

*Journal of the
American Musical
Instrument Society*

VOLUME I • 1975



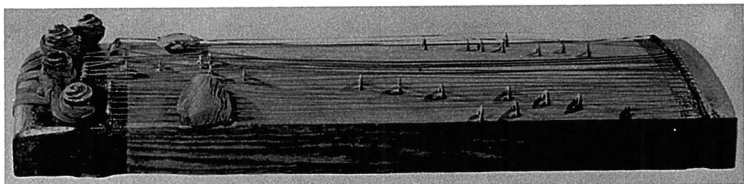
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Han Dynasty Musicians and Instruments

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IN the course of excavations carried out at Ma-wang-tui on the outskirts of Ch'ang-sha, Hunan Province, in central China, a number of objects of great interest to historians of music and of musical instruments were recently discovered. The tomb of a noblewoman tentatively identified as the wife of the first Marquis of Tai (enfeoffed 193 B.C.; died 186 B.C.) excavated in 1972 contained more than one thousand objects of ceramics, wood, lacquer, bamboo, silk, etc., in a remarkable state of preservation. Among these objects were three musical instruments and a group of statuettes representing musicians and dancers. At the time of the first publications concerning these discoveries (*Ch'ang-sha Ma-wang-tui i-hao Han-mu fa-chüeh chien-pao*, "Brief Report on the Excavation of Han Tomb No. 1 at Ma-wang-tui, Ch'ang-sha," issued by the Hunan Provincial Museum and Institute of Archaeology, Academia Sinica, July 1972, and an illustrated article in *China Pictorial*, October 1972), it was believed that the instruments had all originally been playable. Subsequent findings as published in the *Ch'ang-sha Ma-wang-tui i-hao Han-mu* (2 vols., Peking: Wenwu Press, 1973) reveal that at least two of the instruments were probably nonfunctioning tomb objects.

An abridged translation of the relevant portions of the 1973 study is presented herewith, together with two of the accompanying drawings and photographs showing the instruments and a group of the figurines. The "Brief Report" notes that twenty-three of the statuettes seem to form a music and dance troupe and that they were discovered in an arrangement that seems to reproduce a banquet scene with music and dancing that the marchioness would have enjoyed during her lifetime.



Sê (board zither) of twenty-five strings.

The Sê (Board Zither): Construction

The body of the *sê* is made of wood and is 116 cm. long by 39.5 cm. wide (see Figure 1). The top of the soundboard is slightly convex, the height of the middle portion being 10.8 cm., while at the sides it is 8.4 cm. Except for the two ends, which are painted with black lacquer, the body of the instrument is left plain. The underside of the instrument is fitted with a bottom board held in position by bamboo nails. This board has an opening at each end, and measurement made through the opening at the head of the instrument shows the thickness of the soundboard to be about 2 cm.

Crossing the right-hand end of the soundboard is the head communal bridge, 40.4 cm. long, approximately 1 cm. wide, and approximately 1 cm. high. To the right of this communal bridge are twenty-five string holes; the distance between these holes is about 1.5 cm., with rather uneven spacing. At the left-hand end of the soundboard are three tail communal bridges. The inner and outer ones measure approximately 14 cm. in length, and to the left of each of them are nine string holes. The middle communal tail bridge is 11 cm. long, and to its left are seven string holes. The width and height of the tail communal bridges are the same as those of the head communal bridge. At the tail there are also four wooden knobs to which the strings are tied; the tops of these knobs are made of silver, decorated with swirling designs.

The strings are each made up of four strands of raw silk twisted counterclockwise. They are divided into three groups by the tail communal bridges, the middle group consisting of seven strings ranging in diameter from 1.2 mm. to 1.9 mm., the inner and outer

groups of nine strings each, ranging in thickness from 0.5 or 0.6 mm. to 1.2 mm. At the end of the inner and outer groups of strings there is a winding of deep-red silk gauze ribbon, separating the strings and forming a pad that covers them. Under each string there is a wooden movable bridge, approximately 3.5 cm. wide at the bottom and approximately 2.5 cm. high. When the *sé* was excavated, the positions of these movable bridges were slightly disturbed, but on the basis of marks on the soundboard it was possible to reconstruct their original positions.

