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DESIGN AND CONSTRUCTION OF A MOSAIC
MURAL

by

De Lynn C. Colvert

B. A. Montana State University
1957

Presented in partial fulfillment of the requirements
for the degree of


Master of Arts in Art

MONTANA STATE UNIVERSITY

1958

Approved by:


Chairman, Board of Examiners


Dean, Graduate School

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Date

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TABLE OF CONTENTS

Introduction	1
Project Plan	2
Tesserae	6
Glazing and Firing	11
Setting the Tesserae	16
Grouting	20
Mounting the Mural	21
Bibliography	23
Appendix I: Glaze Formulae	24
Appendix II: List of Materials	26
Appendix III: Cost of Materials	27

DESIGN AND CONSTRUCTION OF A MOSAIC MURAL

INTRODUCTION

The requirements for a Master of Arts in Art Degree include the completion of a terminal art project. The terminal creative project, presented in lieu of a written thesis, is the designed, executed, and installed mosaic mural on the south wall of the Treasure State Room, commonly known as the Lodge Cafeteria, Montana State University.

This paper, with illustrations, is supplementary to, and in explanation of the project.

PROJECT PLAN

A mosaic architectural decoration was decided upon for the terminal creative art project for several reasons. The designing and construction of a mosaic coffee table had earlier shown interesting and exciting possibilities in this medium. Equipment and materials were available in the Art Department and locally with which a mosaic mural could be economically created. Mosaic work is currently having a revival after lying dormant for 600 years, and a study of both contemporary and Byzantine mosaic examples proved stimulating, interesting and motivating. Mosaic's permanency, brilliance and textural charm are ideal qualities for architectural decoration, or large murals.

Two locations were found available for such a work: the elevator lobby of the Fine Arts Building, and the south wall of the Treasure State Room of the University Lodge. The Lodge wall was preferred because it gives the viewer a greater variety of observation points, thus offering the challenge of making a design that would be aesthetically pleasing close up as well as far away. In addition, the mural could be appreciated by a larger audience and the wall offered a large, simple surface, an area in need of decoration.

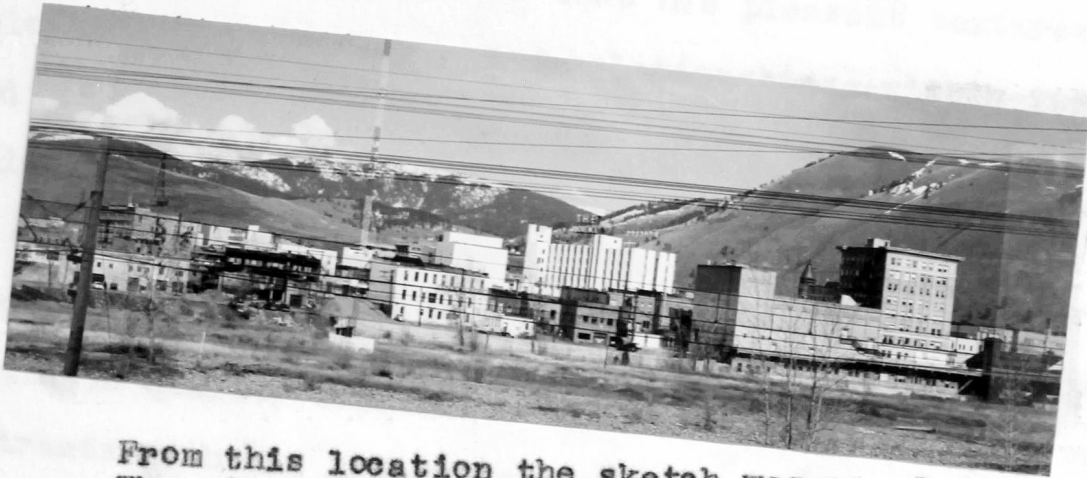
The wall, from door to corner, measures 60' in length, 13' in height. The dominating color scheme is pale green,

harmonizing with a soft peach color on the adjacent wall, and with warm yellow, brown and white of the surrounding environment. A mural 6' x 48' was decided upon, after consideration was given to the use of the room. The mural needed to be placed high enough on the wall so it could readily be seen from all parts of the room over the heads of the diners. Additional space over the mural and at both ends was desirable to counter-balance the space beneath the mural.

