VII.

The Salt Mountain of Hallstadt and Ischl

In Austria[27] there are many cities with salt-works near them. The principal salt-mountain is near Hallstadt[28], another is near Ischl[29], and also in Lambach[30] and Aussee[31], as well as in the archbishopric of Salzburg[32], in the town of Hallein[33]; but the salt is rather impure, and contaminated with bits of muddy and earthy matter. At the top of these mountains there is fresh water, for without water above, the project would not be much use; bringing water in would be very expensive, and not much profit would result. For the customary way of obtaining salt is as follows: Certain tracts are excavated in these mountains, and as they are opened, fresh water is brought down into them and fills them up; the water is ducted down in channels or in some other way that is suited to the particular location. When the fresh water is left there, the surrounding part of the mountain or the sides of the excavation dissolve until the water is saturated with salt. The workers test whether the water has become salty enough by throwing in a piece of crystal salt; if that piece is further dissolved and shrinks in the water, this shows that the water is not yet saturated with salt. This test is repeated until they find that the piece of salt comes out completely undiminished in size and remains intact, showing that the water is sufficiently impregnated with salt.

When this has been done, the brine is drawn out or channelled down to Hallstadt, evaporated in bronze vats and boiled into salt,

[27] "Austria" refers to the Hapsburg territories, and thus does not include Salzburg and Hallein; see footnotes 32 and 33.

[28] Hallstadt. Town about 50 km ESE of Salzburg, noted for its salt mines. See Annotation 7: Zedler, 12:290-91.

[29] Ischl (Ms. has *Yschl).* Town about 40 km E of Salzburg. Now Bad Ischl.

[30] Lambach. Town about 70 km NE of Salzburg.

[31] Aussee. Town about 55 km E of Salzburg. Ms. has *Aussensee* perhaps *Aussersee,* probably from confusion with the name of the nearby lake (der Ausseersee). See Annotation 8: Zedler, 2:2247.

[32] Salzburg. An archbishopric with territorial jurisdiction, centered in the city of Salzburg. At this time it was approximately coextensive with the modern-day *Bundesland* of the same name. The area did not become Austrian until 1816, and so is here distinguished from Austria.

[33] Hallein. Town about 15 km S of Salzburg. See Annotation 9: Zedler, 12:282.

then dried and distributed in the surrounding area.[34]

The salt-mountain near Ischl does not abound in salt so much as the one near Hallstadt; the latter seems inexhaustible, but the one near Ischl does not promise permanence, although it surpasses the former in the goodness and quality of its salt.

VIII.

The Crystal Salt of England

In the county *(provincia)* of Cheshire near the city of Chester there is a salt-mine.[35] In its first level it goes down to a depth of 54 ells, in its second, 30 ells [deeper]. Salt-layers lie to a depth of 60 ells from the ground.[36] They are covered with earthy matter, sand and rock. The rock layer to which the salt adheres is of a brown color, like earth hardened into rock. Salt is found round about at that depth. The salt in its layer can easily be broken away; one man breaks off 1/2 or 3/4 of a ton in a day.[37] The salt varies in kind and color; it is translucent and cubical in form, but is mostly yellowish-brown with some blackness mixed in. This mined salt is divided among refiners in Liverpool in western England[38], and is also transported outside the kingdom to other places such as Stockholm, etc.

IX.

Crystal Salt in Hormuz, China, America, Russia and Elsewhere

The island of *Hormuz*[39] in the Persian sea is very full of salt, to the

[34] This method of mining is described in more detail by an anonymous source quoted by Lefond. See Annotation 10: Lefond, p. 174.

[35] Cheshire. County in NW England. Chester, county town of Cheshire. See Annotation 11: Lefond, pp. 240-41.

[36] The units of measure here are English ells of four feet (1.219 m), not the German and Swedish units referred to in footnote 18. Though it is not explicit in the Latin, the second level must be 30 ells *deeper* than the first. Thus the mine has levels at 54 ells (108 ft. or 32.9 m) and 84 ells (336 ft. or 102.4 m), and "salt layers" are found at 60 ells (240 ft. or 73.2 m). This interpretation coincides with the data in Lefond. See Annotation 12.

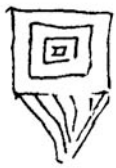
[37] English ton=1.016 metric tonsil.12 US tons.

