

## MINERALS AND GEMS IN INDIAN ALCHEMY

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The Indian alchemical literature in Sanskrit and Tamil refers to the multi-dimensional use of a wide variety of minerals. The most important are: (A) mica, calamine, copper-pyrite, tourmaline, iron-pyrite, copper-sulphate, bitumen and lapis lazuli, called superior minerals and (B) orpiment, alum. sulphur, realgar, tinstone or cassiterite, red-ochre, antimony and iron-sulphate, called subsidiary minerals. An interesting aspect relates to the purifications of these minerals with a view to importing to them the necessary qualities for alchemical operations leading to the preparation of "elixir" and such other medicinal compositions.

Yet another aspect is concerned with the extraction of what is in alchemical literature as their "essence", the chemical details of which are not exactly clear.

The other types of minerals are classed under the heading *gems*. They are: ruby, pearl, coral, emerald, topaz, diamond, sapphire, zircon and cat's eye, nine in number. Even these gems are subjected to various processes in order to obtain their *essences*.

Several apparatuses and contrivances were being designed and used for conducting necessary operations.

Refreshingly, some of the alchemical text also mention the distribution and characteristics of various minerals including gems, thus revealing the technical knowledge of those involving the preparation of several mineral-based medicinal compositions.

The paper attempts to discuss these and allied aspects pertaining in the minerals and gems as embodied in the various texts in Sanskrit, called the "*Rasaśāstra*".

The Indian alchemical literature in Sanskrit and Tamil refers to the multi-dimensional use of a variety of minerals. The pre-eminence of minerals as alchemical substance is first recognized in the famous sayings in *Rasaratnākara* of Nāgārājuna of c. 8th cent. A.D. Attributing minerals with some wonderful properties of conversion of base metals into higher metals. The subsequent periods evince extensive study of minerals started with the search for essential substances for attaining perfection in preparation of elixir to a wide extent. Alchemical literature in India from c. 8th cent. A.D. onwards abounds in details of minerals and gems in regard to physical traits, places of origin in some cases, categorization into superior and inferior,

chemical and medicinal values, processings for utilization as alchemical substance. The paper attempts to discuss these and allied aspects pertaining to the minerals and gems as embodied in the various texts in Sanskrit, called the *Rasasāstra*.

### MINERALS IN ALCHEMICAL PRACTICES

Alchemical operations are predominated by the use of two minerals, mica and sulphur, believed to have been the creative elements of goddess Durgā.<sup>1</sup> Associated with mercury, a male principle owing to its origin from semen of God Śiva, the two minerals, particularly mica, acted as co-generators in alchemical creation involving transubstantiation of body and transmutation of metal (*dehalohakara*). The concept of mercury-mica complex as elixir, found mentioned also in the Siddha systems in Southern India, was undoubtedly developed in India.<sup>2</sup> This is however a deviation from sulphur-mercury complex, pre-eminent in other part of the world.

The range of sixteen minerals distributed in superior (*rasas* or *mahārasas*\*) and subsidiary classes (*uparasas*) according to their degrees of importance as alchemical substance comprise:—

(i) *Rasas* or *Mahārasas*, eight in number generally include, *abhraka* (mica), *vaikrānta* or *vaikṛnta* (a precious stone having eight surfaces and six angles, probably tourmaline), *mākṣika* (copper pyrites), *vimala* (iron pyrites), *śilājatu* (bitumen), *sasyaka* (copper sulphate), *capala* (*bismuth*) and *rasaka* (calamine).

(ii) *Uparasas*, also eight in number comprise *gandhaka* (sulphur), *gairika* (*red-ochre*), *kāsīsa* (iron sulphate), *tuvarī* (alum), *tālaka* (orpiment), *manaḥśilā* (realgar), *añjana* (collyrium: compounds of antimony) and *kankuṣṭha* (tinstone or cassiterite). These scheme of members in both the groups, enumerated in *Rasa-ratna-samuccaya*<sup>3</sup> are not followed in all the texts. Thus in *mahārasa* group *capala* is replaced by *rājavarta* (*lapis lazuli*) in *Rasaprakāśa Sudhākara*;<sup>4</sup> mica is not included as *mahārasa* in *Rasaḥṛdaya*<sup>5</sup> and *Rasārṇava*<sup>6</sup> and the *Rasārṇava* includes *darada* (cinnabar) in *mahārasa* and *rājavarta* in *uparasa*. Further variations are also noted in *Rasasāra* where not only in particular minerals but also increases in number of minerals in the two groups are notable.<sup>7</sup>

The *ratnas* generally are precious stones. The principal gems, roughly nine in numbers are: *māṇikya* (ruby), *mauktika* (pearl), *vidruma* (coral), *tārḥṣya* (emerald), *puṣpaka* (topaz), *vajra* (diamond), *nīla* (sapphire), *gomeda* (zircon), and *vaidūrya* (cat's eye).<sup>8</sup> The *Rasaratna-Samuccaya*<sup>9</sup> adds to it *vaikrānta* (tourmaline) which is also a *mahārasa*, *sūryakānta* (sun stone) and *candrakānta* (moon-stone).

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\**Rasa* in the sense of *mahārasa* is used in a number of texts though these two words are not synonymous. Former is generally used for mercury.

## PROCESSING OF MINERALS

The two essential processing of minerals as alchemical or as medicinal substances were *śodhana* (or purification) and *sattva-pātana* (or extraction of “essence”). Alchemical texts are full of details of these two treatments of minerals and gems.

A. *Purifications*: The general procedures of purification comprise:<sup>10</sup>

I. *Minerals*:

(i) Maceration; (ii) boiling; (iii) boiling in steam with different substances particularly in *Svedana* or *dolā* yantra; (iv) roasting followed by immersion in decoction of desired plant; (v) distillation (only in case in *capala* (bismuth) in apparatus for distillation; (vi) washing (*dhauta*) after heating operation.

