OFFICE OF NAVAL RESEARCH
WESTERN REGIONAL OFFICE
PASADENA

Supplement to
Arabian Sea Project of 1980
Composites of Infrared Images
ONRWEST Report 81-5SUP

Cover: Infrared (3.55 to 3.53 μm) image of the Gulf of Oman, Arabian Sea, obtained by NOAA-6 Satellite on 30 May 1980 and enhanced in the Scripps Institution of Oceanography Remote Sensing Facility.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

(12)

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19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Infrared Imagery
Arabian Sea
Remote Sensing

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

A technique was developed for determining the mesoscale features of the Arabian Sea, and reported on in ONRWEST Report 81-3. A method for assembling composites of images in mosaic form is presented. Enhanced images are presented with surface interpretations for the spring and fall transition periods related to the Northeast and Southwest Monsoons, respectively.

This supplement to ONRWEST Report 81-5 provides larger images for Figures 36 through 45.

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ONRWEST 81-5SUP

SUPPLEMENT TO ARABIAN SEA PROJECT OF 1980--COMPOSITES OF INFRARED IMAGES

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and
Mr. Robert Whritner, Scripps Institution of Oceanography.

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Western Regional Office
1030 East Green Street
Pasadena, CA 91106

December 1981

APPROVED:

LEWIS LARMORE
Scientific Director

EXPLANATION

It became apparent, by feedback from the distribution of ONRWEST Report 81-5, that the composites of infrared images of the Arabian Sea should be reproduced in a larger size. The larger size permits some improvement in spatial details. Also, an effort has been made to improve the contrast in grey shades representing the ocean features, which were the subject of the original report. Figures 1 and 36 through 45 of ONRWEST Report 81-5 are reproduced herein.

The reader is referred to ONRWEST Report 81-5 for explanations of the data contained herein.