[38] Ms. has "Ireland."

[39] Hormuz. Iranian Island on the strait of Hormuz, between the Persian Gulf and the Gulf of Oman. See Annotation 13: Lefond, p. 332; Zedler, 25:1960.

point that almost the whole island consists of salt; all the waters, rivers, wells, as also the terrains themselves are very abundant in salt. There, the reappearing salt is cut as in stone-quarries, and more revenue comes to the kingdom from salt than from gold and pearls.

Rock salt is also found in *Russia,* especially in the region of Ufa[40] in the mountain called Iletskaya[41], near the Ural mountains; but this mountain salt is sold for the most part to the Tartars[42], and is just as good as Tartar salt; rarely is any brought down to Moscow.



There is a certain kingdom *in Africa*[43], called Dancal or "Saltzland" (salt-bearing region), which annually produces crystal salt in a quantity great enough to load 600 camels. Egypt is said to use it in the place of money. This Egyptian salt is always found underground in the form of a little pyramid, for which reason they call it the pyramidal salt of Egypt (see the drawing).

Among the *Calabrians*[44] in a place which is commonly called Altomonte[45], crystal salt is cut in the manner of stones; it is translucent like crystal;[46] when thrown in the fire, it is said that it does not, like

[40] Ms. *in regione Ufmische.* The area around the Bashkir city of Ufa (now capital of the Bashkir ASSR). See footnote 42.

[41] Iletskaya. Ms. has *Ultskaja,* a misspelling. The place in question seems to be Sol'-Iletsk, a town about 450 km S of Ufa. See Annotation 14: Lefond, p. 250; *Great Soviet Encyclopedia,* A Translation of the Third Edition, New York: Macmillan Inc., 1980, cit. 24:289.

[42] Tartars. Probably the "Uffimish Tartars" now known as Bashkirs, who inhabit the area around Ufa (now Bashkir ASSR). See Annotation 15: Zedler, 48:466.

[43] Ms. *India,* a reference which seems to be erroneous. "Dancal" is probably the kingdom of Dancal or Danakil in Ethiopia. This name was used to refer to the Afar tribe, which inhabits the Danakil plain, covering present-day Djibouti and parts of Ethiopia and Somalia. See Annotation 16: Zedler, 27:108-09; Lefond, p. 279.

[44] Calabrians. Inhabitants of Calabria, province of Southern Italy, constituting the "toe of the boot" approximately.

[45] Altomonte. Small town in Calabria, Southern Italy, about 50 km N of Cosenza.

[46] See Annotation 17: Lefond, p. 207; Pliny, Lib. 31, Cap. 7.

other salts, shatter or crack, but glows like iron, as Caesius reports.[47] In *Ethiopia* they strike coins from salt, one foot long and three inches thick;[48] such coins are valued at 20 *sous* each in French money.[49]

There are some places in *India,* where rain never, or very rarely falls: there they build houses out of mined salt.

Heaps of salt, which are built by the Sicilians near the promontory of Drepanum[50], last up to 15 years in the open, and are so high, that they resemble a range of hills; they grow so hard in the suns heat that they do not melt in the rain, and are difficult to cut with iron (Caesius reporting).[51]

In the province *(Comitatu)* of *Brazil* in America a certain plant is found in whose leaves white salt can be found when the sun burns hot; but it melts at night, when it becomes humid. In the daytime, however, the inhabitants can still gather as much as is needed for household use. But these things are from the authors.

X.
The Russian Salt-Lakes

Salt is obtained in Russia from some lakes in the solid ground itself, not far from the sea. These are the lakes of Astrakhan and of Siberia, where, in summer time, when it is hottest and the weather is suitable, salt crystalizes towards the surface and congeals like ice,

[47] Caesius, or Bernardo Cesi (1581-1630), Jesuit professor at Modena, author of *Mineralogin* (1636, Lugduni: I. & P. Prost), part of Swedenborg's library according to Alfred H. Stroh, 1907, *Catalogus Bibliothecae Emanuelis Swedenborgii,* Holmiae: Ex Officina Aftonbladet. See Annotation 18: Zedler, 5:105; Caesius, p. 305, referring to this salt (translation ours).