Common substances recommended for purification of minerals are noted in *Rasaśāstra* texts:

- (i) Vegetable substance — decoction of *kulattha*
- (ii) Animal product — Cow’s urine and cowmilk and other milk-product, particularly, clarified butter
- (iii) Alaki (particularly *yavakṣāra*), acid substance (particularly sour gruel), salt.

II. *Gems*:

The purification of gems are stated to have been performed by steaming in *Svedana* apparatus with the aid of plant-juice and other vegetable product, as required for particular gems. The *Rasaprakāśasuddhākara*<sup>11</sup> specifically mentions particular plant or other substances for particular gems in this way:

- a) Ruby — plants of sour group
- b) Pearl — expressed juice of *Jayanti*
- c) Coral — alkalis
- d) Emerald — cow-milk
- e) Topaz — sour gruel
- f) Diamond — decoction of *kulattha*
- g) Sapphire — leaf-juice of indigo plant
- h) Zircon — yellow pigment prepared from cow’s bile.
- i) Tourmaline — decoction of three myrobalans.

Suitability for internal use and for any other operations purification formed the primary treatment of alchemical substances.

### *Extraction of 'essence'.*

The second processing involved extraction of principal matter from minerals and gems. The special term used for this product is *sattva* or 'essence', suggestive of 'soul', and itself as an elixir<sup>12</sup> (*rasāyana*). Obviously for some minerals it forms "the metal contents" and the texts described them accordingly. The *Rasasāra*,<sup>13</sup> a text of 13th-14th cent. A.D. states the "essence" of minerals, like tourmaline, bismuth (*capala*), iron-pyrites, and sulphur as highly efficacious in alchemical preparation.

The mechanism of extraction of "essence", entailed metallurgical operation using crucibles, mostly closed and adequate heating equipments. The procedures included: (i) Trituration with essential substances (with the properties of decomposition of minerals). The pasted product was employed in three forms, (a) as paste, (b) as pasty mass in ball-shape, and (c) as pallet (*guṭikā*). (ii) The next operation was processes leading to extraction by (a) smelting, or by (b) boiling in steam, or by (c) vapourization.

The 'essence' was obtained in two forms, as molten state and as "condensed vapour".

#### APPARATUS AND APPLIANCES RELATED TO THE OPERATION.

##### I. *Smelting:*

The principal apparatus for smelting was the closed crucible (*mūkamūṣā*), a device coming down from the period of Nāgārjuna<sup>14</sup>. The later period brought the system of arranging two crucibles stacked one upon the other. However in all cases use of blower one or two for the purpose of strong heating or for regulating heat is noticed.

In connection with smelting two other devices are noticed:

(i) *Koṣṭha* or *Koṣṭhika-yantra*.<sup>15</sup> A specialized fire place or oven filled with charcoal and provided with arrangement of strong heating by means of one or two blowers (*bhastra*). The minerals properly treated were kept confined in a closed crucible and the crucible was placed inside *koṣṭha*. A hole was made at the lower part of the fire place to insert the nozzle of blower. Two types of this apparatus were used: *aṅgāra-koṣṭhī* as described above and *pātāla-koṣṭhī*, i.e. underground firing device. (Fig. 1 and 2).

The apparatus was particularly used for reduction-roasting of hard minerals, like, mica, tourmaline, etc.

(ii) *Vṛntāka-mūṣā*.<sup>16</sup> Brinjal-shaped closed crucible provided with a hole at the mouth over which is placed in inverted position a 12 *aṅgulas* tube with its fore-part resembling an inverted *dhuttura* flower (Fig. 3).

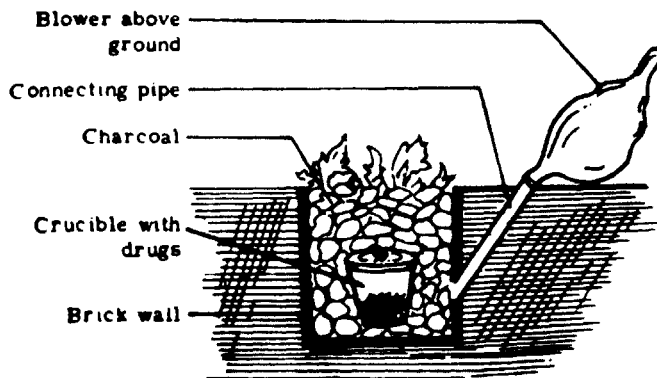


Fig. 1 — *Pātāla Koṣṭhikā* (Under Ground Oven)

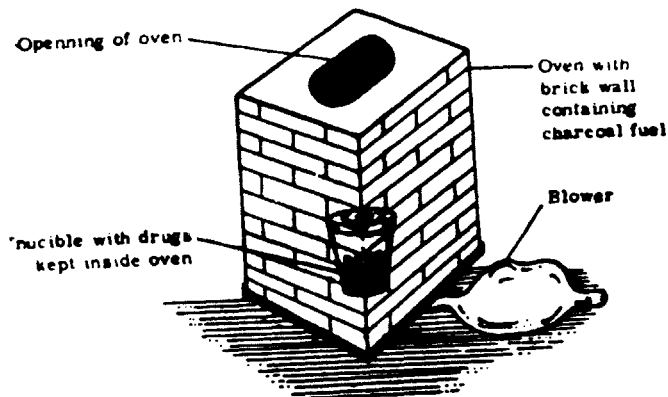


Fig. 2 — *Aṅgāra Koṣṭhikā* (Special Type of Oven)

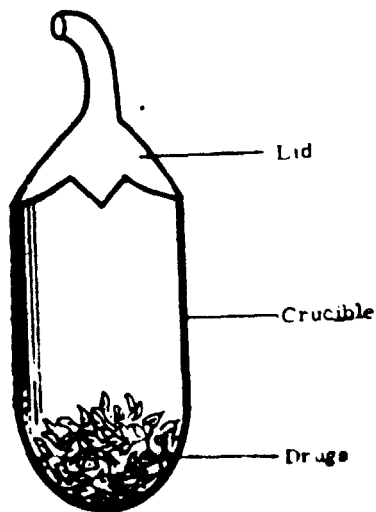


Fig. 3 — *Vṛntāka Muṣā* (Brinjal Shaped Crucible)

In another method a brinjal shaped crucible containing the chemical was placed over another crucible. Like the former, the crucible was covered but provided with hole adjusted to the hole of the stalk of the brinjal. The stalk, and the channel served as an outlet of smoke as also of the molten "essence". This method was also probably followed in Chinese practice.<sup>16a</sup>

Calamine or other such soft mineral was processed in this type of retort.