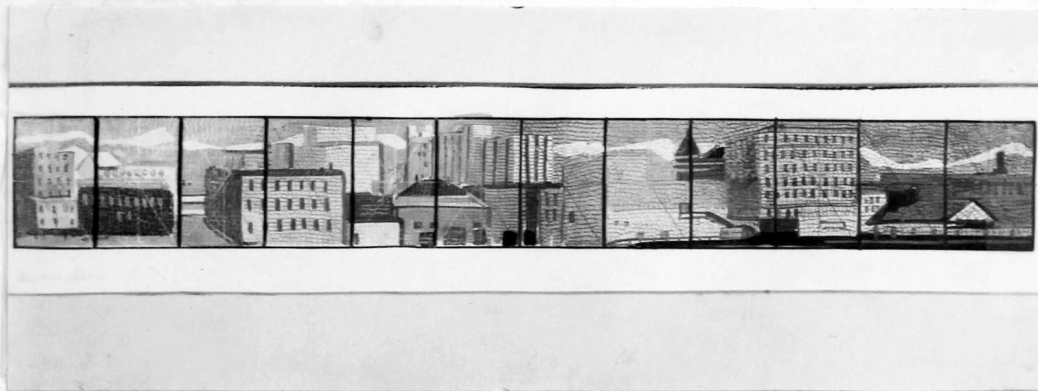
Several rough color sketches and studies utilizing these proportions were completed. A variety of subject matter was tried, with landscape motifs dominating. A relaxing, quiet subject would agree with students during their meal hours. The final choice was a city skyline using a section of Missoula.¹ This choice was made after consideration was given to three factors: one, basic lines and rhythms of building forms harmonize with the rather severe architectural lines of the Treasure State Room, two, the subject matter was of local interest, and three, the basic material of the mural--rectangular tesserae--are especially well adapted to architectural illustration.

The mural has not been designed to be representational, or naturalistic, but designed as a personalized expression of the designer. Specifically, buildings have been elongated, hues changed and greyed, and the distant mount-

1. See page four.



From this location the sketch was completed.
The view is looking north across the river
from a point two blocks west of the Milwaukee
Depot.



The tempera sketch selected as subject
matter for the mosaic mural.

aims changed to give a decorative motif which unifies the long, narrow mural. The aims in designing the mural were to create a wall decoration that has pleasant textures, colors, patterns, forms, and relationships--within itself and to the surrounding architecture. The mural would provide a visual center of interest to the large room, which is dominated by sharp, monotonous lines and rather stark surfaces (with the exception of the front wall). The major aesthetic quality emphasized is the textural element, which contrasts with the linear, smooth architecture, creating a pleasant accent for the room. The mural contains other aesthetic qualities--the intangibles peculiar to the art field--which could be discussed at length. However, the designer prefers the completed mural to speak for itself.

TESSERAE

A mosaic may be defined as a surface decoration created by inlaying various material, usually permanent, into various binding bases.

The various materials used in mosaic work are called tesserae. Hand-made ceramic tesserae were chosen to be used in the projected mosaic mural after consideration was given to costs, available materials, and colors needed in the completion of the mural.

First, natural clay had to be dug. Suitable clay² was found in an abandoned brick yard four miles west of Missoula, near the county airport. The clay is a fairly pure low-fire clay, containing very few stones and other impurities. This aided in the mixing as it greatly simplified screening, or straining, the clay. The clay matures between 1850 degrees and 2050 degrees Fahrenheit.

The clay was mixed with 10% Kentucky Bell Clay and a cup of barium carbonate was added for each 50 pounds of clay in order to reduce the bloom produced by undesirable salts such as lime and calcium carbonate.

Following standard procedures of screening, mixing, and wedging,³ the clay was brought to a workable state and formed into brick shapes approximately 4" x 7" x 10".

The next step was the slicing of this clay brick into thin slabs 1/8" to 3/8".⁴ This was accomplished by

2. See page seven.

3. See page eight.

4. See page nine.



This abandoned brickyard was the source of the clay used in the manufacture of the ceramic tesserae.



The freshly mixed clay was wedged by pushing down and twisting in order to eliminate any trapped air in the clay and to give it an even consistency.