[48] Ms. *pedis...digitorum.* The length of the foot and inch varied from place to place, but the foot was usually half an ell (Zedler, 8:898). The inch *(digitus)* was 1/12 of a foot, or 1/24 of an ell; there was also a "decimal inch" which was 1/10 of a foot *(ibid.,* 7:906). The Swedish foot *(fot)* was 0.02474 m *(Svenska Uppslagsbok,* Andra Omarbetade och Utvidgade Upplagan, Malmö: Förlagshuset Norden AB, 1949, 10:137, 29:1160).

[49] The French coinage was based on the *livre,* divided into 20 *sous* of 12 *deniers* each *(La Grande Encyclopédie,* Inventaire Raisonnée Des Sciences, Des Lettres et Des Arts, 2nd éd., Paris: Société Anonyme De La Grande Encyclopédie, c. 190022:369).

[50] Drepanum, now Trapani, town on the western coast of Sicily.

[51] Caesius, p. 294.

and sometimes attains a thickness of half an ell or one foot, until one may safely walk upon this salty crust as if on ice, and may break rather large pieces of salt off of it, no differently than pieces of ice, with the help, of course, of iron tools. If a branch or leaf of a tree is thrown into the lake, the salt crystalizes all around it like sugar or glass. This saline encrustation occurs when the summer is hottest, then thickens more and more, but as soon as the rainy weather comes, it immediately melts and dissolves into the water. Lakes of this kind lie from three to six miles from Astrakhan. The local people use salt of this kind to preserve fish and caviar; also it is sent to many places and serves the inhabitants of almost the whole kingdom of Kazan. Part of it is brought into Russia; but since this kind of salt is not considered equally pure and free of dirt as other salt in Russia, it is not valued very highly except for the salting of fish and meats.

Many lakes of this kind are found in Siberia, and among them one which is called Yamischev[52], from which a great enough supply of salt is obtained to meet the needs of almost the whole kingdom of Siberia. Anyone is allowed to take as much salt from this lake as he requires for his own household use, but no more. Moscow also gains a great revenue from it.

In *Kalmuck* a lake is also found, not of great depth, about a quarter of a mile in length and width, at whose bottom lies crystalized salt of such thickness that one can take as much as one wants. This salt consists of large grains and has the color of white salt, but is not equally suitable for preserving fish and meat. They think that this kind of salt is mixed with lime *(calce),* but it is very sharp-tasting and almost unfit for eating. Some years ago they found that one third part of saltpeter was contained in this kind of salt; a quantity of saltpeter from that source is thought to be possible whenever there is an abundance of wood in the region.

XI.

Evaporation of Salt from Sea Water: Rochelle, etc.

Since many terms having to do with the construction of salt-marshes and the areas in which evaporation is done cannot be expressed except in the French language, and even if given in Latin,

[52] Ms. Jamischevo. A lake in Kazakh SSR (cf. Zedler, 14:192, 37:856; *Soviet Encyclopedia* 19:352).

would hardly be understood by the layman, I wish here to report this description in the French language.[53] It is found both in *Nouvelle Description de la France* by M. Piganiol de la Force, vol. 3, p. 364,[54] and in the *Dictionnaire Universel de Commerce.*[55]

It is a description of a double-fielded salt-marsh containing 48 evaporating areas, with its *jas*[56] and its *conches*[57] or *vivres* (various reservoirs).

The *system* that the salt-workers have for introducing the water into the salt-marshes:

—The water enters the *jas* through the *varaigne*[58] (tide-gate).
—From the *jas* into the *conches* by the *gros mâts* (big wooden pipe).
—From the *conches* into the *mort* (moat surrounding the evaporating area) through the connecting pipe *(ame d'eau).*
—From the *mort* into the *table,* through the *pertuis*[59] (aperture).
—From the *table* into the *means* (middle channels).

[53] The translator concurs with this reasoning. Many of the French terms used in this chapter, which from this point to the end is quoting P. de la Force, cannot be found in the *Grand Larousse (Grand Larousse de la langue française,* en six volumes, Paris 1971: Librairie Larousse), the most exhaustive French dictionary available to us. Even when a relevant definition can be found, there may be no good English equivalent. For these reasons many words in this chapter are left untranslated.