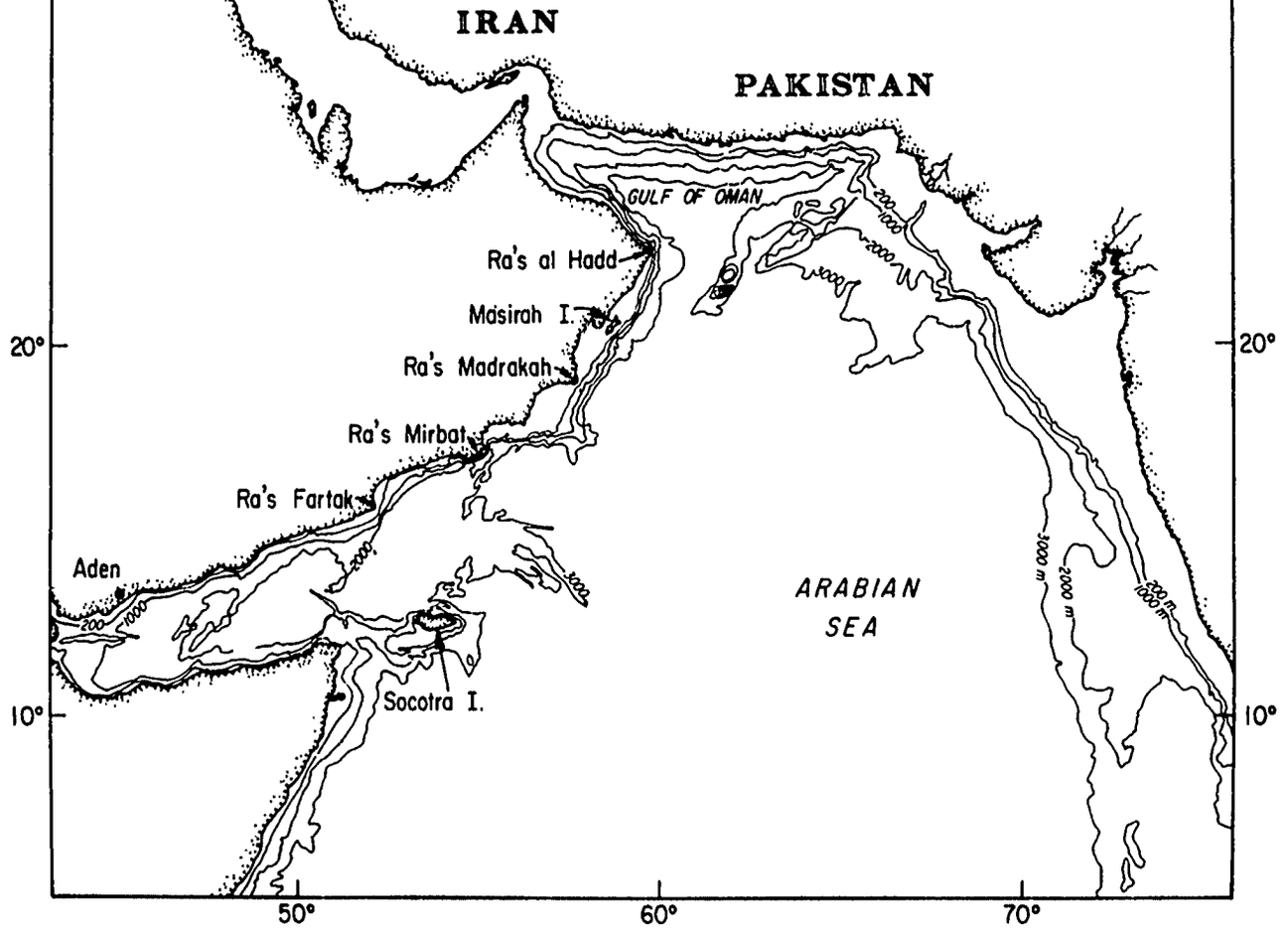
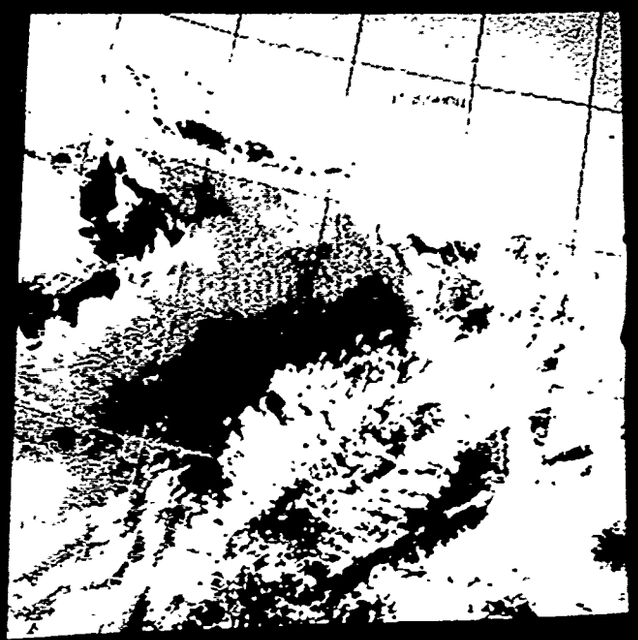
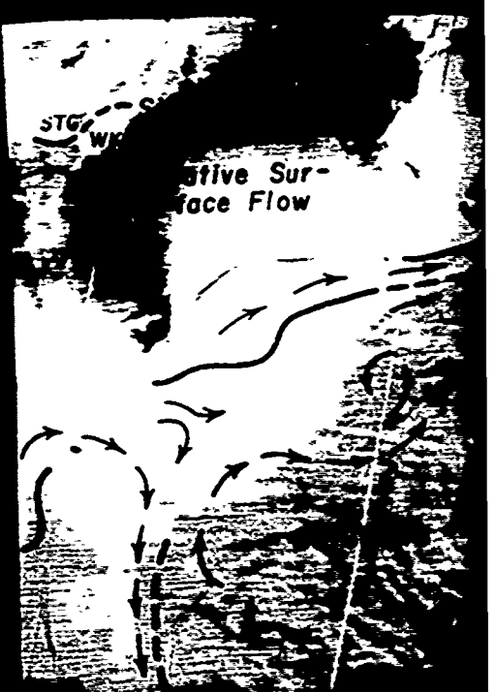