## II. Steaming:

The principal functionary apparatus was *Dolā-yantra*.<sup>17</sup> In this apparatus which consisted of an earthen vessel was filled generally with sour gruel or any other prescribed liquid over which was hanged the charged wrapped up in birch-bark and cloth by means of a rod fixed to the vessel at its throat. Fir was ignited below. (Fig. 4).

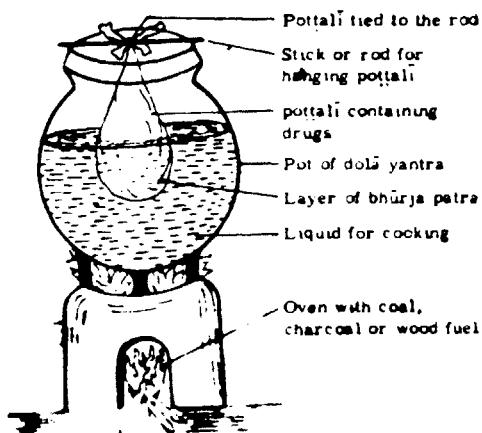


Fig. 4 — *Dolā Yantra* (Apparatus for Cooking in Liquid)

For purification of all minerals, and also for extraction of "essence" from gems this particular apparatus had of special use.

## III. Vapourization:

The "essence" in form of vapour was emitted and later condensed in this method. The operation was carried on in *pātanayantras*, and in *valukā-yantra*.

### (i) *Pātana-yantra*.<sup>18</sup> (Distillation apparatus)

(a) In one method two earthen jars were arranged, one bigger than the other. The bigger one placed on oven or any firing place contained the material and was covered. The smaller filled with cold water, covered and was placed in lower level. The two jars were connected by means of a tube through which the vaporized 'essence' fell in water and condensed. (Fig. 5).

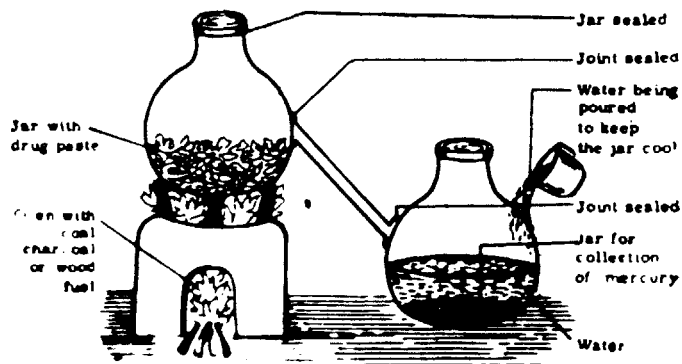


Fig. 5 — *Tiryak Pātana Yantra* (Apparatus for Distillation)

The particular device was first introduced by Nāgārjuna for extraction of essence from cinnabar and later followed by other alchemist for this purpose.

(b) Another *pātana-yantra*, called *damaruka*<sup>19</sup> (drum-bell shaped) the apparatus for upward sublimation consisted of two vessels stacked one above the other in inverted position. The lower one contained the substance and heated below and the upper with the arrangement of cold water kept above. (Fig. 6).

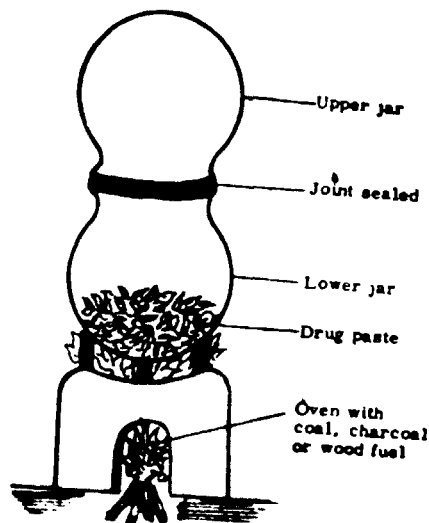


Fig. 6 — *Damaru Yantra* (Drum-bell like Apparatus)

(ii) *Vālukā-yantra* (sand bath).<sup>20</sup> A closed flask containing the mineral was deposited in sand filled in an earthen vessel. The vessel was closed. The 'essence' extracted in this way was clinged to the upper part of the flask. (Fig. 7). ').

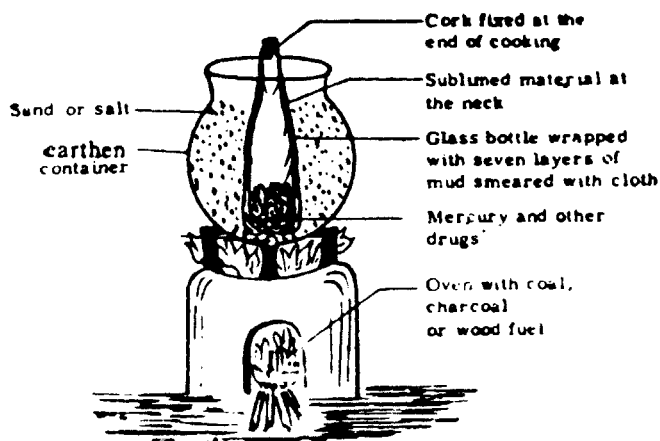


Fig. 7 — *Vālukā Yantra* or *Lavāna Yantra*

Extraction of orpiment was performed in this method.

