ABSTRACTS

A STUDY OF THE IKUNO SILVER MINE

By

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In the middle years of the sixteenth century mines of precious metals began so be exploited in Japan, and flourished for a century. Especially noteworthy was the vast output of silver. The silver mine at Ikuno in Tajima (now Hyogo Prefecture), discovered in 1542 was one of them. Having been worked for more than four hundred years, it is now under the management of the Mitsubishi Metal and Mineral Works.

Back in the latter part of the sixteenth century (1580) the mine was in the hands of Hashiba (later Toyotomi) Hideyoshi and, when he had brought the whole land of Japan under his rule and establishad his own system of fiefs, it remained under his direct control. The number of mines of which he took possession was small, but to these mines he despatched special commissioners (*Bugyo-nin* 奉行人), who were entrusted to collect taxes—*unjo-zei* (運上税), as they were called—and for the collection they shared responsibility with similar officials in the service of the feudal lords of the districts in which the mines were located. The Ikuno Mine was, of course, not free from this feudal control, but on the other hand it was by this direct administration that it had attained, for example, as early as 1597 an annual production of silver amounting to some 10,040 kg. Hideyoshi's policy was continued and carried forward by the Tokugawas, under whose iron rule most of the important mines of the country were made the domain of the first feudal lord (Shōgun). Such was the staus of the Ikuno Mine after 1600, until at last it came under the jurisdiction of the bailiff of the Shogunate with a feudal grant of 37,000 *koku* in kind.

The evidence suggests that in many of the mines which were worked in the latter part of the sixteenth century two systems of management prevailed : *jiki-yama* (直山) and *uke-yama* (請山). In the first case, the feudal lord to whom the mine belonged entitled the entrepreneurs to open pits upon conditions satisfactory to him. Arrangements were made as to the length of time for digging, usualy a month or so, and as to the payment of tribute, which was determined by bidding on the part of the entrepreneurs. In the second case, the right of the entrepreneur was more secure. The management of the whole mine was entrusted to him and he was entitled to hold it at least a year or so. Therefore, he could not only avail himself of the mineral resources but was also immune to the claims of the Shogunate and other feudal overlords, which were so cumbersome to *jiki-yama* entrepreneurs.

To the silver mine of Ikuno the system of *jiki-yama* was first applied in 1583, but whether or not before that time another system was in practice we do not know. However, this year marks the beginning of an epoch in the increase of the silver production of the mine, and by 1600 the yield was as high as 516 kg per pit. The process of mining in this

district was not very different from the system we have already spoken of. But at the same time it must be noted with regard to the increase of production that the newly invented method of mining was introduced from the Aikawa Mine in Sado, the greatest silver mine in contemporary Japan.

At Sado the usual method of payment was called *niwake*[1] (荷分) which originally meant the division of the output between the owner and the entrepreneur. The proportion was still undetermined in the early seventeenth century, but some evidence shows that the percentage of the payment of tribute ranged from one-third to one-fourth of the total yield. Of the payment at Ikuno we can not speak with certitude, but it is still assumed that the percentage was lower than that of Sado. Moreover, the entrepreneurs of Sado were awarded by the Shogunate with ample materials for the mining, and thus they were burdened with no expenses except for the wages of the laborors, while the entrepreneurs of Ikuno were subject to the whole cost of the mining operation. In those days at Ikuno a pit was divided into several sub-pits (*tsubo* 坪), and each sub-pit was further divided into sub-sub-pits called *tokoro* (所). The worker[2] occupied such a niche in the pit, and the daily output of minerals which he dug was divided between himself and the entrepreneur. The tribute was paid out of the entrepreneur's dividend and the greater the dividend, the greater the amount of payment. But, generally speaking, it was only in the rich pits that this kind of payment was made.