The cutting of the clay "brick" into flat, thin slabs was accomplished by this very practical home-made slicer. A hard, smooth surface was also needed in the process.

constructing a cutter from a concrete reinforcing rod, bent into a "U" shape, and stretching a non-rusting wire between the ends. To vary the thickness of the slabs, the wire was simply raised or lowered.

These slabs of clay were then placed on a newspaper covered table. The newspaper served a dual purpose: first, it helped absorb water from the underside of the slabs (evaporation dried the top side) to minimize warping, and secondly, it protected the table from any excess glaze when it was applied to the slabs.

GLAZING AND FIRING

The clay slabs were allowed to dry for approximately an hour, then liquid glaze was freely brushed on the slabs. The glaze was applied with a 2" flat bristle brush and it was the consistency of thick cream. Two coats of glaze were applied,⁵ otherwise the tesserae would have a glazed surface with "crawling" (shrinking away of glaze) causing a mottled effect, or show streaks or brush marks.

Glazing was the most complicated and unpredictable process in the construction of the mosaic mural. However, a person with sufficient ceramic experience should encounter no difficulty.

The basic colors the mosaic required insofar as glazes were needed were as follows:

White	
Black	
Blue	(shades and tints)
Red	(shades and tints)
Yellow	
Green	(shades and tints)

After glazing, the clay slabs were allowed to dry for three or four hours and then cut into tesserae. When the slabs were cut too soon, the glaze and clay adhered, causing unnecessary breaking after being fired, and when they dried too long, the clay broke and crumbled when cut. It was found that the ideal time for cutting occurred when the slabs were leather hard and had crisp, clean edges when cut.

With a small pointed knife, the slabs were quickly cut

5. See page twelve.

into small rectangles of varying sizes. They were
put directly on kiln shelves and were
for drying in order to eliminate the
of the small kiln. The color varied from white
to 3/4" which would give the finished product



The second coat of glaze was applied after the first coat dried, usually in fifteen minutes. If engobe colorants were used, they were allowed to dry, and then the glaze applied.

See page fourteen.
See page fifteen.

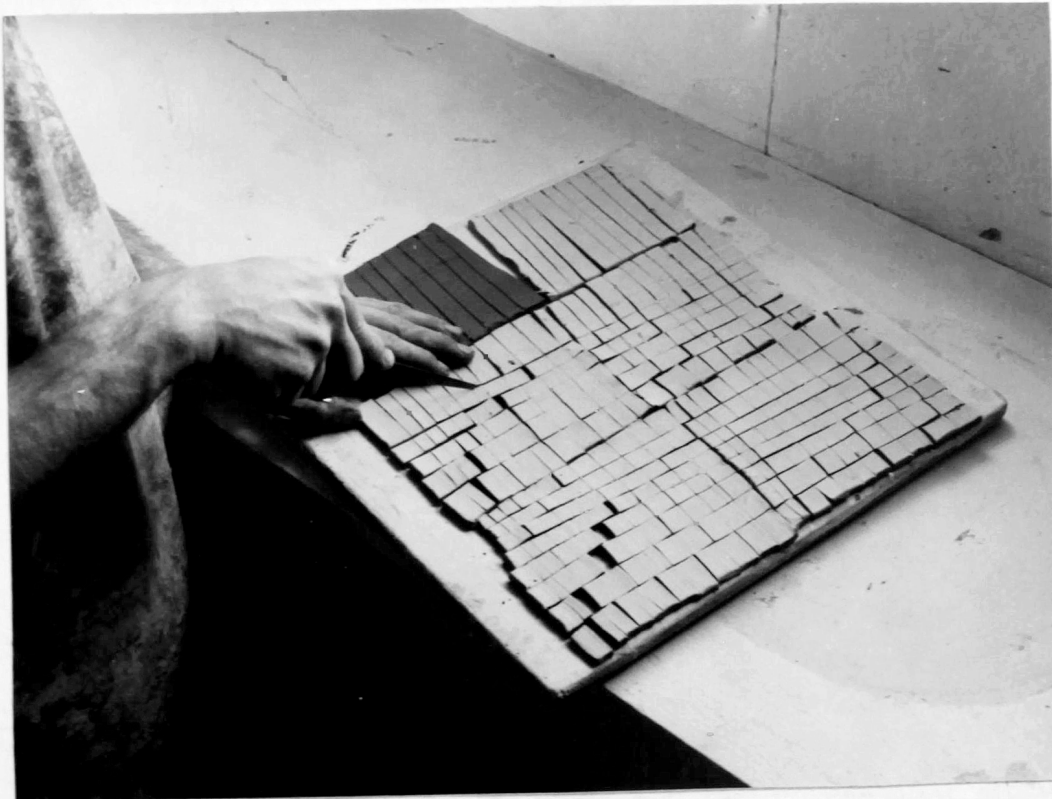
into small rectangles of varying size.⁶ The slabs were cut directly on kiln shelves and stacked in the open kiln⁷ for drying in order to eliminate any unnecessary handling of the small tesserae. Pieces varied in size from 1/4" to 3/4" which would give the finished mural added interest and texture, and help avoid the commercial tile effect.