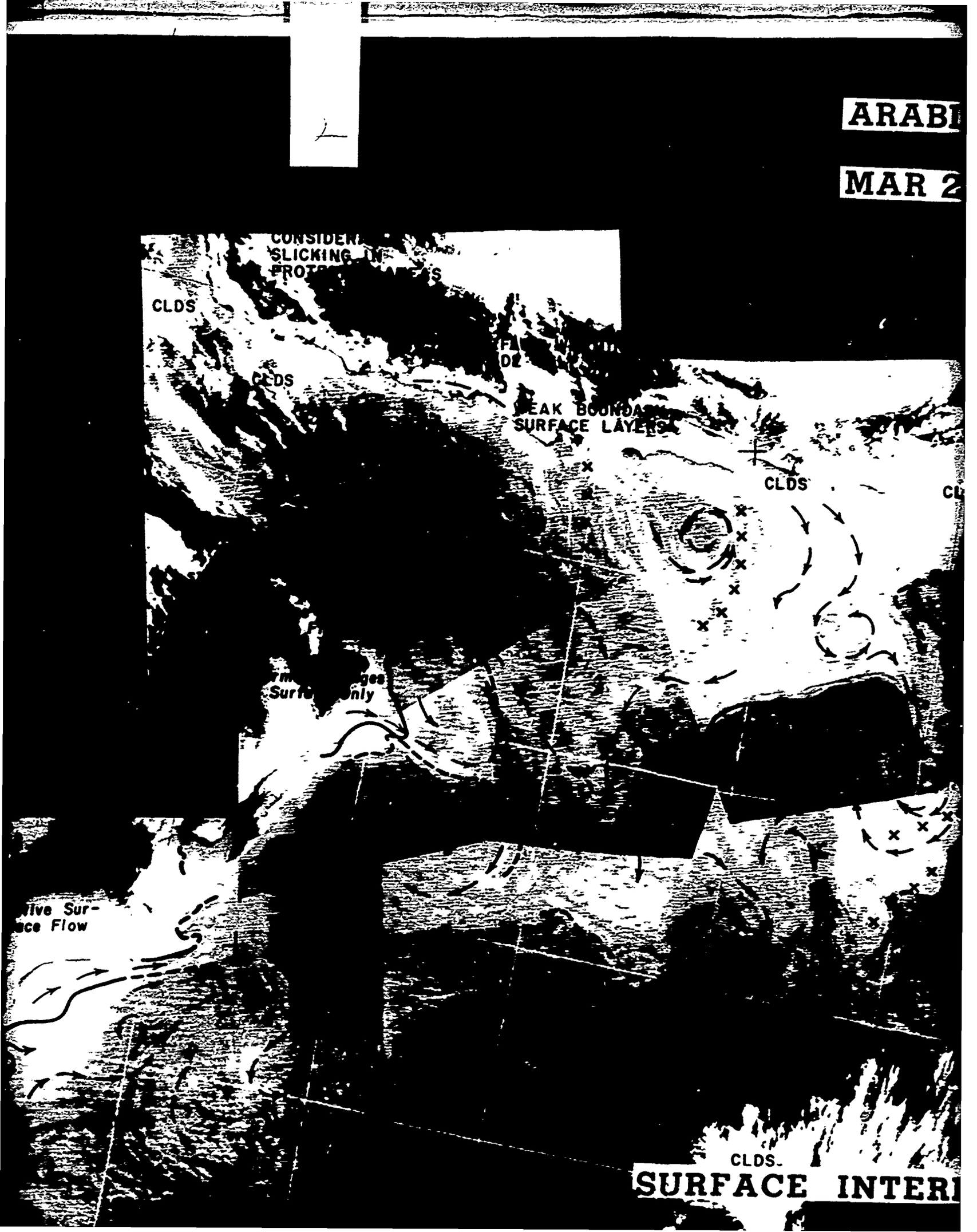
Figure 1. Map of Arabian Sea.

The Arabian Sea is bounded on the west by the Arabian Peninsula, on the north by the coasts of Iran and Pakistan, and on the east by the coast of India. Bathymetry is provided down to 3000 meters to illustrate the rapid fall-off of the shelf in some areas. The Oman Basin is partially closed by the Murray Ridge with an opening to the Arabian Sea near the Arabian Coast.