[54] We have not found the edition of this work that Swedenborg used (published 1722, according to Acton). We have compared this chapter with the third edition (Paris, 1754), and made minor corrections. According to Zedler, M. Piganiol de la Force is "Heinrich Jacob von Caumont" (sic), (1675-1726), Duc de la Force, a member of the *Académie Française.* This work is not mentioned. (Zedler 28:137, 5:1681)

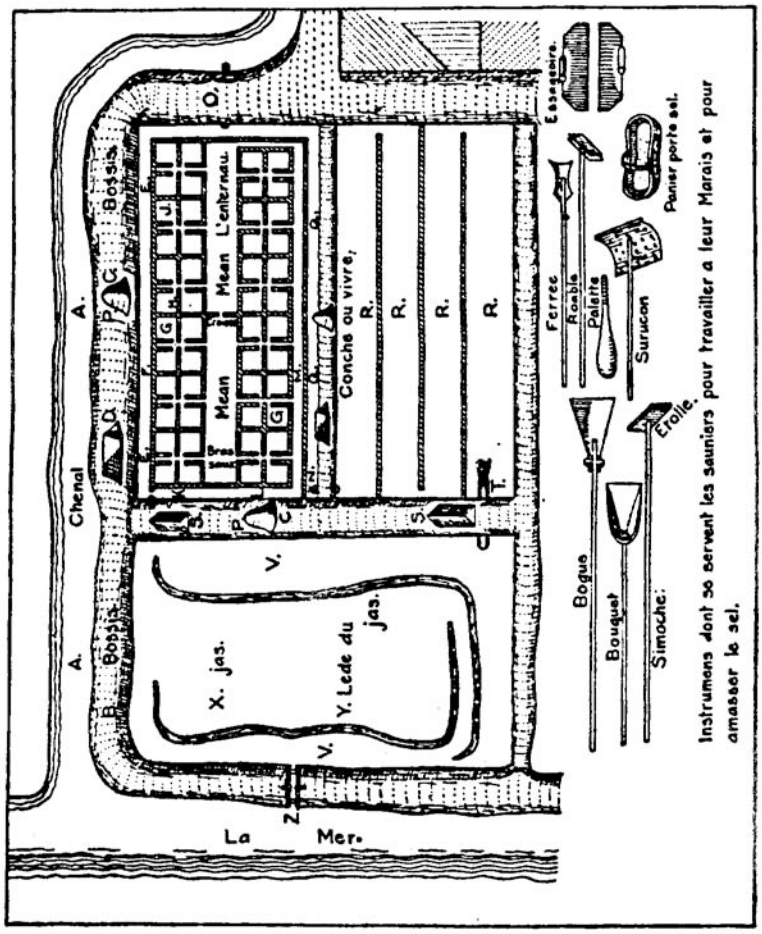
[55] We have not found any copies of this work. Acton states that the order of Swedenborg's excerpts from de la Force in this chapter agrees better with that in the *Dictionnaire* than with de la Force's original edition.

[56] "Jas...in salines, (marais salants), the first basin into which the sea water is let. By extension, the wooden tap which allows the entry of the water." *(Grand Larousse)*

[57] "Conche...Dialect. Bight (baie) or bay (anse), e.g. La conche de Pontaillac." *(Grand Larousse)*

[58] "Varaigne...the opening through which sea water is let into a saline." *(Grand Larousse)*

[59] "Pertuis...Opening in a sluice-gate, which allows the water to pass through to feed a water-wheel." *(Grand Larousse)*



[Interpretation from Acton; see our reproduction of the de la Force original and the author's copy, Annotation 19.]

A. Channel. B. *Bossis* (hump). C. *Pilot.* D. *Vache* of salt. E. *Mort.* F. *Vettesor Vées.* G. Evaporating area. H. *Visor Vaze* (middle path). J. *Conches* of the evaporating area. K. *Pertuis.* L. *Table.* M. Water table or surface. N. *Âme d'eau.* O. *Coi* or *acoyement (probably* dike). P. *Pilot.* Q. *Tasselierov Bosse (probably* settling ditch). R. *Conche* or *vivre. Viraison (prob.* slewing channel) of the above 48 evaporating areas. S. *Vache.* T. *Gros mâts.* V. *Bouche* or *Doiie.* X. *Jas.* Y. *Lede du jas. Z. Varaigne.*

—From the *means* into the *brassaux* (conduits).
—From the *brassaux* into the evaporating areas where the salt forms.