#### ESSENTIAL SUBSTANCES FOR EXTRACTION OF "ESSENCE"

Varied substances of different origins are prescribed by alchemists in different ages. The *Rasahrdaya*<sup>21</sup> of 10th-11th cent. A.D. described in a very simple way the substances for this purpose. "*Rasas* and *Uparasas* macerated in a number of times in juice of any of the plants like, *sūryāvarta* (a kind of sun flower), *kadalī* (*Musa sapientum*), *kanyā* (*Aloe indica*), *koṣātakī* (*Luffa acutangula*), *suradālī śīgru* (*Moringa pterygospermum*), *vajrakanda* (*Euphorbia nerifolia*), *nirakanā* (a kind of *andropogan*) and *kācamācī* (*Solanum indicum*), alkali and acid, attains purification. The purified minerals yield their essence by roasted over fire urged by blower."

#### EXTRACTION OF 'ESSENCE' FROM GEMS.

Likewise minerals gems underwent several processes for yielding their 'essence'. In case of gems mostly the essence form the colouring principle, utilized for colouration of mercury. Special apparatus for extraction of essence was "*svedana-yantra*."<sup>22</sup>



A number of composition are prescribed in the *Rasasāra*<sup>23</sup> attributed with the properties of extraction of 'essence' from gems. One of them was '*Kṣāra-drāva*' i.e. a liquid preparation with alkalis and salts — as principal substances. The *Rasaprakāśa Sudhākara*<sup>24</sup> prescribed asafoetida along with other substances for a composition aiding extraction of essence from gems.

#### MINERALS AND GEMS AS ALCHEMICAL SUBSTANCES

The manifold applications of minerals in alchemical operations are discussed at length in the *rasāstra* texts. Not in the treatments of mercury as elixir or touchstone, minerals alone were occasionally used as transmuting agent.

In a general way the "essence" of *mahārasas* are stated as 'elixir', while *uparasas* are declared as suitable in mercurial operations and gems are attributed with the properties of "fixation of mercury" (*manibandha*). Further, particular gems are specified as effective in alchemical preparations. These include diamond, pearl, ruby, sapphire, topaz, cat's eye and coral.<sup>25</sup>

The application of minerals and gems in alchemical operations may be summed up as follows:—

(i) Imparting mercury the capability to consume pure metals employed as *bīja*, called *grāsa*, and operation to prepare mercury as transmuting agent.

The principal substance was mica and diamond was among the auxiliaries.<sup>26</sup>

(ii) "Calcination of mercury", *jāraṇa*, an operation leading to complete assimilation of *bīja* (seed metal) with mercury.

Minerals and gems involved in this operation were mica, sulphur, diamond and alum.<sup>27</sup>

(iii) "Fixation of mercury", *bandhana*, an operation leading to solidification and thereby amalgamation of mercury with particular minerals and enhancement of its (mercury) potency particularly as drug of longevity.

The principal substances were mica, sulphur and diamond.<sup>28</sup>

(iv) "dyeing of mercury", *rañjana*, an operation empowering mercury for fabrication of either gold or silver for which it was projected.

Minerals and gems for this purpose comprise —

- a) mica of white, yellow and red varieties
- b) sulphur and other *uparasas*
- c) diamond specially and other gems also.<sup>29</sup>

(v) Transmutation, *vedha-kriyā*, an operation imparting mercury different degrees of potency to convert base metals into higher metals. Minerals mostly used were mica, calamine, (the variety imported from Rome), realgar, sulphur and gold-pyrites.<sup>30</sup>

Utilization of manifold properties of minerals was not confined to these operations only, but distributed to numerous operations leading to alchemical achievements.

#### Therapeutic Aspects of Minerals in Combination with Mercury

Popularity of mercurial drugs, a way to *dehasiddhi*\* (attainment of a 'perfect body', 'imparting body', or a new body' i.e. a body of perpetual youth by transsubstantiation of body element with the aid of mercurial drug) or *dehavedha* (i.e. transformation of body and tissues through mercury and metallic/mineral group) started through *lohavedha* (transmutation of metals) concept in alchemical pursuits. In the later part of history of alchemy in India, *dehavedha* concept attained more prominence.

This led to the appearance of a number of iatro-alchemical texts containing details of preparation of mercurial drugs imparting rejuvenation and long life.

In all the preparations, mercury derived from cinnabar was considered suitable for this purpose. And as potentate, sulphur was made absorbed in mercury by means of calcination, known as "*gandhakajāraṇa*." The *rasaśāstra* texts claim that mercury treated with "*gandhakajāraṇa* process" acquires many pharmacological and therapeutic properties. The texts also states that invigoration of mercury depends on proportion of sulphur to be added and allowed to burn. Hence in sulphurmercury compositions "*ṣaḍguna-gandhaka-jāraṇa*, (i.e. mercury calcined with six times its weight of sulphur)<sup>31</sup> drugs acclaims one of the highly effective medicine conferring *dehasiddhi*. The preparations of *Rasasindūra* (lohita-bhasma)<sup>32</sup> and *Makara-dhvaja*<sup>32a</sup> (sulphur and gold containing drug) also involved calcination of mercury with sulphur. The other important sulphur-mercury drugs are *Kṛṣṇa-bhasma* of mercury known, as *kajjali*<sup>33</sup> and *Rasaparpati*<sup>34</sup>. In this preparation mercury was subjected to have been pasted with sulphur and other essential substances. The importance of all these drugs are still recognized in the regimen of present Ayurvedic medicines.