For the beginning of the seventeenth century, however, it is difficult to estimate the output of silver from the Ikuno Mine. A report of about the year 1622 says that there existed more than twenty rich pits with an output of silver ranging from 400 kg to 600 kg respectively, and that besides them many ordinary pits were also open. The refined silver was called *haibuki-gin* (灰吹銀) and all of it went into the hands of the Shogunate in exchange for silver currency (*cho-gin* 丁銀) during the latter part of the century. Meanwhile the upper strata of the mine with rich deposits of good silver were worked in the middle years of the century, and this resulted in a gradual decrease of output. In addition, as the pits became deeper, the quality deteriorated, and the pit workers were often troubled with flooding.

From the end of the seventeenth century the pits were classified into five grades according to their output. The first was the *kotowari-yama* (断山), with a monthly payment of five *monme* (about 15g) of silver, and a lease was limited to one year. The second, the *shirofuda-yama* (白札山), was a more promising pit, its lease renewed every three years after 1730, but actually the lessee was allowed to hold it for life, even to inherit it from generation to generation with nominal renewal of the deed. But it was also the custom that, when the workers met with an unexpected vein and that vein was estimated by the official overseers, a first- or second-class pit could be easily reclassifed.

(1) At this time a bagful was called *ni*, and amounted to some 20 kg.

(2) The worker was called *gezai* (下財), and was exclusively engaged in digging. But besides *gezai* there emerged several other kinds of mine workers: *tego* (手子) who were emloyed in transporting the minerals; *yamatome* (山留), pit superintendents, and *hibiki* (樋引), who were engaged in drainage by means of *hi* (樋), a kind of pump.

Then the standard of estimation was of course the output and the quality of silver. The *neiri-yama* (直入山), as the third class was called, made a monthly payment of ten *monme* of silver, but, according to the estimate, the rate of payment might vary even up to sixty *monme*. In 1755 the *niwake* system was applied to the *neiri-yama* and this change led to the payment of one-third of the output by the entrepreneur. The fourth class was the *goshomu-yama* (御所務山), and the fifth the *goshomu-yama-kaku* (御所務山格), which means "quasi-*goshomu-yama*". In these kinds of pits we see many *tokoro* (working places), and at the entrance of the pit a hut was built, where the officials superintended the transference of the minerals night and day. The payment, in this case, was rendered twice a month, and its rate reached 12% of the entrepreneur's dividend.

The mineral product was auctioned off to merchants (*kaishi* 買石) and carried to the refineries (*toko* 床) under their supervision. In the early eighteenth century the Ikuno Mine counted some fifty merchants and more than seventy refineries. The silver ores were classified according to their quality —— *minashi* (皆石) which was the best kind of ore; *ishigane*, (石銀), another name for galena; and *haku* (鉑), which contained ores of chaleoprite, bornite, and tetrahedrite. Beginning with the latter half of the century, however, copper pits—*wakabayashi-yama* (若林山) and *Senju-yama* (千珠山), to mention but two of them—were exploited, and the output of copper began to replace that of silver.

In the thirties of the seventeenth century a new method of refinement was introduced into Ikuno from the Tada Mine in Settsu (now Osaka prefecture). This method was called *katage-buki* (カタゲ吹), and two processes of refinement were involved in it The one process was what we call *nanban-buki* (南蛮吹) and was well-known as having been introduced by an ancestor of Mr. Sumitomo, a contemporary Japanese millionaire. At any rate, by these means the production of copper in the Ikuno Mine gradually increased after the end of the sixteenth century and reached as high an output as 600,00 *kin** a year.

TABLE I

Estimated Annual Production of Copper (in *kin*)

1756——1775	470,628
1789——1798	200,000
1800——1809	123,122
1810——1819	85,167

TABLE II

Estimated Annual Production of Silver (in *monme*)

1682——1706	621,088
1707——1732	504,118
1733——1758	480,638
1759——1784	479,745
1785——1810	390,868
1811——1846	476,423
1837——1851	280,952

* 1 *kin*=160 *monme*, and 1 *monme*=3.75 gram.