SATELLITE VIEW

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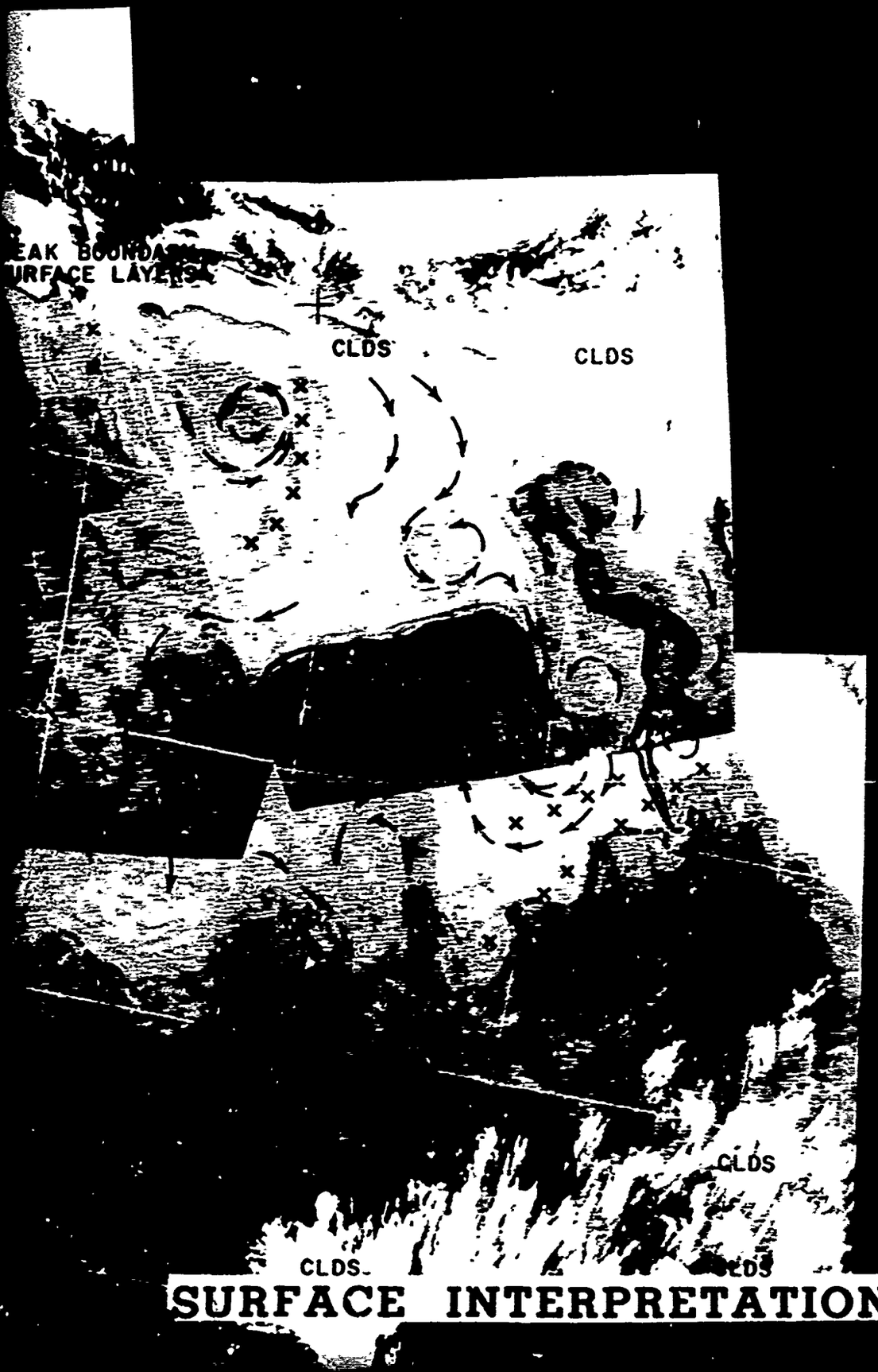
SURFACE INTERI

