16–18:** Process of calcination for *kasturi karuppu* (including *iracam*, *pūram*, *iliṅkam*). Photos taken at the Government Siddha Medical College GSMC, Palayamkottai ©Christian Sébastia.

of siddha knowledge and identity. Through the strict use of plants, siddha medicine hardly differs from ayurvedic medicine as it is practised in the neighbouring state of Kerala. Siddha practitioners refer to Kerala ayurveda when they try to convince patients of the therapeutic effects of plants. Their goal is to make their medicine as attractive as the plant-based ayurveda practised in Kerala, which is perceived by both Indian and foreign clientele as the authentic ayurveda.

However, not all siddha practitioners share the same view in regard to the equivalence of efficacy between plants and metals. Several practitioners I visited were proud to exhibit their iatrochemical products such as solidified mercury

(*iracamaṇi*), *muppū* or *kaṭṭu* as a testimony of their skills in siddha medicine.<sup>79</sup> A few claim that they have discovered methods of purifying metals, formulas and processes of making complex medicaments thanks to rigorous asceticism. They assert that they are not afraid of causing poisoning because they strictly follow the instructions given in the *cittarkaḷ*'s texts, inherited from their ancestors or gurus, or revealed during meditation. Their opinion of practitioners who have abandoned the use of metals is severe. They accuse them of being mediocre practitioners, in quest of money rather than being concerned with their patients' health. They interpret their refusal to use metals as a pretext to hide their ignorance and lack of expertise. Some siddha practitioners insist that, even though the process costs a lot, it is necessary to redo calcination until the colour and aspect of the final product are perfect, in order to ensure the safety and quality of the preparation.<sup>80</sup> To quote Egilane, a practitioner who acquired his practice of yoga and knowledge of siddha from a twenty-year apprenticeship to his guru who had founded a *kurukulam* (traditional school of teaching from master "guru" to disciple "śiṣya"):

Those who do not want to use metals are poor practitioners. When you know how to treat metals correctly, carefully respecting each stage of fabrication until the final product, you are not afraid to give drugs based on metals. Practising siddha medicine is difficult because it requires time, patience, trust and a long practice of yoga. It is only through yoga that we can understand the *cittarkaḷ*'s formulas and know the secrets of purifying and transforming the metals. But how many practitioners today practise yoga? So many practitioners prefer to give herbal medicines; they are so easy and cheap to prepare. But, this is not siddha medicine these people practise, it is ayurveda.<sup>81</sup>

In Egilane's opinion, the difference between the practice of ayurvedic and siddha medicines is that the former is primarily commercial while the latter must not generate financial profit because the knowledge is intrinsically linked to esoteric values. As I have noticed in my extensive fieldwork, the siddha

---

<sup>79</sup> Sébastia 2015.

<sup>80</sup> Siddha practitioners consider calcination an important part of the purification process. While I observed that Egilane, among others, did not hesitate to redo the calcination process if his final products were not satisfying, in governmental pharmacy at the siddha college of Palaiyamkottai, I noticed sometimes that the purification and calcination processes were not complete.

<sup>81</sup> Interview conducted in May 2009 at Egilane's home at Pondicherry. According to Egilane, the practice of yoga is key to the fabrication of medicinal preparations: "Yoga is the path of excellence to develop the knowledge of siddha medicine through its practice; the ascetic can reveal the location of the necessary herbs for the preparation of remedies, and the method of purifying a metal or creating a new formula."