The above study on minerals and gems in perspective of alchemy in India is suggestive of — importance of minerals and gems more or less in the same scale with

\*The commonly accepted term for this is rejuvenation.

mercury, the active principle in alchemy, was recognized and brought the three under one significant term, *rasa* embracing widely minerals, gems and the like and specially mercury. The special treatise thus based on this was significantly known as *Rasaśāstra*, indicating alchemical treatise.

#### ACKNOWLEDGEMENT

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- <sup>3</sup>*Rasaratna-samuccaya*, ii. 1; iii. 1.
- <sup>4</sup>*Rasaprakāśa-sudhākara* of Yaśodhara, Edited by Siddhinanda Misra, Chowkhamba Orientalia, Jayakrishnadas Ayurveda Granthamla, No. 54, V. 2. 1983
- <sup>5</sup>*Rasahr̥daya* of Govinda Bhāgavat, ed. by Jadavji Tricumji Acharya, *Āyurveda Granthamāla*, Vol. I, IX. 4. 1910-11.
- <sup>6</sup>*Rasār̥nava*, Edited by P.C. Ray and Harish Chandra Kaviratna, Bibliotheca Indica Series, Asiatic Society, VII. 2,56. 1910.
- <sup>7</sup>*Rasasāra*, Edited by Jadavji Tricumji Acharya, *Āyurvediya Granthamālā*, Vol. II, 1911-12, ii. 1-2.
- <sup>8</sup>*Rasaprakāśa-Sudhākara*, VII. 1-2.
- <sup>9</sup>*Rasaratnasamuccaya*, IV. 1-2.
- <sup>10</sup>*Rasār̥nava*, VII. *Rasaprakāśa Sudhākara*. V. VI; *Rasaratna-Samuccaya*, ii, iii.
- <sup>11</sup>*Rasaprakāśa-Sudhākara*, VII. 54-56.
- <sup>12</sup>Mahadihassan, S. *Ibid.*, p. 136.
- <sup>13</sup>*Rasasāra*, XV.
- <sup>14</sup>*Rasaratnākara* of Nāgārjuna, quoted in *History of Chemistry in Ancient and Medieval India*, by P. Ray. Indian Chemical Society, Calcutta, pp. 313-315. 1956
- <sup>15</sup>*Rasār̥nava*, IV. 56-57; *Rasaratna-Samuccaya*, IX. 44; X. 33:43; *Rasasāra*, VI. 10.
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- <sup>16a</sup>Biswas, A.K. "Rasaratna-samuccaya and the mineral processing state of Art in the 13th cent. A.D.", *Indian Journal of History of Science*, Vol. 122 (1), p. 39. 1987.
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- <sup>18</sup>*Rasaratna-Samuccaya*, IX. 48-50; *Rasaratnākara*, *Ibid.*, p. 314, Vs. 37.
- <sup>19</sup>*Rasasāra*, V. 33; *Rasaprakāśa-Sudhākara*, V. 129-130.
- <sup>20</sup>*Rasār̥nava*, IV. 28; *Rasaratnasamuccaya*, IX. 34-37; *Rasaprakāśasudhākara*, VI. 9-10.
- <sup>21</sup>*Rasahr̥daya*, IX. 4; *Rasār̥nava*, VII. 91-95.
- <sup>22-24</sup>*Rasaprakāśa-sudhākara*, 55-62; *Rasasāra*, VIII. 56-58.
- <sup>25</sup>*Rasasāra*, X. 1-19.
- <sup>26</sup>*Rasaprakāśa-sudhākara*, I. 79-100.
- <sup>27</sup>*Rasaratna-samuccaya*, XI. 70,72,73; *Rasaprakāśa-Sudhākara*, i. 101-119; VI. 16.
- <sup>28</sup>*Rasaprakāśa-Sudhākara*, ii. 5-6; 36-57, 76-69.

- <sup>29</sup>*Ibid.*, i. 120-127; *Rasārṇava*, VII. 5-6; *Rasasāra*, XVI, 21-22.
- <sup>30</sup>*Raṣārṇava*, XIV; *Rasaprakāṣa-Sudhākara*, V. 108; VI. 132.
- <sup>31</sup>*Rasaprakāṣa-Sudhākara*, III. 23-26; Joshi, D. "Mercury in Indian medicine", *Studies in History of Medicine*, Vol. III. (4), p. 260. 1979.
- <sup>32</sup>*Rasaprakāṣa-Sudhākara*, III. 10-18.
- <sup>33</sup>Ray, P. *Ibid* p. 194 (Refers *Rasendra-cintāmaṇi and Rasendra-sāra-Samgraha*)
- <sup>33</sup>*Ibid.*, III. 31-51.
- <sup>34</sup>*Āyurveda Prakāṣa* of Mādhava, ed. by Jadavji Tricumji Acharya, *Ayurvediya Granthamālā*, Vol. III, 1912-13, Bombay.
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- <sup>36</sup>*Kankāli-Rasa* (Ms) Deposited in Asiatic Society, Bengal No. G 16.

## ABBREVIATIONS: (FOR TABLES)

AUP : *Ayurveda Prakāśa* of Mādhava, ed. by Jadavji Tricumji Acharya, *Ayurvedīya Granthamālā, Vol. III, 1912-13, Bombay.*

KR : *Kahkālī Rasa*

RH : *Rasahr̥daya*

RP : *Rasopaniṣat.*

RNV : *Rasār̥ṇava.*

RPS : *Rasaprakāśa-sudhākara.*

RRS : *Rasaratna-samuccaya.*

RS : *Rasasāra.*

TABLE I  
MAHĀRASAS.

Name and places of occurrences:	Physical characters, Essence:	Classes, Varieties:	Varieties used in Alchemical preparations:	Alchemical values:	References:
Abhraka, MICA	Glazed layered mineral. 'Essence' — iron —	4 classes: <i>vajra, pināka, vajra</i> , VAJRA CLASS <i>nāga</i> and <i>maṇḍuka</i> . Each of 4 types according to colour — white, red, yellow and black.			i) White — preparation of silvers. RPS. V. 3-7. RNV VI. 4-9. RH IV. 10. ii) Red and Yellow — preparation of gold. iii) Black-panacea.