The municipality includes the district of Aunis, the district of Brouage, the isles of Ré, Oléron, etc.[60] The coasts of this municipality have the advantage of many ports, of which the most important are those of Rochefort, la Rochelle, Brouage, St. Martin de Ré, la Tremblade and Tonnay-Charente. This country, although dry, produces good wheat and much wine, and in marshy places there are grasslands that sustain many cattle, and salt-marshes from which the best salt in Europe is extracted.

The greatest amount of sea salt is crystalized in Bretagne, Saintonge and in the district of Aunis, as mentioned before. In these latter two districts are located Brouage, Marans, and the Isle of Ré, and in Bretagne, the Bay of Bourgneuf, Guérande and Croisic, which are the places containing the most salt-works.

The Bay of Bourgneuf, which is something like 12 leagues in circumference, with the Isle of Bouin, Noirmoutier, Beauvoir sur Mer, Machecoul and la Barre-de-Monts, having about twenty thousand saltworks, each having 50 evaporating areas or wings *(aillettes)*, and each section capable of producing annually a quarter of a barrel[61] of salt, Parisian measure (weighing 700 pounds).

As the evaporating areas or wings of Croisic and Guérande are 4 times as large as those of Bourgneuf, it is estimated that each wing produces a barrel of salt, and the saltworks of these two places roughly about thirty thousand barrels, and those of Bourgneuf thirty-seven thousand barrels.

There are also saltworks in Languedoc[62], among other places at Mardirac and at Sigean; those of Mardirac produce in an average year 1500 barrels of salt, or two hundred sixteen thousand *minots*[63], for use by lower Languedoc, Auvergne, Bourgogne, and Savoie.
The saltworks of Sigean are less sizeable, and produce only sev-

[60] This describes the coastal area of the present-day *département* of Charente-Maritime. The places mentioned can be found on present-day maps.

[61] Ms. muid. An old French dry measure, varying with the substance measured; in the case of salt, 2497 liters. *(La Grande Encyclopédie* 24:538)

[62] Languedoc. Former province in southern France.

[63] Minot. Another highly variable dry measure *(La Grande Encyclopédie* 23:1011), here apparently 1/144 of a *muid*.

enty five *minots* of salt, which are consumed in upper Languedoc and Roussillon.

They select a low terrain which nature has rendered suitable because of its being situated in such a way as to receive the sea water when the tide rises, which industry has made it possible to retain by means of constructed enclosures; and after having examined its bottom, they dig out the sea floor and mark out various sections. The earth that they raise from these marshes forms the walkways *(chaussées):* the first reservoir of the marsh is called the *jas,* and is separated from the sea by a small dike of earth covered with dry stones. This dike is open in one place where it can be closed by a lock like a sluice-gate, and this opening is called the *varaigne.* They open it during the high tides of March, and through it the sea water is introduced into the reservoir. As soon as the sea starts to go down they close the *varaigne,* leaving the reservoirs full of water, which spreads through the pools or *conches* by means of wooden pipes; the less water there is in these *conches* the sooner it becomes warm. The water entering from the sea through the *varaigne* into the *jas* passes from the *jas* through a hollowed wooden pole into the *conches,* where, after having moved 4 times the length of the *conche,* it goes into what is called the *mort* by a wooden canal they call *ame d'eau.* This *mort* is bordered by a mound or elevation of earth, onto which they throw the salt in large heaps which they call *vaches de sal* (salt-cows) when they are long and *pilots* when they are round. From the *mort* the water passes into the *table,* a reservoir where they let the water heat up before it enters into what they call the *means,* where it is conducted through the *pertuis.*

These *pertuis* are boards sunk into the ground of the salt-marsh and bored with a number of holes which they stop up with so many plugs, and when the water begins to fail in the *méans* or *muans,* they pull out the highest plugs, and then the next row, until enough water has entered. The *méan* or *muan* is a fifth reservoir 22 feet wide, separated at regular intervals by little walkways of earth which they call cross ways *(croisées).* They leave the water in these channels until the time has come to make salt. Then it is distributed into the evaporating areas through the *brassaux* and through the mouths of the evaporating areas up to a height of 2 inches. These *brassaux* are little ditches between two areas, and through them the water spreads to the evaporating areas through the mouths *(bouches)* which they make there with the little shovel. These mouths join at the simple crossing that separates the two areas, and are closed as soon as the water has been let in. The areas or rooms are squares of 15,