The glazes were designed to mature between cone 06 (1830° F.) and cone 02 (2048° F.). Best results were found at cone 03 (2014° F.) and the majority of the tesserae were fired at this temperature.

After firing, the pieces were simply put into cardboard boxes, one color to a box.

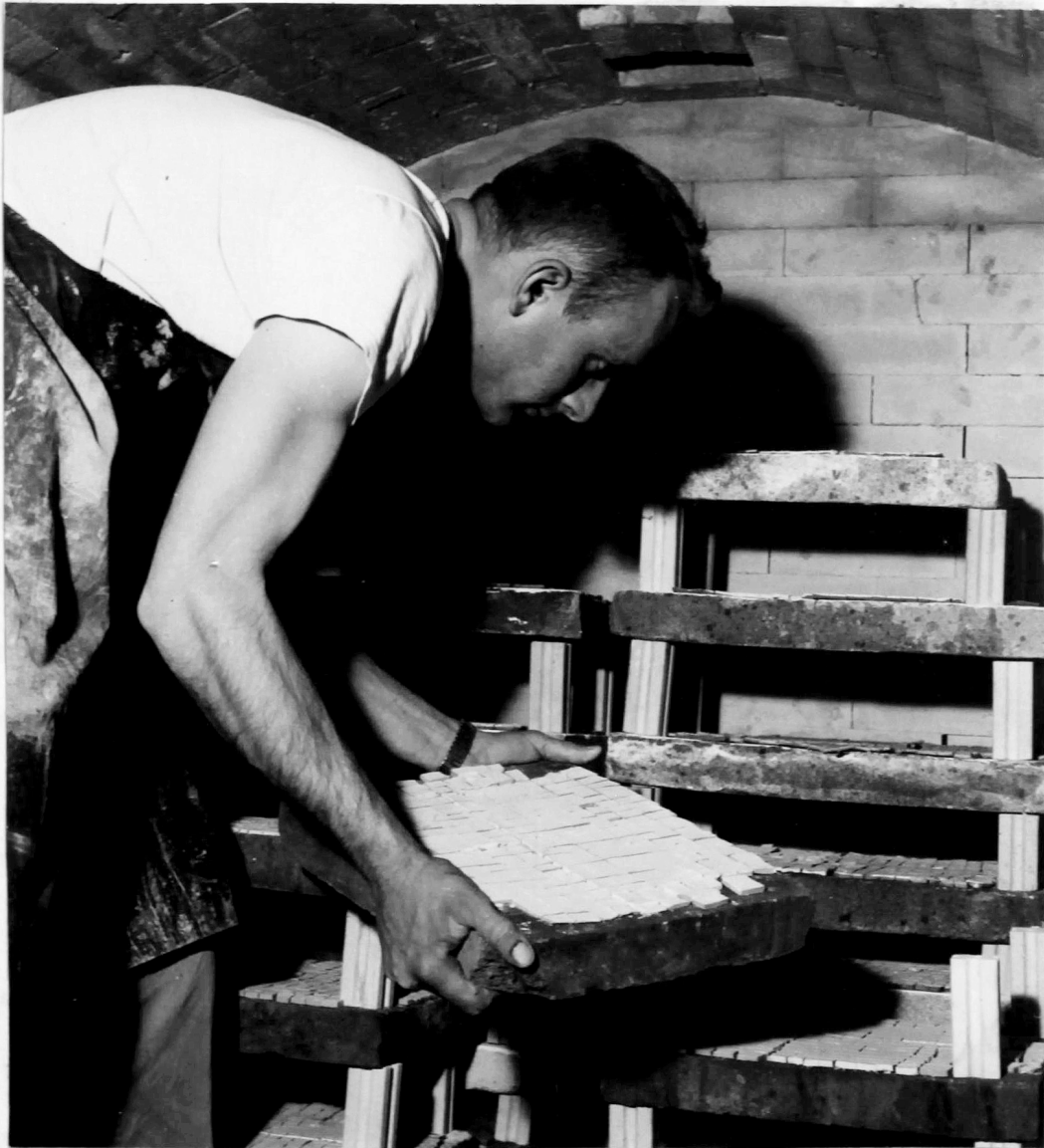
6. See page fourteen.