Name and places of occurrences:	Physical characters, Essence:	Classes, Varieties:	Varieties used in Alchemical preparations:	Alchemical values:	References:
<b>Rasaka.</b> <b>CALAMINE</b>	Clay, in stone form, layered and non-layered. Essence — 'Zinc'.	2 classes: (i) <i>Kāravella</i> (layered) (ii) <i>Dardura</i> . (Non-layered and containing essence)	Dardura, containing 'essence'.	a) Excellent for dyeing of mercury. b) Preparation of gold.	RPS. V. 106-108, 115. RNV. VII. 28-38 RH VIII. 14
<b>Māksika,</b> <b>COPPER PYRITES.</b> (identified as compound or iron, copper & sulphur Places of deposition: Kanaui; bank of river Tāpti.	Pebble Shaped. Plain without any corners, heavy. Essence — Copper.	2 classes: <i>Rukma</i> (golden) <i>Tāpya</i> (tawny).		a) Elixir with the powers of — i) Transmutation of metal ii) Transubstantiation (Quoting <i>Rasapaddhati</i> ). b) A media for mixing of different metals (yogavāhī)	RH X.9 RPS. V. 121-123, 132. RNV. VII.5; 10-11 AUP. XII. 32
<b>Vaikrānta,</b> <b>TOURMALINE</b> Included also in Gem group. Places of occurrence: i) River bank in mountainous region of Himalaya. ii) Region of Vindhya mountain.	A variety of stone, with eight faces and six angles, slippery, heavy, uniform or mixed tint. Essence — iron.	8 varieties on the basis of colours: white, red, yellow, blue, pigeon coloured, grass-green or emerald green, black and variegated.	i) Yellow, and white ii) Red and emerald-green iii) Black.	i) In the fabrication of gold and of silver ii) Perfection in all alchemical preparations iii) Perfection in transubstantiation of body	RNV. VI. 122-137; RRS. II. 55-70; RP. XVI. 28-34; VII. 413-14; 511-514; 536-554.

Name and places of occurrences:	Physical characters, Essence:	Classes, Varieties:	Varieties used in Alchemical preparations:	Alchemical values:	References:
<p><i>Vimala</i>, IRON PYRITE. (Identified as iron and sulphur compound) Place of occurrence. On the bank of river Tāpī (likely māṅṣika)</p>	<p>Circular, with six corners and six angles, cool. Essence — (i) lead, or appearing like silver-gold alloy (possibly due to mistake, (ii) iron, the true metal-content.</p>	<p>Three classes: i) <i>Rupyavimala</i>, white, or silver tinge. ii) <i>Hemavimala</i>, yellow, or golden tinge. iii) <i>Kāmsyavimala</i>, red or bellmetal tinge.</p>	<p>All the three varieties.</p>	<p>i) <i>Hemavimala</i> — fabrication of gold. ii) <i>Rupyavimala</i> — fabrication of silver. iii) <i>Kāmsyavimala</i> — in chemical or alchemical operations.</p>	<p>RNV. VII. 5; 16-17. RPS. V. 80-81; 83-84 AUP. XII. 27-29. Ras Pad. Sl 77 (quoted in RH, Edited by Daultan Shastri, P. 85)</p>
<p><i>Sasyaka</i>, COPPER SULPHATE</p>	<p>A mineral of Copper, dark-coloured or dark blue with the shade of emerald. Essence — Copper resembling cochineal (red); soft</p>			<p>a) Elixir. b) Dyeing of chemicals (Particularly mercury) RH X. 11 c) Aid to the preparation of <i>pakva-bija</i> (ripe seed", here ripe gold)</p>	<p>RNV. VII. 38-39, 43-45, VIII. 58 RH X. 11 RPS. V. 71, 76, 77; AUP. XII. 35.</p>
<p><i>Śilājatu</i>, <i>Saita</i>, BITUMEN</p>	<p>Exudes of from mountain containing gold-, silver, and copper-ores. Three colours for three fold origins — red — gold whitish — silver black — copper.</p>	<p>Two classes: (i) smelling cow's urine, (ii) smelling camphor. Further division of the former into (a) having 'essence' and (b) "essenceless".</p>	<p>Red variety</p>	<p>Highly efficacious in alchemical pursuits.</p>	<p>RNV. VII. 18-22 RPS. V. 90-100.</p>

Name and places of occurrences:	Physical characters, Essence:	Classes, Varieties:	Varieties used in Alchemical preparations:	Alchemical values:	References:
<i>Rājāvarā</i> , LAPIS LAZULI.	Mineral with some traits of Stone, slightly red, blue, variegated, heavy, and glossy	2 varieties: <i>Gulika</i> (small roundish) <i>Cārṇa</i> (powdery or easily powdered).	Heavy and glossy	The variety is excellent for all purposes, specially conversion of gold-silver alloy into gold.	RPS. V. 55. RH XVIII. 12 RNV. VII. 85. RRS. III. 149-155 Ras. Nāg. Sl. I (vide, P. Ray, P. 311) Ras Nit, <i>Vādikhanda</i> , V. 18-22
<i>Capala</i> , BISMUTH.	Lead and tin product. Crystalline, six cornered, heavy, and pebble form.	4 varieties: <i>Gaura</i> (golden), <i>śveta</i> (white), <i>Aruṇa</i> (red) and <i>Kṛṣṇa</i> (black).	Golden and white. (i.e. lustre of gold and silver)	Fixation of mercury.	RNV. VII. 23. AUP. XII. 128-130. RRS ii. 143-146 RC 1st chapter (vide P. Ray, P. 352)
<i>Darada</i> or <i>Hingula</i> , CINNABAR. Place of occurrence: Dardistan (Mod. Taxila).	Compound of mercury and sulphur ( <i>rasa-gandhaka sambhavau</i> ). <i>Hamsapāda</i> , class coral coloured with numbers of thin streaks of spikes, high percent of mercury content. Essence — mercury.	3 varieties: <i>Carmāra</i> <i>Śukatundaka</i> <i>Hamsapāda</i> .	<i>Hamsapāda</i> .	Alchemical values:— Mercury obtained from it is highly potentiate in alchemical preparation. Excellency in liquefaction. Transmutation of gold-silver alloy into gold. Conversion of silver into gold.	RNV. VII. 46-51. RPS. VI. 85-89. RH. IX. 4; XVIII 2., 13 Ras Nit <i>Vādikhanda</i> , v. 20-22