16, 17, or 18 feet in which the salt forms; the number of these squares depends on the size of the marsh; when there are two double rows of evaporating areas with *means* between them, these marshes are called double-fielded salt-marshes. All the little roads and walkways of these marshes have their particular names. The *vettes* are the two roads that border the *tables* beside the evaporating areas. The *enternau* is the little path that separates the *méan* from the evaporating areas. *Vie* or *vee* is the path that separates the two rows of evaporating areas, onto which they put to drain the salt extracted from the evaporating areas, in small heaps called *pilots*. This path is a little wider than the others. The crosses *(croix)* are the paths that cross and divide the evaporating areas. The *lignon* is the double row of squares from one end of the marsh to the other. *Demi-lignon* is a simple row of squares. The *livre de marais* consists of 20 areas, and they calculate the value and the revenue of the salt-works by *livre*. Each *livre* produces six *livres* of revenue per year, the stronger compensating for the weaker.

The best time to make salt is from about the middle of May to the end of August, because then, the days being long and the sun's rays hottest, the salt cooks and crystalizes better and more promptly. When they wish to supply sea water to the marshes, these first have to be entirely emptied of the water that has been left there all winter, to keep them in a state to contain the new water which must serve to make salt and which they allow to enter close to the height of six inches; however, after having let it rest and warm up for two or three days in large reservoirs outside of the salt-works, to the point where it has become lukewarm, and when the right quantity of water has entered, they close the *écluse* and leave it to the sun and the wind to do the rest of the work. The sun and the northeast or northwest wind act on the water so introduced, which is already considerably warmed. In three or four hours the bottom of the area reddens, and there arises a foam on the water. Under this foam, which dissipates itself, there is formed a thin layer consisting of little squares which are so many grains of salt beginning to form on the surface of the water, until they break this layer, which then goes to the bottom.

The surface of the water, hit squarely by the rays, thickens at first almost imperceptibly and then becomes covered with a light crust which finally, hardening by the continued heat, converts entirely into salt; the water at this point is so hot that one cannot put ones hand in it without getting burned.

When the salt has undergone this natural cooking, they break it with a *perche* which has a *douve* at the end, called a *simange* [elsewhere *simoche],* which makes it go to the bottom of the water, whence it is taken out almost immediately with the same rake, and after leaving it for some time in little heaps at the side of the area to dry, they then put it in larger piles containing some thousands of barrels *(muids)* of salt, which they cover with straw or rushes to keep them from the rain; these piles of salt are called *vaches* ("cows") in Poitou.

To get very white salt, one must take this sheet or ice, like taking cream off milk. At this moment the salt smells so strongly of violets that the flower itself is not more fragrant or pleasant. When the salt workers want to take some salt out to pile it up, they break this sheet of salt daily and stir it in the evaporating areas, causing the grains to join and enlarge. Then it is pulled onto the embankment, where it is put in a "cow" or pile. One does not allow all the water in the area to turn to salt, so that it will come out whiter and cleaner, and also so that the remaining water may act as a fermenting agent to make the new water that is brought in turn to salt sooner.

The crystalization of the salt being accomplished in eight or ten days, or at most fourteen days, they open the beds again to fill them with water from the rising sea, and they continue thus, alternately putting in the water, gathering the salt that forms and emptying them, until the weather is no longer right for this operation.

Rain is very frustrating to this work, because when rainwater is too profusely mixed with the sea water, the latter becomes useless, so that new water must be brought into the salt-marsh. It is in fact the rainy weather that determines in favor of this kind of harvest, which is only suitable on good days and while the sun is hottest.

The salt from the salt-marshes is grey on leaving the beds, and it is the salt of this color that is sold abroad. However, white salt is made by refining the grey salt in the same provinces where the salt-marshes are located, and in French Flanders.

It is a very curious thing to see the workers occupied by tasks like these. The names of the tools which they use to make their salt-marshes, maintain them and take out the salt, deserve an explanation here. The *bogue,* the *bouguet* and the *ferr'ee* are for lifting out the mud that has accumulated during the winter, to cut off useless earth, and finally to straighten up the marshes when they are being reconstructed. The *étolle,* whose handle is called the *simoche,* is also for pulling the mud out when the salt-marsh is being scraped out. Its blade may be two feet long and six inches high. The *palette* is for