7. See page fifteen.



Cutting the clay slabs into small mosaic tesserae was accomplished with a long pointed knife.

All shelves, obtained from the heating plant, were being loaded in the specified order. The last firing was 2,000 tesserae (utilizing all available shelves).



Kiln shelves, obtained from the heating plant, shown being loaded in the gas-fired kiln. Maximum firing was 20,000 tesserae (utilizing all available shelves).

SETTING THE TESSERAE

After a sufficient supply of tesserae was accumulated, work on the panels began. The master sketch was supplemented by an enlarged photograph of the skyline.

The mosaic base is composed of $\frac{1}{2}$ " exterior plywood chosen because the grout, when liquid, is water soluble. The tesserae adhesive used was Macco M-111 rubber base ceramic tile cement.

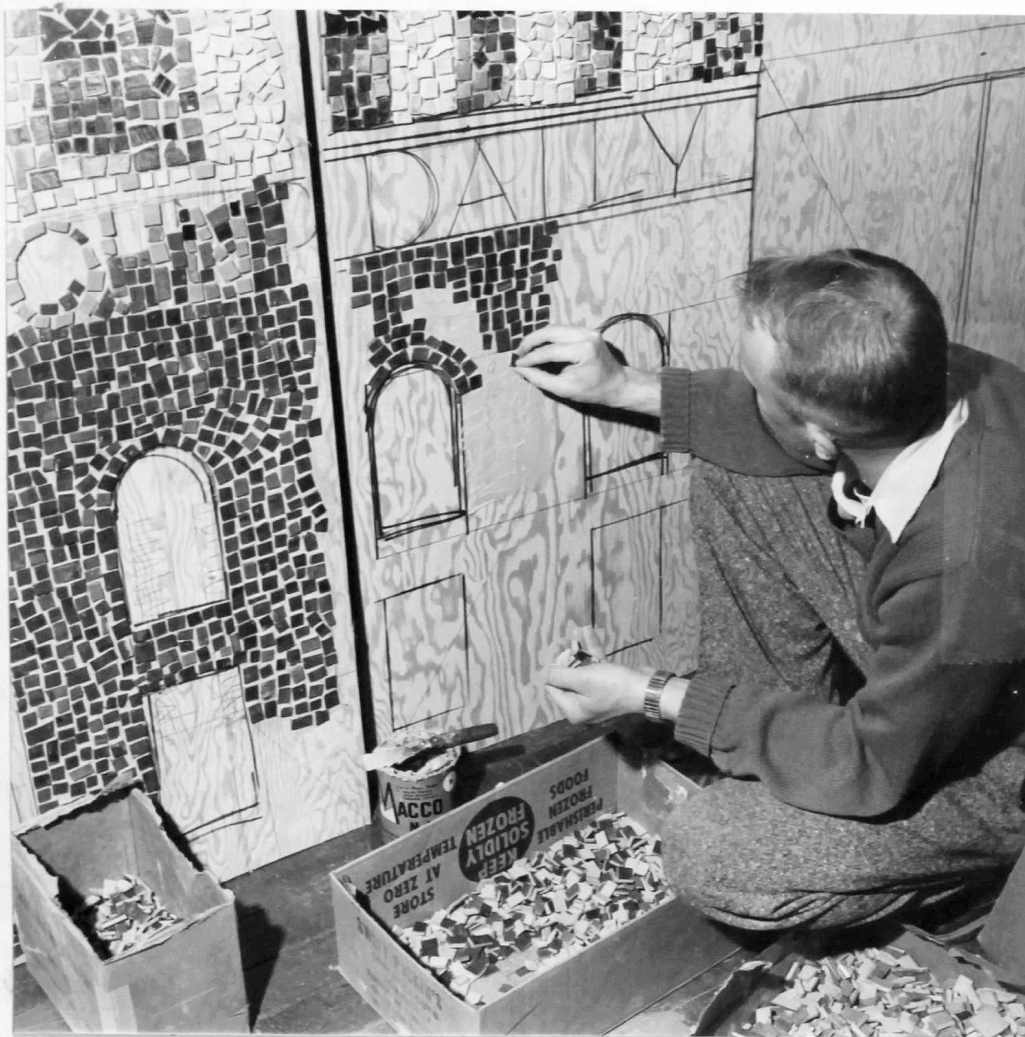
The mosaic is composed of 12 plywood panels, each 4' x 6'. Soft pencils, crayons, and felt tip pens were used for guide lines and the under drawing. A line heavy enough to be seen through the tile adhesive was all that was necessary.