practitioners who point to this difference belong mainly to the category of traditionally trained practitioners. For example, during a discussion in February 2008 with members of the Madurai Siddha Sangham, one practitioner argued: “Our medicine is powerful because of the great knowledge of our *cittar* who developed alchemy. But nowadays, we have to be careful because if we use medicine with metals, we are accused of quackery. To avoid to be bothered by the government, we prefer to give plants to the patients, like ayurvedic people”. As I have observed during my interaction with the institutionalised practitioners working in siddha colleges and at CRIS (Council Research Institute for Siddha), the term quack is frequently used as a synonym for traditional siddha practitioners: “90% of traditional siddha practitioners are quacks. They have no education, but they claim to know secrets from their gurus and ancestors and, using astrology and mantra, they cheat people.”<sup>82</sup> Admittedly, there are still self-confident traditional practitioners who continue to treat patients with metal-based medicines (Sébastien 2010, 2015), and to conduct research on siddha manuscripts and texts in order to discover iatrochemical recipes for treating difficult curable diseases. However, the fact that siddha medicine has been institutionalised in reflection of biomedical sciences, asceticism and esotericism which contribute to siddha knowledge and medical practice tend to disappear, reducing this system to the sole practice of medicine. As Rajendran, a practitioner of Kanniyakumari district who runs a sixty-bed hospital, told me when I questioned him about his practice compared to that of his father: “Since my childhood, I learnt siddha from my father and from *ācāṅkaḷ*. From the *ācāṅkaḷ*, I learnt alchemy and secret formulas of our great *cittar*. My father was an expert in medicine and he was also *mantiravāṭi* (magician, sorcerer). But I do not practise *mantirakkaḷ* because patients come to us only for medicines. *Mantiraṅkaḷ* were efficacious, they worked well in psychological issues, but practising them will give us the reputation of quack.”<sup>83</sup> Interestingly, while Rajendran relates magic to quackery, he feels that his training in alchemy has been the key to developing his “powerful” medicines. In contrast to Jeyananda, he does not fear being accused of quackery if his metal-based medicines cause iatrogenic effects. His trust in his medicines is such that, for four years, he has been producing them on a large scale and selling them on the market. In a certain way, Rajendran confirms Egilane’s statement regarding the relation between confidence in metal-based medicines and the skill to produce them.

---

<sup>82</sup> Interview at the CRIS, Chennai, in December 2006.

<sup>83</sup> Interview in Rajendran’s hospital in May 2008.

## 6 Conclusion

The use of metals and the complexity of medicinal preparations are still testimonies of a past dominated by discoveries about matter and by philosophical and spiritual ideologies. However, the question arises how long this rich knowledge will survive in the face of modern considerations about safety and efficacy and the newly imposed accompanying legislation. Indeed, acting on the demands of pharmaceutical and biomedical lobbies, western countries implicitly force the governments of the countries of origin of the traditional medicines to adopt their regulations on drugs in matters of safety, standardisation, clinical trials, etc. (WHO, 2002). This hegemonic attitude is worth enquiring into. The health warning from Saper and his colleagues begs more questions. Why is the number of poisoning by heavy metals in ayurvedic and related medicines reported in medical literature so small if the medicines themselves are supposedly so toxic? This question is all the more relevant in the case of mercury as there are hardly any medical articles which warn of poisoning by mercury and mercurial components from HMPs (personal communication, October 2006). Lastly, why have no supplementary studies been conducted to analyse the bioavailability of heavy metals in the organism? If traditional medicines, as the World Health Organization suggests,<sup>84</sup> have the potential to heal various diseases biomedicine is unable to cure, is there then no risk that such health warnings may prevent patients from improving their conditions?

A first version of this study, funded over two years by the French Institute of Pondicherry, was published in 2011 under the title “Le passage des frontières de médecines pas très douces: prévenir l’innocuité ou préserver l’authenticité? Le problème des formulations iatrochimiques dans la médication siddha” in the *Revue de l’anthropologie des connaissances* 5.1: 71–98. The present paper has been updated and enlarged with information on the Tamil siddha tradition linked with tantrism and alchemy with a special focus on mercury. It has greatly benefited from comments by Dagmar and Dominik Wujastyk, especially about the history of ayurvedic alchemy, as well as comments of the two reviewers.

## Bibliography

Anandan, Anaivaari R. (1999): *Siddha toxicology. A translation of Tamil Siddha Text Nanju Murivu Nool written by Vaydia Sironmani Pandi K.S. Murugesu Mudeliar and Revised by Dr Pon. Gurusironmani*. Chennai: Department of Indian Medicine and Homeopathy.