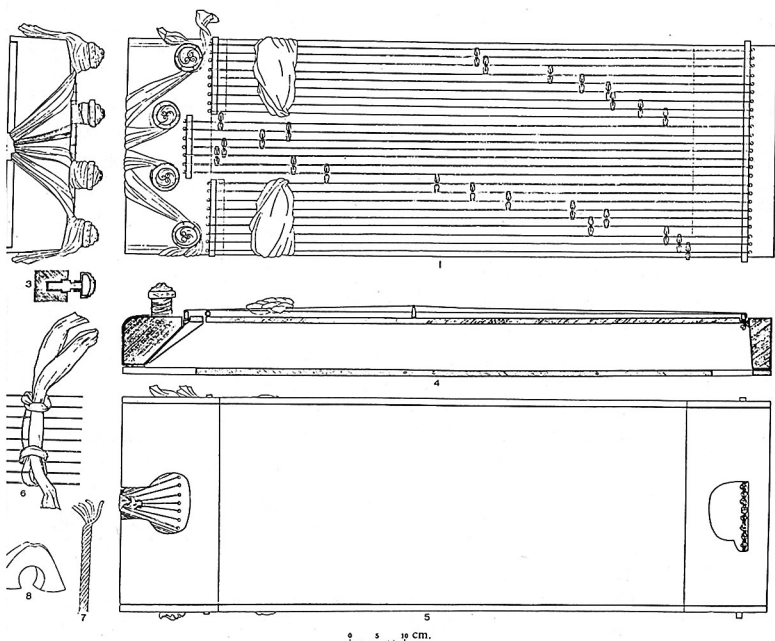


FIGURE 1. The *sé*: 1. Top view. 2. Tail view. 3. Cross section of knob. 4. Longitudinal section. 5. Bottom view. 6. Tying of silk on the strings. 7. String wound from four strands. Movable bridge. (Features 6, 7, and 8 not to scale.)

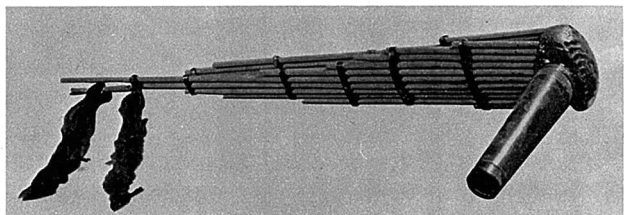
The method of stringing employed is as follows: A butterfly knot was tied at one end of the string, which was then passed through the opening in the bottom of the instrument at the head end and threaded through the appropriate string hole at the head end of the soundboard. The string was drawn across the soundboard and threaded through the appropriate string hole at the tail end of the instrument and bent to the left through the string trough, passed around the tail end, and wound around one of the knobs. The number of strings wound around these knobs, counting from the outer one to the inner one, is six, six, six, and seven. Between the string trough and the knobs, the strings are wrapped with deep-red silk gauze ribbons, which are then wrapped around the knobs.

The workmanship in this *sê* is rather coarse, and the lacquering is not very even. However, there is no sign of wear at any point. Moreover, it is possible to see through the bottom opening at the tail a shaving remaining from the drilling of one of the string holes still hanging from the side of the hole. One can therefore surmise that the instrument had not been touched since it was first strung. These clues clearly show that this *sê* was newly made as a burial object; but the form and the construction are so complete and perfect, in particular the strings are so carefully made to specification, that it is difficult to tell whether the instrument was originally intended only for this purpose.