After the drawing on the panel was completed, the tile adhesive was spread on with a small putty knife. Usually an area of two square feet was applied at one time. The tesserae were then applied by using the forefinger and thumb to press each piece into place.⁸

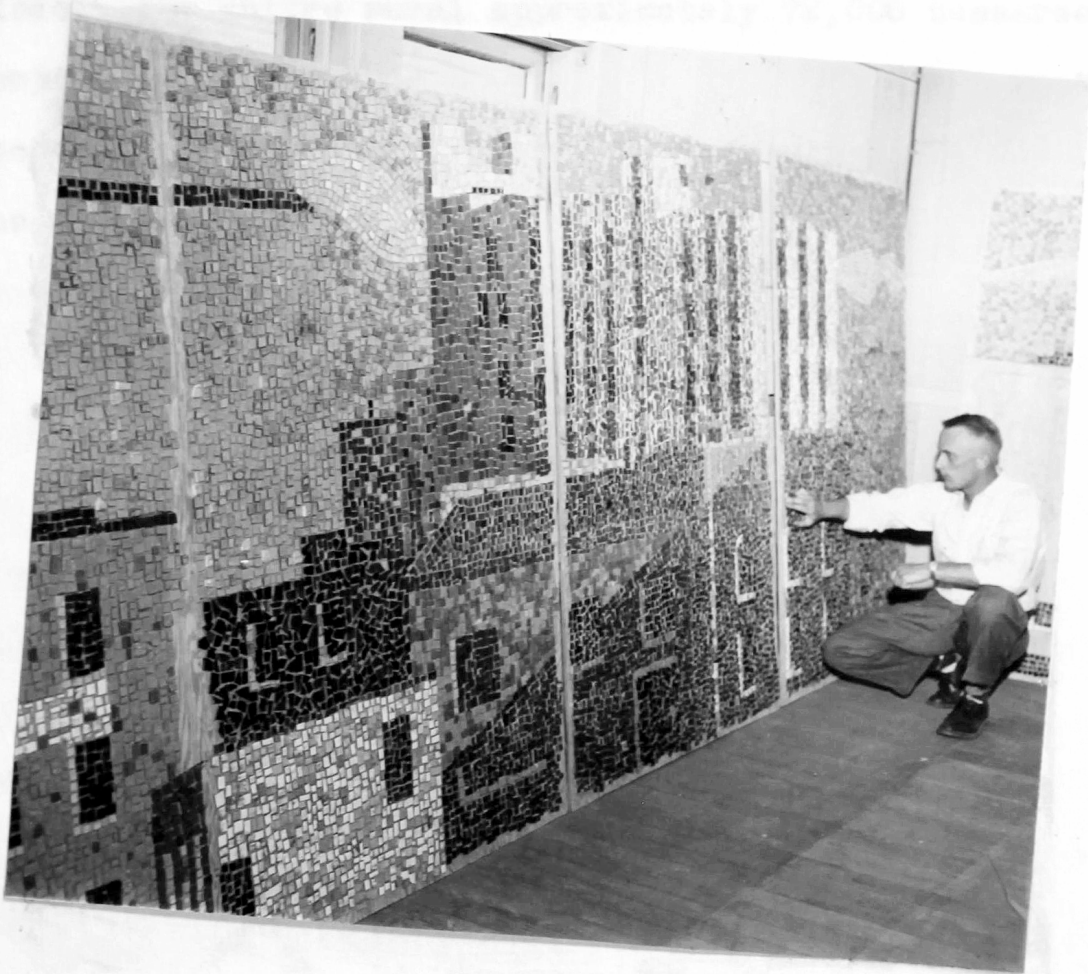
The two center panels were completed first, then alternating between right and left,⁹ panels were worked on until the ends of the mural were reached. This procedure was followed in case of a tesserae shortage, and/or a drastic change in color, texture, etc. However, no difficulty was encountered, with the exception of the value of the blue sky pieces. There is a slight variation in the value, causing the blues on the ends of the mural to

8. See page seventeen

9. See page eighteen.



The tesserae were set into a slow drying rubber base adhesive. The drawing is clearly seen through the adhesive.