TABLE 2  
UPARASAS

Name and places of occurrences:	Physical characters, Essence:	Classes, Varieties:	Varieties used in Alchemical preparations:	Alchemical values:	References:
<i>Talaka</i> or <i>Haridala</i> ORPIMENT	<i>Khanija-dhadu</i> mine-born. Layered ( <i>patala, patra</i> ) and non-layered ( <i>pinda</i> ). Essence — white substance	2 classes:— i) Fine-leaved, golden, heavy, glossy, bright and full of "essence". ii) In stone-form, light and having "less-essence".	1) Layered class.	a) In mercurial preparation for "elixir". b) Empowered mercury with the capability of transmutation of metals.	RNV. VII. 4.; XV 107-108 RPS. VI. 2-3. RRS. III. 63-87. RH IX. 5.
<i>Saurāṣṭrī</i> or <i>Tuvārī</i> , Alum. Place of occurrence: Saurashtra (Surat).	Powder ( <i>cūrṇa</i> ) and in pieces ( <i>khaṇḍa</i> ). Essence.	2 classes: i) Yellow ( <i>Phūikā</i> ) ii) White ( <i>Phulīkā</i> ) further i) White ( <i>sita</i> ) ii) Black ( <i>kṛṣṇa</i> ).	The white variety.	i) Incineration of Iron ii) Aiding calcination of <i>bija</i> with mercury. RUV. VII. 81. RPS. VI. 11-12, 14-16.	
<i>Gandhaka</i> , SULPHUR	Essence — Soft substance	4 varieties: i) White (chalk like) ii) Yellow, called also <i>amalasāra</i> iii) Red iv) Black (this variety not mentioned in earlier texts).	Alchemical properties of the first three varieties.	1. White-Incineration of Iron: Common properties — i) fixation of mercury ii) Calcination of mercury iii) Yellow-Elixir, and mercurial properties. iv) Red — colouration of metals, mercury. v) Black — Immortalization of life.	RNV. VII. 65, 67; XV. 63-106 RPS. VI. 29-33, 37-39.

Name and places of occurrences:	Physical characters, Essence:	Classes, Varieties:	Varieties used in Alchemical preparations:	Alchemical values:	References:
<p><i>Manah śilā</i>, REALGAR. Place of occurrence — Nepal.</p>	<p>Essence — White substance</p>	<p>3 varieties: i) <i>Śyāma</i>, Variegated and heavy. ii) <i>Rakā</i> (red), called also <i>Kanavitraka</i> Copper-red. iii) <i>Khaṇḍikā</i>, excessively red when powdered; heavy and smooth.</p>	<p>a) Elixir. b) Dyeing of mercury.</p>	<p>RPS. VI. 17-22 RH VIII. 8-9 RRS III. 97</p>	
<p><i>Kankuṣṭha</i>, TINSTONE OR CASSITERITE Place of occurrence: At the foot of Himalaya</p>	<p>Coral-coloured Available in two forms: i) a hollow tubular shape ii) powdery particle (<i>renuka</i>).</p>	<p>2 classes: Nalika (in tubular form): yellow, smooth, heavy and cool. <i>Renuka</i> (powdery particle): Dark yellow.</p>	<p>i) Elixir, ii) Mercurial preparation.</p>	<p>RNV. VII. 88. RPS. VI. 54-57. RH IX. 5</p>	
<p><i>Gairika</i>, RED-OCBRE</p>	<p>Available in two forms: i) Copper colour hard stone form. ii) red colour soft substance. Essence — White and red</p>	<p>2 classes: i) <i>Pāṣāna-gairika</i> ii) <i>Svarṇa-gairika</i>.</p>	<p>i) MERCURIAL PREPARATION ii) Dyeing as mercury and other chemicals</p>	<p>RPS. VI. 70-73 RNV VII. 83-84 RRS III. 156 RH XI. 3,6</p>	

Name and places of occurrences:	Physical characters, Essence:	Classes, Varieties:	Varieties used in Alchemical preparations:	Alchemical values:	References:
<p><i>Ānjanāni</i>, ANTIMONY</p>	Smoke-coloured	5 varieties.			RPS. VI. 23
<p>i) <i>Sauvirāñjana</i>, GALENA or LEAD-SULPHATE</p>					
<p>ii) <i>Rasāñjana</i></p>	Yellow.				RPS. VI. 25.
<p>iii) <i>Srotāñjana</i> ANTIMONY SULPHATE</p>	<p>i) Appearance like that of the top of ant-hill. ii) Inner surface having the colour of lotus-blue. iii) Red — ochre colour when rubbed.</p>			i) Fixation of mercury.	<p>RNV. VII. 53-54 RPS. VI.25</p>
<p>iv) <i>Puṣpāñjana</i>, ZINC OXIDE (?)</p>	White				RPS. VI. 26.
<p>v) <i>Nīlāñjana</i>, STIBINITIS.</p>				i) Killing of gold. ii) Softening of iron. iii) Elixir.	RPS. VI. 27.
<p><i>Kāśisa</i>, SULPHATE OF IRON</p>	<p>Alkali (natron like), sour substance, light and colour like of smoke of bellium.</p>	<p>2 classes: i) <i>Vālukā-kāśisa</i> or <i>Dhātu-kāśisa</i>, ii) <i>Puṣpa-kāśisa</i>.</p>	i) <i>Vālukā-kāśisa</i>	(1) Colouration of alchemical substances.	<p>RNV. VII. 81-82. RPS. VI. 63-65; RRS. III. 51-58. AUP. VIII. 31-33.</p>