---

84 WHO 2002: 23.

- Arora, Krishan (ed.) (2007): *Drugs and Cosmetics Laws*. New Delhi: Professional Book Publishers.
- Ayurveda and Health Tourism* (March 13, 2008). <http://ayurvedamagazine.org/ayush-to-enforce-label-rules-from-july-2006> (03/20/2015).
- Banerji, Sures Chandra (1992): *New Light on Tantra*. Calcutta: Punthi Pustak.
- Dasgupta, Amitava/ Mammatt-Stabler, Catherine A. (eds.) (2011): *Herbal Supplements. Efficacy, Toxicity and Interactions with Western Drugs and Effects on Clinical Laboratory Tests*. Hoboken, NJ/Toronto, Ontario: John Wiley and Sons.
- Dash, Vaidya Bhagwan ([1986] 2003): *Alchemy and Metallic Medicines in Ayurveda*. New Delhi: Concept Publishing Company.
- Ernst, Edzard (2002): "Toxic Heavy Metals and Undeclared Drugs in Asian Herbal Medicines". *European Journal of Clinical Pharmacology* 57: 891–896.
- Ernst, Edzard (2003). "Serious Adverse Effects of Unconventional Therapies for Children and Adolescents: A Systematic Review of Recent Evidence". *European Journal of Pediatrics* 162: 72–80.
- Filliozat, Jean (1979): *Yogaśataka. Texte médical attribué à Nāgārjuna*. Pondichéry: Institut Français d'Indologie.
- Formulatory of Siddha Medicines* (2000): Madras: The Indian Medical Practitioners Co-operative Pharmacy & Stores Ltd (IMPCOPS).
- Ganapathy, T.N. (1993): *The Philosophy of the Tamil Siddhas*. New Delhi: Indian Council of Philosophical Research.
- Geest, Sjaak van der (1987). "Self-Care and the Informal Sale of Drugs in South Cameroun". *Social Science and Medicine* 25.3: 293–305.
- Geest, Sjaak van der/ Reynolds Whyte, Susan/ Hardon, Anita (1996): "The Anthropology of Pharmaceuticals: A Biographical Approach". *Annual Review of Anthropology* 25: 153–178.
- Gogtay, N.J. et al. (2002): "The Use and Safety of Non-Allopathic Indian Medicines". *Drug Safety* 25.14: 1005–1019.
- Greiner, Frank (1998): *Aspects de la tradition alchimique au XVIIe siècle*. Actes du colloque international de l'Université de Reims-Champagne-Ardennes (Reims 28 et 29 novembre 1996), Paris: SEHA; Milan: ARCHE.
- Greenhalgh, Trisha (1987): "Drugs Prescription and Self-Medication in India: An Exploratory Survey". *Social Science and Medicine* 25.3: 307–318.
- Gupta, Vikas et al. (2013): "Variation of Heavy Metal Content of Market Variants of Ayurvedic Formulation – Lack of Good Manufacturing Practices (GMP)". *British Journal of Pharmaceutical Research* 3.3: 401–406.
- Hausman, Gary J. (1996): *Siddhars, Alchemy and the Abyss of Tradition: 'Traditional' Tamil Medical Knowledge in 'Modern' Practice*, unpublished thesis, University of Michigan.
- Hutin, Serge ([1977] 1995): *Les alchimistes au Moyen Age*. Paris: Hachette.
- Kamat, Vinay R./ Nichter, Mark (1998): "Pharmacies, Self-Medication and Pharmaceutical Marketing in Bombay, India". *Social Science and Medicine* 47.6: 779–794.
- Kamath, Sushant U. et al. (2012): "Mercury-Based Traditional Herbo-Metallic Preparations: A Toxicological Perspective". *Archives of Toxicology* 86: 831–838.
- Koch, Iris et al. (2011): "Bioaccessibility of Lead and Arsenic in Traditional Indian Medicines". *Science of the Total Environment* 409: 4545–4552.
- Kutumbiah, P. (1973): "The Siddha and Rasa Siddha Schools of Indian Medicine". *Indian Journal of History of Medicine* 18: 21–33.