The four center panels before grout was applied. Each area is a combination of colored tesserae, usually combined by their relationship in value, or to either warm or cool colors. Varying thickness of the tesserae give mural hand-laid charm.

be of a slightly darker value. This is not serious, as the sky's value is symmetrical.

Each of the twelve panels contains approximately 6,000 pieces, the entire mural approximately 72,000 tesserae. About twelve hours per panel was the average time to set the tesserae in place. Approximate time it took to complete the mural was 500 hours.

GROUTING

Before the panels were grouted, one coat of clear lacquer was sprayed onto the panels to eliminate the possibility of the grout sticking to any imperfectly glazed tesserae. This aided in the cleaning of the grouted panels.

The grout consisted of five parts portland cement to one part hydrated lime. In addition, $\frac{1}{2}$ part of graphite black powdered pigment was added to neutralize the color of the grout. Water was added to this mixture until it reached the consistency of thick cream. It was then spread and forced into the cracks between the tesserae with a plastic squeegee. After waiting an hour, the grout had dried sufficiently to clean. This was accomplished by using a stiff scrub brush, a putty knife, and wiping with rags. After the grout had dried overnight, the panel was cleaned with a weak solution of hydrochloric acid. Rubber gloves were worn during this operation.

MOUNTING THE MURAL

About two inches on the edge of each panel were left uncompleted for mounting the panels. After the panels were fastened in place with nails, the vacant areas were filled in with the appropriate tesserae and grouted. The grout was of a slightly heavier consistency than that used on the large areas since application here was on a vertical surface.

Carpenters from Maintenance completed the frame work (2x4 stringers), nailed the panels in place, and framed the mural with a beveled 2x4.

When all the panels were in place and the framing completed and the panels grouted, the mosaic surface was given a final cleaning with a weak acid solution and polished with soft cloths. The frame was then painted a soft peach color (harmonize with the adjacent west wall) with the lower edge painted a darker, duller value as the bevel reflected too much of the overhead lights. The mosaic mural was then completed.¹⁰

10. See page twenty two.



Work on the mural began in January, 1958, and was completed in August, 1958.

BIBLIOGRAPHY

Anthony, Edgar Waterman. Mosaics. Boston: P. Sargent, 1935.

A thorough book dealing with the historical aspects of mosaic work, continuing through contemporary mosaic work. Good background material.

Jenkins, Louisa. The Art of Making Mosaics. Princeton, New Jersey: P. Van Nostrand Company, Inc., 1957.

An excellent book concerned with procedures encountered while making mosaics. The book stresses contemporary mosaic work, with clear illustrations.

Bovini, Giuseppe. Mosaics (Ravenna Mosaics). Greenwich, Conn.: New York Graphic Society, 1956.

Superb illustrations of Ravenna Mosaics, in color, illustrating clearly how the early mosaicists used color, tesserae, and composition.

Anthony, Edgar Waterman. Mural Painting and Decoration. Princeton: Princeton University Press, 1951.

This publication stresses mural design and work on a large scale, with ideas, procedures, etc.

Bossert, Helmuth Theodore. Mural Painting and Decoration. London: Victor Gollancz, 1938.

Design and painting of murals, with historical background.

Nelson, Glenn C. Ceramic Reference Manual. Minneapolis, Minnesota: Burgess Publishing Company, 1957.

A brief, condensed summation of all technical material needed in ceramic work, with historical data in ceramics presented with contemporary ceramics. Equipment and suppliers are also listed. Excellent reference for ceramic work.

APPENDIX I

GLAZE FORMULAE

The following glaze formulae are designed to mature between Cone 06 and Cone 02, and were used exclusively in the design of the mosaic mural.