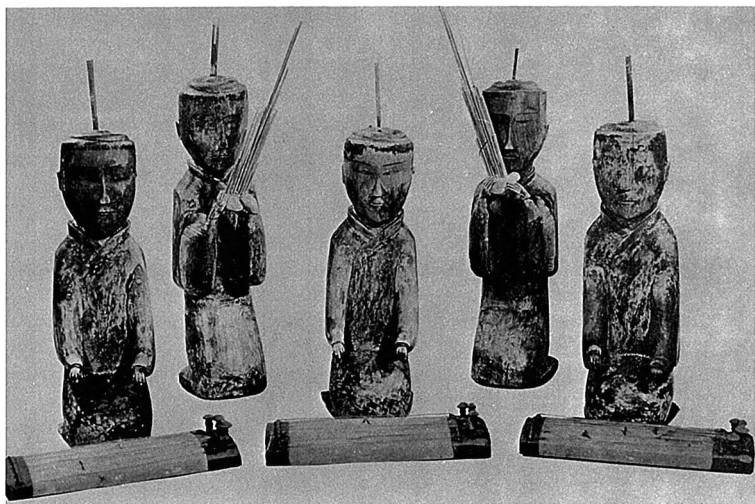
The Sê: Tuning of the Strings

Although the twenty-five strings of the *sê* are divided into three groups by the communal bridges at the tail of the instrument, the gradual reduction in thickness of the strings in the middle group of seven strings and the inner group of nine strings shows them to belong to a continuous series, with the outer group of nine strings forming a separate series with thicknesses similar to those in the inner group (see Table I).

There are usually three methods of tuning the *sê*, either according to the twelve-halfstep gamut, the seven-tone scale, or the five-tone scale. It seems most likely that this *sê* was tuned to the five-tone scale, because counting from certain of the low-pitched strings to the sixth string following, the length of the latter is close



Yü (mouth organ) made of twenty-two bamboo pipes.



Five of the twenty-three figurines found in the tomb, showing playing positions for the instruments.

TABLE I
Diameters of Strings and Positions of Movable Bridges of the *Sê*

<i>String grouping</i>	<i>Distance between communal bridges at apex in millimeters</i>	<i>String number</i>	<i>String diameter in millimeters</i>	<i>Distance from head communal bridge to movable bridge</i>
Outer 9	952	1	1.2	— ^a
		2	1.2	481
		3	1.2	468
		4	1.1	352
		5	1	295
		6	0.8	245
		7	0.8	240
		8	0.7	190
		9	0.6	145
Middle 7	1000	10	1.9	936
		11	1.9	815
		12	1.7	860
		13	1.6	931
		14	1.6	939
		15	1.5	805
		16	1.2	745

Inner 9

952

}	17	1.2	550
	18	1.2	486
	19	1	423
	20	1	308
	21	0.9	245
	22	0.8	273
	23	0.7	138
	24	0.6	115 ^b
	25	0.5	101 ^b

Measured 5 October 1972 at Ch'ang-sha Provincial Museum.

^a Movable bridge had fallen off. Position unknown.

^b At the time of excavation these bridges had been moved to a point between the 23rd and 24th strings.

to half that of the former (e.g., strings 2 and 7 and strings 17 and 22), suitable for producing a note an octave higher. Counting over a group of four strings, the length of the fourth one is often close to two-thirds that of the first (e.g., strings 4 and 7 and strings 5 and 8), suitable for producing a note a fifth higher.

The Sê: An Enquiry into the Playing Method

There is no record in the early literature on the manner in which the *sê* was played, but on the basis of the system of tuning, of other Han artifacts, and a comparison with later writings, one can attempt a guess. The three *sê*-playing statuettes found in the tomb and the picture painted in color on the black ground of the casket's headboard seem to show how the *sê* was played during the Han dynasty. The three statuettes show the index fingers of both hands plucking the strings simultaneously. The players are kneeling with the *sê* placed horizontally in front of them. Their arms are extended with the palms of both hands facing downward over the instrument with the thumbs bent inward and the index fingers hooked so as to form a ring and apparently ready to sweep the strings. According to later writings, the *sê* could be played in octaves, fifths, or fourths, using both hands, and this seems to be confirmed by the statuettes and by the tuning of the instrument in the five-tone scale which gives each group of strings a range of more than an octave.

The painted figure on the headboard of the casket shows a second manner of playing the *sê*, that is, with the instrument tilted to the left, with one end of the instrument supported by the knee and the other end tilted toward the ground, the right hand plucking the strings on the end of the instrument over the knee and the left hand pressing the strings in the middle of the soundboard. Similar illustrations of *sê*-playing can be seen relatively frequently in Han stone reliefs, some of which show details even more clearly. The reliefs also show a third method of playing the instrument in which the *sê* tilts toward the right, resting across the knees or placed to the right of the player; in both cases the left hand is used to pluck the strings and the right hand presses upon them. Normally, one would pluck the strings with the right hand and press upon them

with the left to produce a vibrato or to raise the fourth and the seventh notes of the seven-tone scale, but some of the reliefs show just the opposite; perhaps this was done for purposes of pictorial composition.