- Kumar, A. et al. (2006): "Availability of Essential Elements in Bhasmas: Analysis of Ayurvedic Metallic Preparations by INAA". *Journal of Radioanalytical and Nuclear Chemistry* 270.1: 173–180.
- Liu, Jie et al. (2008): "Mercury in Traditional Medicines: Is Cinnabar Toxicologically Similar to Common Mercurials?" *Experimental Biology and Medicine* 233.7: 810–817.
- Madhavan, V.R. (1984): *Siddha Medical Manuscripts in Tamil*. Madras: International Institute of Tamil Studies.
- Mahdihassan, S. ([1979] 2002): *Indian Alchemy or Rasayana: in the light of Ascetism and Geriatrics*. Delhi: Motilal Banarsidass.
- Meenakshi, P. (2001): "The Siddhas of Tamil Nadu: A Voice of Dissent". In: *Tradition, Dissent and Ideology; Essays in Honour of Romila Thapar*. Edited by R. Champakalakshmi and S. Gopal. New Delhi: Oxford University Press, 111–134.
- Meulenbeld, G. Jan (2000). *A history of Indian Medical Literature*, Volume II A and B. (Groningen Oriental Studies; XV). Groningen: Egbert Forsten.
- Mookerji, Bhudeb (2006): *Rasa-Jala-Nidhi. Ocean of Indian Chemistry and Alchemy*, 4 vols. New Delhi: Cosma Publications.
- Murthy, P. Himasagara Chandra (2008): *Rasaśāstra. The Mercurial System*. Vanarasi: Chowkhamba Sanskrit Series Office.
- Natarajan, Kanchana (2004): "'Divine Semen' and the Alchemical Conversion of Iramatevar". *The Medieval History Journal* 7.2: 255–278.
- Obringer, Frédérique (1997): *L'aconit et l'orpiment. Drogues et poisons en Chine ancienne et médiévale*. Paris: Fayard.
- Palanichamy, K. (1973): "Works on Medicine by Siddhars". *Bulletin of the Indian Institute of History of Medicine* 3.2: 71–75 and 3.3: 132–134.
- Parthasarathy, R. (1993): *The Cilappatikāram of Iḷankō Aṭikaḷ*. New York: Columbia University Press.
- Parthipan, B./ Santhanakumar, G. (2005): *Monograph on the Medicinal Plants of Marundivalmalai Hills*. Nagercoil: Society for Environmental Education and Development.
- Pharmexcil (Pharmaceuticals Export Promotion Council) (2005): "Press Release: Export of Herbal Ayurvedic, Siddha & Unani Medicines – Order Relating to Labelling on Heavy Metals Amended". December 16, Ministry of Commerce & Industry, Government of India. [http://www.pharmexcil.org/v1/docs/PressReleases/Export\\_of\\_Herbal\\_Ayurvedic\\_Siddha.pdf](http://www.pharmexcil.org/v1/docs/PressReleases/Export_of_Herbal_Ayurvedic_Siddha.pdf) (06/12/ 2014).
- Pillai, T.V. Sambasivam (1968): *Tamil-English Dictionary of Medicine, Chemistry, Botany and Alien Sciences (Based on Indian Medical Science)*, Volume 1. Madras: Government of Tamil Nadu.
- Poisons Act (1904): <http://lawmin.nic.in/legislative/textofcentralacts/1904.pdf> (05/18/2015).
- Rao, Mruthyumjaya Meda/ Kumarmeena, A./ Galib (2011): "Detection of Toxic Heavy Metals and Pesticide Residue in Herbal Plants Which are Commonly Used in the Herbal Formulations". *Environmental Monitoring Assessment* 181: 267–271.
- Raviraja A. et al. (2010): "Three Cases of Lead Toxicity Associated with Consumption of Ayurvedic Medicines". *Indian Journal of Clinical Biochemistry* 25.3: 326–329.
- Ray, Prafulla Chandra (1925): *A History of Hindu Chemistry: From the Earliest Times to the Middle of the Sixteenth Century*, 2 vols. Calcutta: Chuckerverty, Chatterjee & Co.
- Roy, Mira/ Subbarayappa, B.V. (1976): *Rasārṇavakalpa*. New Delhi: Indian National Science Academy.