TABLE 3  
RATNAS (GEMS)

Name and places of occurrences:	Physical characters, Essence:	Classes, Varieties:	Varieties used in Alchemical preparations:	Alchemical values:	References:
<b>Mānikya,</b> RUBY	<i>Padmarāga</i> — Round, hard, big, red with lotus tint, glossy and heavy.	4 classes: i) <i>Padmarāga</i> ii) <i>Kuruvinḍa</i> iii) <i>Sugandha</i> iv) <i>Nilagandhaka</i> ,	<i>Padmarāga</i> .	Excellent in alchemical operations:	RS. X 8, 13; 48; XVI. 20.
<i>Nilagandhaka</i> — Born in Ganges' water.	<i>Nilagandhaka</i> — Inside exhibits blue and red tints.			i) Calcination of mercury for colouration ii) Incineration of cat's eye.	RRS. VII. 3-5, 7.
<b>Muktā,</b> <i>Tārakāntamani</i> PEARL	White, round, big, waterlike transparent, glossy and heavy.	8 classes on the basis of 8 places of origin.		Efficacious in alchemical operation — i) Fabrication of silver ii) Fixation of mercury iii) Used as container of mercury for heating under astral rays.	RS. X. 5-6; XVI. 17. XVIII. 7-8. RPS. VII-10. RRS IV. 16.
<i>Vidrūma</i> CORAL Origin in ocean from coral tree, red like the rays of rising sun.	Red, glowing, and round.	4 variations on the basis of four colours, viz. white, red, yellow and black.		i) Colouration of mercury for transmutation of silver into gold.	RRS. IV. 17; RS. X. 16; XVI. 20. AVP. XIII. 88.
<i>Marakata</i> or <i>Tārkyya</i> EMERALD.	Green, heavy, smooth, emitting lustre and bright.		Peacock-throat greenish, soft and having brilliance like that of glow-worm.	Efficacious in alchemical operation — i) Colouration of mercury.	RRS IV. 21-22. RS. X. 13; XVI. 19.

Name and places of occurrences:	Physical characters, Essence:	Classes, Varieties:	Varieties used in Alchemical preparations:	Alchemical values:	References:
<i>Puspārāga</i> TOPAZ	Transparent, yellow coloured and glowing.			i) In fabrication of gold ii) High colouring capacity.	RS. X. 14. XVI. 18,20.
<i>Vajra</i> , DIAMOND	Male — Round, perfect with all angle, big, brilliant with play of rainbow and devoid of lines or dots. Essence — Full of essence. Female — Furnished with lines and dots, and in broken form. Hermaphrodite — Three cornered and thin.	3 classes: Male, female and hermaphrodite. 4 varieties on the basis of colours. Each of the three classes having four varieties, i.e. white, red, yellowish, black.	i) Male ii) Female.	Alchemical values — i) Calcination of mercury ii) Fixation of mercury iii) Increase of transmutation power of mercury iv) Penetration in iron v) Colouration of mercury.	RNV. VI. 65-73; XI. 130-131. RRS. IV. 26-32 RS. X. 2-4; XVI. 2-15; 19; RPS. II. 36-49 KR. VSS. 105-107
<i>Indranīla</i> , <i>Nīla</i> . SAPPHIRE.	i) <i>Jalanīla</i> — Flat, inside emits, white lustre, light; one side one coloured and the obverse with five tints. ii) <i>Indranīla</i> — lump-shaped, inside emits dark lustre; heavy; transparent, cool.	2 classes: i) <i>Jalanīla</i> , each having seven varieties ii) <i>Indranīla</i> , each having seven varieties.		Alchemical values — i) Efficacious in alchemical preparation. ii) Calcination of mercury.	RNV. XI. 151. RRS. IV. 49-53. RS. XVI. 10-13; 19; XI. 50. RPS. VII. 44.

Name and places of occurrences:	Physical characters, Essence:	Classes, Varieties:	Varieties used in Alchemical preparations:	Alchemical values:	References:
<b>Gomeda,</b> <b>ZIRCON.</b>	i) <i>Superior types</i> Non-layered, transparent, colour identical with that of cow's urine, cool and glossy. ii) <i>Inferior type</i> Flat, discoloured, glazeless, rough, small, covered with layers, light, yellow glass-like appearance.			Alchemical values — i) Calcination of mercury ii) Excellent elixir.	RPS. VII. 45-46. RS. XVI. 50.
<b>Valdurya</b> <b>CAT'S EYE</b>	<i>Superior type</i> Transparent, surface uniform, white with greenish, heavy, showing three lines like sacred thread and looks like cat's eye. <i>Inferior type</i> Rough, light, green, flat, a tinge of water-like colour, and with red inside.			Efficacious in alchemical preparations, colouration.	RPS. VII. 49-50. RS. X. 15; XVI. 20.
<b>Sūryakānta</b> <b>SUN STONE</b>	Sun-born stone glowing with fiery inside and appearing like burning stone.			Fixation of mercury; used as container of mercury for roasting under the heat of Sun.	RS. XVIII. 2-3. AUP. XIII. 136.
<b>Chandrakānta</b> <b>MOON STONE</b>	Moon-born stone, cool inside, and gets melted in connection with moon.			Fixation of mercury; used as container of mercury while heated under moon rays.	RS. XVIII. 6. AUP. XII. 139-141.