The Yü (Reed Mouth Organ)

The instrument has an overall height of 78 cm. and is made of bamboo and wood, including a bowl, mouthpiece, and twenty-two bamboo pipes, as well as a plug inserted into the sixth pipe (see Figure 2). The bowl and the mouthpiece are made of wood and painted with deep-red lacquer. The bowl is made of two pieces having an oval cross section, and its largest diameter is approximately 10 cm. The mouthpiece, 28 cm. long and 3.5 cm. in diameter, is connected to the center of the front of the bowl. A mouth rim approximately 1 cm. wide and made of horn is inserted into the outer end, and a band approximately 1 cm. wide connects the mouthpiece and the bowl.

Each half of the bowl has eleven holes into each of which a pipe is inserted. To the right of each of the two rows of pipe holes there are two round holes of similar size, but these are not drilled through to the bottom and there are no pipes to be inserted into them. The bowl also has a round hole at the front for insertion of the mouthpiece and an oval hole in the center of the back, which is covered by a lid.

The twenty-two pipes are made of bamboo approximately 8 mm. in diameter. These pipes have their bamboo skin shaved off and are hollow. The longest is 78 cm. in length; the shortest, 14 cm. The longest pipes are in the center in both rows, and to the left and right in each row there are five pipes of decreasing length. The front row of pipes is held in place by five bamboo splints, the back row by four splints. The space between the two rows is wide enough for the insertion of a finger. The upper part of the two longest pipes is tied with a deep-red silk gauze ribbon as decoration. Except for the third and fourth pipes, there is a finger hole approximately 1.5 cm. in diameter 3 cm. above the bowl. Pipes 6, 7, 17, and 18 have a second finger hole 1.5 cm. above the first.

The plug inserted into the sixth pipe is 14.2 cm. long overall. The

upper section is made of horn and is 10.8 cm. long and 8 mm. in diameter; there is a hole 4 mm. in diameter and 10 mm. deep at the lower end. The lower section is made of wood and is 4.4 cm. long and 4 mm. in diameter; except for the portion that is inserted into the section made of horn, this part is wrapped with black silk thread.

From its outward appearance the *yü* looks like a playable instrument, but its internal construction is very incomplete. There is no connection between the mouthpiece and the pipes, that is, no air chamber in the bowl. In the upper end of the pipes there is no air

TABLE II
Dimensions and Frequencies of the *Yü* Pitch Pipes

Pipe	Order when found	Length (cm.)	Inside diameter (cm.)	Frequency (hz)	Equivalent ^a
Huang-chung	1	17.65	0.60	455.78	A ₄ -39
Ta-lü	2	17.10	0.80	491.89	B ₄ -7
T'ai-ts'ou ^b	4	16.50	0.75		
Chia-chung ^c	3	16.75	0.75	459.22	A ₄ -26
Ku-hsien	5	15.55	0.70	540.77	C ₅ -43
Chung-lü	6	14.90	0.65	563.40	C ₅ +28
Jui-pin	8	14.00	0.60	591.76	D ₅ +13
Lin-chung	7	13.30	0.70	616.89	D ₅ -15
I-tsê	10	11.50	0.60	655.08	E ₅ -11
Nan-lü	9	12.60	0.70	659.64	E ₅ +1
Wu-i	11	10.80	0.70	744.71	F ₅ +11
Ying-chung	12	10.10	0.65	782.63	G ₅ -3