<u>White</u>	White Engobe	Clear Glaze
	Feldspar 25	White lead 195
	Ball clay 20	Flint 60
	Kaolin 20	Cornwall stone 45
	Flint 25	
	Whiting 5	
	Borax 5	
<u>Black</u>	Black Engobe (Barnard Clay)	Clear Glaze
	or: White lead 195	White lead 195
	Flint 60	Flint 60
	Cornwall stone 45	Cornwall stone 45
	Cobalt oxide 40	
<u>Blue</u>	White lead 195	Cobalt oxide is added in varying amounts depending on the shade or tint desired. A light blue would have 6 parts, a deep blue up to 36.
	Flint 60	
	Cornwall stone 45	
	tin oxide 24	
	Cobalt oxide 9	
<u>Yellow</u>	White lead 195	
	Flint 60	
	Cornwall stone 45	
	tin oxide 24	
	Naples Y. oxide 9 (or Antimony oxide) 24	
<u>Brown</u>	Clear Glaze	Over local "airport" clay this glaze creates a rich brown and can be varied by adding from 5% to 20% bar- nard clay to make shades.
	White lead 195	
	Flint 60	
	Cornwall stone 45	
<u>Turquoise</u>	White lead 195	
	Flint 60	
	Cornwall stone 45	
	1021 turquoise 12	(commercial: Van Howe, Denver)
	tin oxide 24	

Green

White lead	195
Flint	60
Cornwall stone	45
Chromium oxide	15
tin oxide	15

Grey-Green

Utilized all the scrap glaze, low-fire, that had accumulated in the ceramic department. Formula was unknown.

Red

No low-fire red formula was developed in the ceramic department. Powdered glaze ordered from Van Howe Ceramics, Denver, Colorado:

5 lbs.	68195	Camellia Pink
1 lbs.	6881	Bridal Rose
2 lbs.	68121	Opaque White

Miscellaneous glazes

Small amounts of commercial glazes that were on hand whose use were being discontinued were utilized, primarily Amaco Art Glazes. Examples:

E-30	Maroon brown
UG 350	Red or ox blood
UG 353	Lilac
UG 352	Violet

APPENDIX II

List of Materials

- 800 pounds local "airport" clay
- 10 pounds white lead
- 4 pounds flint
- 3 pounds flint
- 1 pound barnard clay
- 50 pounds Kentucky ball clay
- small amounts of: Kaolin, Whiting, Borax, Cobalt oxide, Tin oxide, Naples yellow oxide, Antimony oxide, Turquoise oxide, and chromium oxide.
- commercial glazes: Van Howe supply #68195, 6881, 68121; Amaco supply # E-30, UG 350, UG 352, UG 353
- 20 mesh screen
- 5 pounds barium carbonate
- washing machine (clay mixer)
- clay cutter
- pointed knife
- kiln shelves
- kiln
- 2" brush
- pyrometric cones (04 03)
- shovel
- cardboard boxes (30)
- transonite board (2' x 4')
- plaster vats (4)
- kiln stilts (160)
- mixing jars
- yardstick
- felt pen, crayons, soft pencils
- putty knife
- spray gun and compressor
- newspapers
- 300 pounds portland cement
- 50 pounds hydrated lime
- 10 pounds black graphite pigment
- 12 4x6 plywood $\frac{1}{2}$ " exterior panels
- 15 quarts Macco M-111 cement adhesive
- 2 quarts clear lacquer
- 1 quart lacquer thinner
- rubber gloves
- rubber and plastic spatulae
- 2 scrub brushes
- 1 gallon hydrochloric acid
- rags
- stepladder
- wash pan (mixer)
- 20 gallon container (grout mixing)

APPENDIX III

Cost of Materials

12	plywood panels	\$76.80
15	quarts Macco M-111	28.50
8	pounds commercial glaze	11.80
	Supplementary photographs	15.00
	Ceramic fees	10.00
2	bristle scrub brushes	1.00
300	pounds portland cement	5.37
50	pounds hydrated lime	1.35
10	pounds graphite black pigment	1.00
2	putty knives	.78
2	quarts clear lacquer	3.20
1	gallon lacquer thinner	1.50
	Rubber gloves	.79
	Plastic spatula	.10
	Rubber spatula	.15
	Illustration boards, tempera	2.00
1	gallon hydrochloric acid	.50
		<hr/>
	Total material cost	159.84