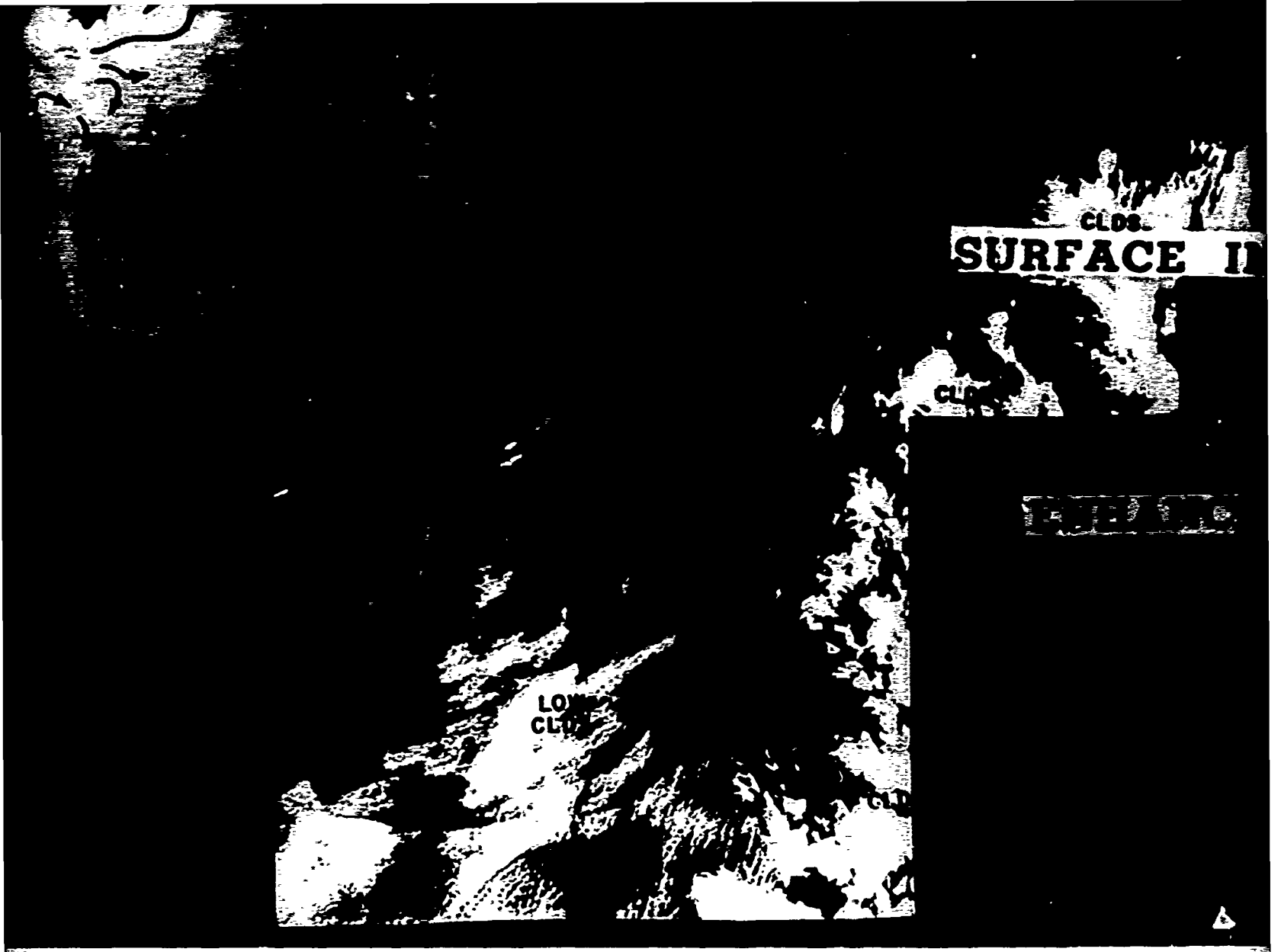
ARABIAN SEA

MAR 28, 1980

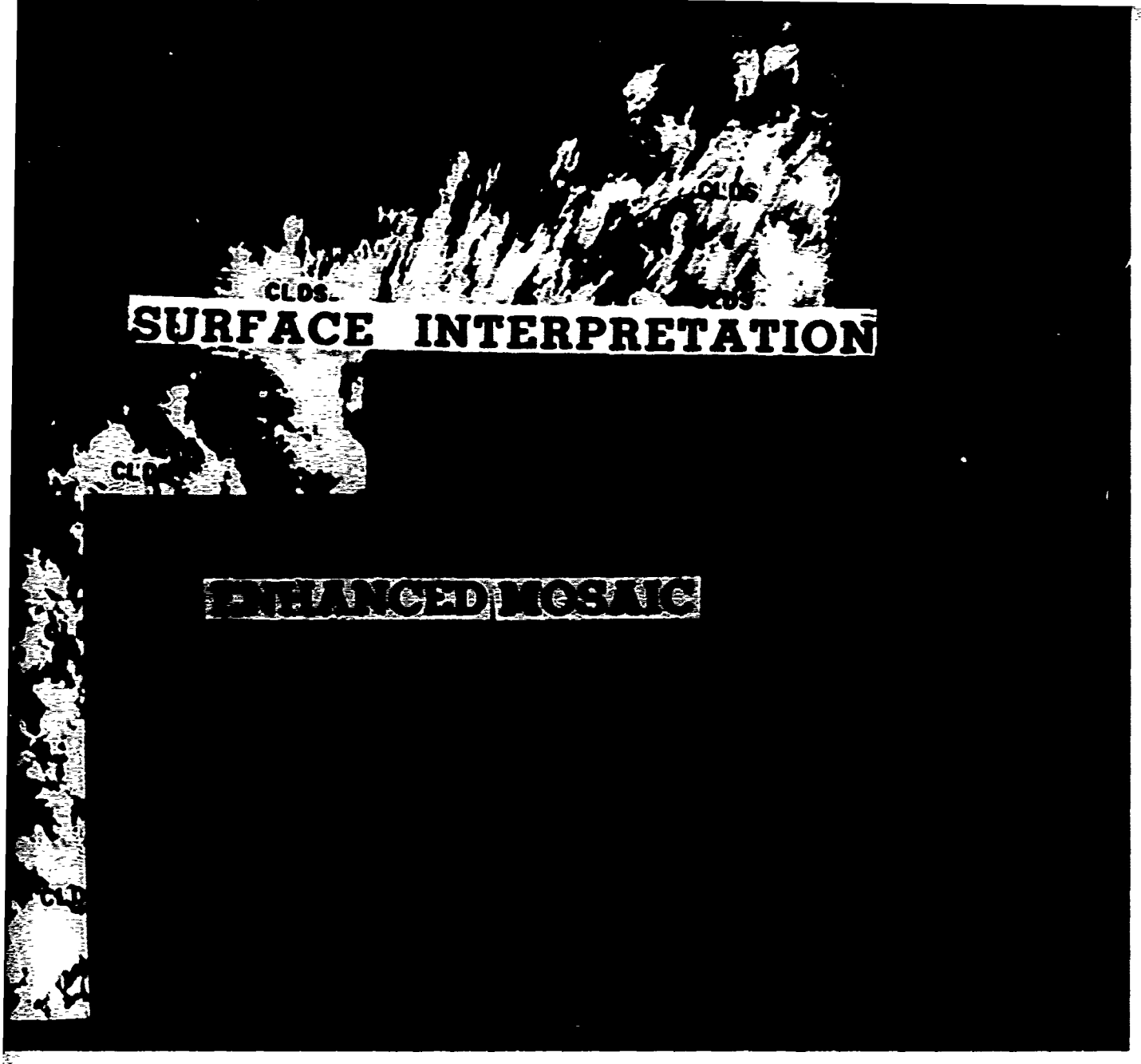