The silver extracted from the copper ore was inferior in quality to the silver produced in the earlier stages of the mine, so to meet the needs of the Shogunate it had to be further refined by special processes. Then the standard currency was minted from Ikuno silver mixed with some copper. The proportion of silver to copper was 1,000 to 195 in the *Keicho-gin* (慶長銀), the most common currency of the time. So the Shogunate calculated a profit of 13% or more in taking Ikuno silver in exchange for the standard currency.

During the eighteenth century the most flourishing pits were those of Wakabayashi and Senju, and when the next century dawned, it witnessed the rise of Taiseizan (太盛山). In the heyday of the former, for instance, about the year 1770, in Wakabayashi the annual output of silver and copper reached 134,240 *monme* and 134,342 *monme* respectively, amounting to about 30 % of the total production of the mine. In the latter part of the century four pits were especially busy at Wakabayashi, but among them the most noteworthy was the pit of *Usumi-no-uchi* (薄身之内). Here the problem of drainage was most acute. The workers used a number of *hi*, for this purpose, but it was constantly troubled with flooding after 1766. When we examine the elaborate policies of the Shogunate, with its attempts to offer ample materials for drainage, to regulate the working processes, and to encourage workers and entrepreneurs alike with increased rewards, we see successive feudal magnates giving sleepless nights to the problem of reviving the dying veins of the great Ikuno Mine.

In summing up, let us attempt to enumerate some of the causes for the decline of the greatest mine in feudal Japan. The techniques of the age found it difficult to continue the work in the flooded conditions which resulted from the deepening of the pits. Moreover, the manufacture, the prevailing mode of production, demanded a great amount of labor, the excessive use of which soon exhausted the upper layer of the mine, which had been richly stocked with good silver. Hence the deterioration of the State currency and copper control in connection with foreign trade. Indeed, the price of copper was not in proportion to the cost of production, but was determined with complete disregard to the entrepreneurs' profits. For example, in 1806 the public assessment of Ikuno copper was 155 *monme* of silver per 100 *kin*, while in the money market of Osaka the same amount of copper reached the value of 320 *monme* of silver. So we are not surprised when we hear of the complaints of entrepreneurs on the brink of ruin because of inflation. The Price Revolution set in. With the advent of the merchant capital of the Western powers, and through political ineptitude of the Shogunate, the feudal regime of Japan, and with it the prosperity of the Ikuno Mine, showed signs of drawing to a close.

CONSTRUCTION OF NEW SELF DIAGNOSTIC INVENTORIES.

By

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In the first part of this study, we have constructed a self diagnostic personality inventory which permits a unitary score. The widely accepted AWAJI VERSION TEST obtains its unitary score, called version quotient, as the ratio of the real numbers to the possible numbers of extraverted responses. For such a unitary score to be valuable it is requisite that all test items must be internally consistent, at least not be contradictory. In this respect the AWAJI TEST may be considered far from perfect. The main purpose of the first study is to remedy this imperfection.

We started from KIBLER SELF DIAGNOSTIC LIST, and after several applications of the good-poor analysis technique, we constructed a new inventory which has almost perfect internal consistency. After application of the correction formula :

$t = \frac{|p-q|-\phi}{\sqrt{\sigma_p^2+\sigma_q^2-2\phi\sigma_p\sigma_q}}$, most of its 50 items show significant differences beyond 5% level between the upper quartile and the lower quartile of subjects. In data on 400 college students, only two items, and in data on 400 junior high school pupils, only 10 items did not show significant differences.