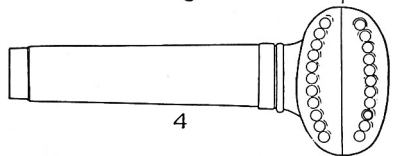
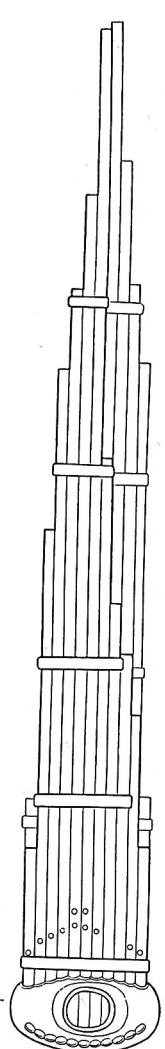
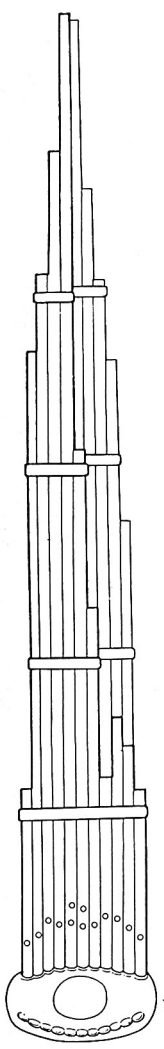
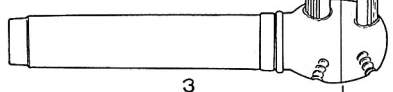
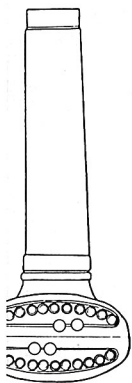
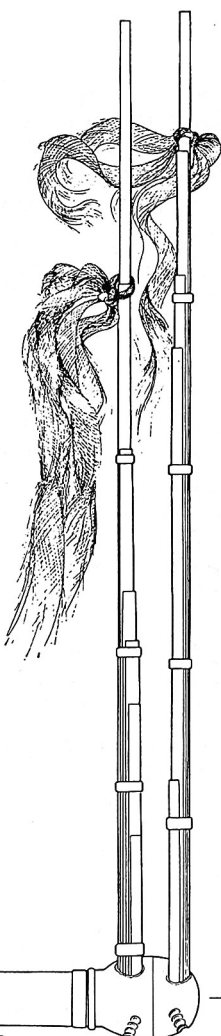
All pipe walls approximately 1.2 mm. thick. Tested on 7 October 1972, using Strobconn 6T-3; Temperature 22° C. Frequencies determined with the lower end of the pipe plugged by a finger. The pipes were preserved by immersion in water; some pipes warped slightly during testing.

^a A₄=A-440; difference from named note given in cents.

^b Broken; could not be tested.

^c Cracked but tested.

FIGURE 2. The *yü*: 1. Plug found in sixth pipe. 2. Top view. 3. Side view. 4. Bottom view. 5. Back row of pipes. 6. Front row of pipes.



0 5 10 cm.

vent, and the reeds are missing at the lower end. All these facts point to the instrument's being purely a burial object.

This is the first time that a *yü* has been found. According to various ancient literary sources, the *yü* looks like a *sheng* but is larger, measuring 4 feet 2 inches long, and using a gourd as a bowl, with thirty-six pipes later reduced to twenty-three. Thus the *yü* is an instrument of wider range and lower pitch. The set of pitch pipes discovered with the *yü* suggest that the instrument was tuned to the twelve-halfstep gamut.

The Yü Pitch Pipes

The set of twelve pipes, like those in the *yü*, is made of bamboo with the skin shaved off. Each pipe is hollowed, has no bottom, and is roughly made with a wall thickness of approximately 1.2 mm. At the bottom of each pipe is the name of one of the twelve tones of the gamut (see Table II). As can be seen from Table III, neither the lengths nor the pitches of the pipes tally with the specifications found in historical writings. Some of the pipes were placed

TABLE III
Comparison of Yü Pitch Pipes with Prescribed Standard

Pipe	Frequency		Length (cm.)	
	Measured	Prescribed	Measured	Prescribed
Huang-chung	455.78	455.78	17.65	17.65
Ta-lü	491.89	486.72	17.10	16.13
T'ai-ts'ou	[broken]	512.76	16.50	15.33
Chia-chung	459.22	547.56	16.75	14.27
Ku-hsien	540.77	576.84	15.55	13.57
Chung-lü	563.40	616.02	14.90	12.72
Jui-pin	591.76	648.96	14.00	12.10
Lin-chung	616.89	683.67	13.30	11.26
I-tsê	655.08	730.08	11.50	10.64
Nan-lü	659.64	769.14	12.60	9.88
Wu-i	744.71	821.34	10.80	9.18
Ying-chung	782.63	865.26	10.10	8.74

in the wrong compartments of the bag in which they were discovered, and some of the pitch names were written incorrectly.

This is the first time that a set of pitch pipes has been found. The discrepancy between the pitches of these pipes and the prescribed standard seems to indicate that the pipes were intended only as burial objects.

The Metropolitan Museum of Art
New York