- Sallon, S. et al. (2006): "Mercury in Traditional Tibetan Medicine—Panacea or Problem?" *Human and Experimental Toxicology* 25: 405–412.
- Samuel, G. John (1998): *A Descriptive Catalogue of Palm-Leaf Manuscripts in Tamil, Vol. V, Part II*. Chennai: Institute of Asian Studies.
- Sanyal, P.K. (1964): *A Story of Medicine & Pharmacy in India. Pharmacy 2000 Years Ago and After*. Calcutta: Shri Amitava Sanyal.
- Saper, Robert B. et al. (2004). "Heavy Metal Content of Ayurvedic Herbal Medicine Products". *JAMA* 292.23: 2868–2873.
- Saper, Robert B. et al. (2008): "Lead, Mercury, and Arsenic in US- and Indian-Manufactured Ayurvedic Medicines Sold via the Internet". *JAMA* 300.8: 915–923.
- Scharfe, Hartmut (1999): "The Doctrine of the Three Humors in Traditional Indian Medicine and the Alleged Antiquity of Tamil Siddha Medicine". *Journal of the American Oriental Society* 119.4: 609–629.
- Schipper, Kristofer ([1982] 1997): *Le corps taoïste. Corps physique – corps social*. Paris: Arthème Fayard.
- Sébastien, Brigitte (2010): "Governmental Institution Versus Associations. Multifaceted Expression of Siddha Medicine in Tamil Nadu". <http://rcsi.hypotheses.org>.
- Sébastien, Brigitte (2012): "Competing for Medical Space. Traditional Practitioners in the Transmission and Promotion of Siddha Medicine". In: *Medicine, State and Society. Indigenous Medicine and Medical Pluralism in Contemporary India*. Edited by V. Sujatha and L. Abraham. Delhi: Orient BlackSwan, 165–185.
- Sébastien, Brigitte (2015): "Coping with Diseases of Modernity: The Use of Siddha Medical Knowledge and Practices for Diabetics' Care". In: *Routledge Handbook of Contemporary India*. Edited by K.A. Jacobsen. Abingdon: Routledge, 474–489.
- Shanmugavelan, A. (1963): *Siddhar's Science of Longevity and Kalpa Medicine of India*. Madras: Sakthi Nilayam.
- Sieler, Roman (2015): *Lethal Spots, Vital Secrets. Medicine and Martial Arts in South India*. New York: Oxford University Press.
- Srivastava, Amita et al. (2005): "An Epidemiological Study of Poisoning Cases Reported to the National Poisons Information Centre, All India Institute of Medical Sciences, New Delhi". *Human & Experimental Toxicology* 24: 279–285.
- Subramanian, Nitya (2005): "Govt to Set New Standards for Ayurvedic, Unani Drugs". *The Hindu Business Line*, 24 September.
- The Siddha Formulary of India* (1992): New Delhi: Government of India, Ministry of Health and Family Welfare, Department of Indian Medicine and Homeopathy.
- The Siddha Pharmacopoeia of India. Part I, volume I* (2008) and *volume II* (2011). New Delhi: Government of India, Ministry of Health and Family Welfare, Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy (AYUSH).
- Tieken, Herman (2003): "Old Tamil Cankam Literature and the So-called Cankam Period". *Indian Economic Social History Review* 40: 247–278.
- Usman, Khan Bahadur Muhammad (1923): *The Report of the Committee on the Indigenous Systems of Medicine*. Madras: Office of the Committee on the Indigenous Systems of Medicine.
- Uthamaroyan, C.S. (1995): *Pharmacopoeia of Hospital of Indian Medicine, Part II Siddha*, Madras: Tamil Nadu Siddha Medical Board.
- Vaidya Yoga Ratnavali (Formulatory of Ayurvedic Medicines)* (2000): Madras: The Indian Medical Practitioners Co-operative Pharmacy & Stores Ltd (IMPCOPS).

- Venkatraman, R. (1990): *A History of the Tamil Siddha Cult*. Madurai: NS Ennes Publications.
- Weiss, Richard S. (2008): "Divorcing Ayurveda: Siddha Medicine and the Quest for Uniqueness". In: *Modern and Global Ayurveda: Pluralisms and Paradigms*. Edited by D. Wujastyk and F.M. Smith. New York: SUNY Press, 77–99.
- Weiss, Richard S. (2009): *Recipes for Immortality. Medicine, Religion and Community in South India*. New York: Oxford University Press.
- White, D.G. ([1996] 2004): *The Alchemical Body. Siddha Traditions in Medieval India*. New Delhi: Munshiram Manoharlal Publishers.
- WHO (2002): *WHO Traditional Medicine Strategy 2002–2005*. Geneva: World Health Organization.
- WHO (2007): *Exposure to Mercury. A Major Public Health Concern*. Geneva: World Health Organization. <http://www.who.int/phe/news/Mercury-flyer.pdf> (06/30/2014)
- Wujastyk, Dominik (1983): "An Alchemical Ghost. The rasaratnākara by Nâgârjuna". *Ambix* 31.2: 70–83.
- Zvelebil, Kamil V. ([1973] 1993). *The Poets of the Power. Freedom, Magic and Renewal*. Lower Lake, CA: Integral Publishing.