The purpose of the second part of this study was to construct a new self disgnostic inventory from which one can get consistent scores on several different personality traits separately. Starting from three inventories of GUILFORD and GUILFORD-MARTIN which give 13 scores for different traits, we prepared at first a test of 240 items for 17 traits and applied it to 200 younger college students. Each of the 240 items was tested against the 17 measures by the good-poor analysis technique. Then we selected most significant items for each trait, and constructed two new inventonies. FORM I consists of 25 items each for 16 traits with reduplication of items. FORM II consists of 12 items each for 13 traits, each item given only once. These tests, especially FORM II, have these desirable characteristics : very high internal consistency and independence between the measures of each trait. These 13 traits for FORM II could be given the same names as in GUILFORD's tests, namely, 1. social introversion, 2. thinking introversion, 3. depression, 4. cyclothymia, 5. rhathymia, 6. general activity, 7. ascendance, 8. masculinity, 9. inferiority, 10. nervousness, 11. objectivity, 12. agreeableness, 13. cooperativeness. But the trait definitions are not exactly the same. Our "thinking introversion" is purer than GUILFORD's, i. e., is devoid of emotional tones. Depression, cyclothymia, inferiority, and nervousness are much more separated from each other. The largest change is effected in the trait of "objectivity". We have endeavoured in vain to conserve a trait in our list which may represent the character of an individual whose concern is always with himself and shows some paranoid symptoms. At the end of our efforts we found instead a trait which expresses an incli-

nation to phantasy and neurasthenia. For like reasons the name aggressiveness seems to fit its category better than agreeableness, and frustration better than cooperativeness.

It should be noted that our items for measuring masculinity were prepared by a procedure different from that of Guilford. We analysed all 240 test items with respect to the real biological sex difference of the subjects and selected those items which showed significant differences between the answers of both sexes.

In the third part of our study we did a factor analysis of our FORM II Inventory. According to Thurstone's centroid method, and after rotations of the axes, we found eight primary factors which have striking affinities with factors analysed by Thurstone himself on the 13 GUILFORD-MARTIN scores given by Lovell. Only the trait called "impulsiveness" by Thurstone was not detected, and the factor called "sociable" is divided into two traits in our case. The names and the main loadings of our primary factors are as follows : **

S^1 (D^1) SOCIAL INTROVERSION or DOMINANT (Social Introversion : 0.56 ; Ascendance : 0.54)

E^1 (E^1) EMOTIONAL STABILITY (Cyclothymia : 0.53 ; Nervousness : 0.56 ; Phantastic or Objectivity : 0.49 ; Depression : 0.47 ; Inferiority : 0.39)

M^1 (V^1) MASCULINITY or VIGOROUS (Masculinity : 0.70)

G^1 (A^1) REALITY GRADE or GENERAL ACTIVITY (Phantastic or Objectivity : 0.57 ; Reality Grade or General Activity : 0.43)

T^1 (R^1) THINKING INTROVERSION or REFLECTIVENESS (Thinking Introversion : 0.81 ; Rhathymia : 0.26 ; Nervousness : 0.25)

F^1 (S^1-I) FRUSTRATEDNESS or SOCIABILITY-I (Frustratedness or Cooperativeness : 0.79 ; Phantastic or Objectivity : 0.23 ; Nervousness : 0.21)

A^1 (S^1-II) AGGRESSIVENESS or SOCIABILITY-II (Aggressiveness or Agreeableness : 0.45 ; Inferiority : 0.50 ; Nervousness : 0.38)

X^1 (I^1) The independency of this factor is doubtful.

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The names and loadings of secondary factors are as follows :

A^2 EMOTIONAL STABILITY (E^1 : 0.78 ; S^1 : 0.67 ; A^1 : 0.56)

B^2 REALITY GRADE (G^1 : 0.78 ; S^1 : 0.49)

C^2 ACTIVITY (G^1 : 0.63 ; F^1 : 0.60 ; M^1 : 0.57)

D^2 SOCIAL ADAPTABILITY (F^1 : 0.96 ; M^1 : 0.81 ; A^1 : 0.68)

While the first three of the secondary factors correspond approximately to those of Baehr, the fourth factor deviates from Baehr and approaches rather to Thurstone's primary factor "sociable".

** The second names are THURSTONE's ; the values in parenthesis are largest loadings of the test measures.