SURFACE INTERPRETATION

4



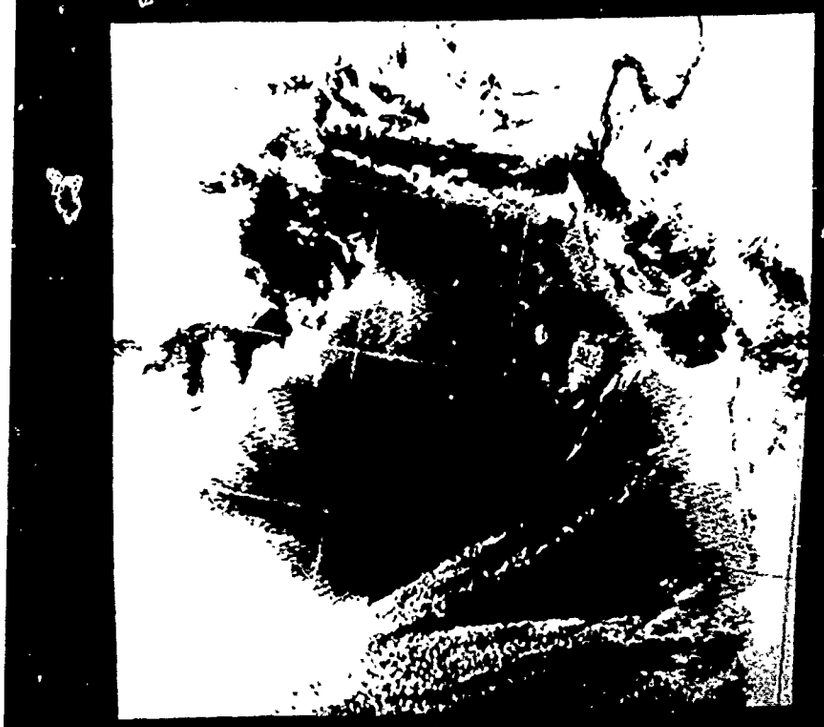
5'



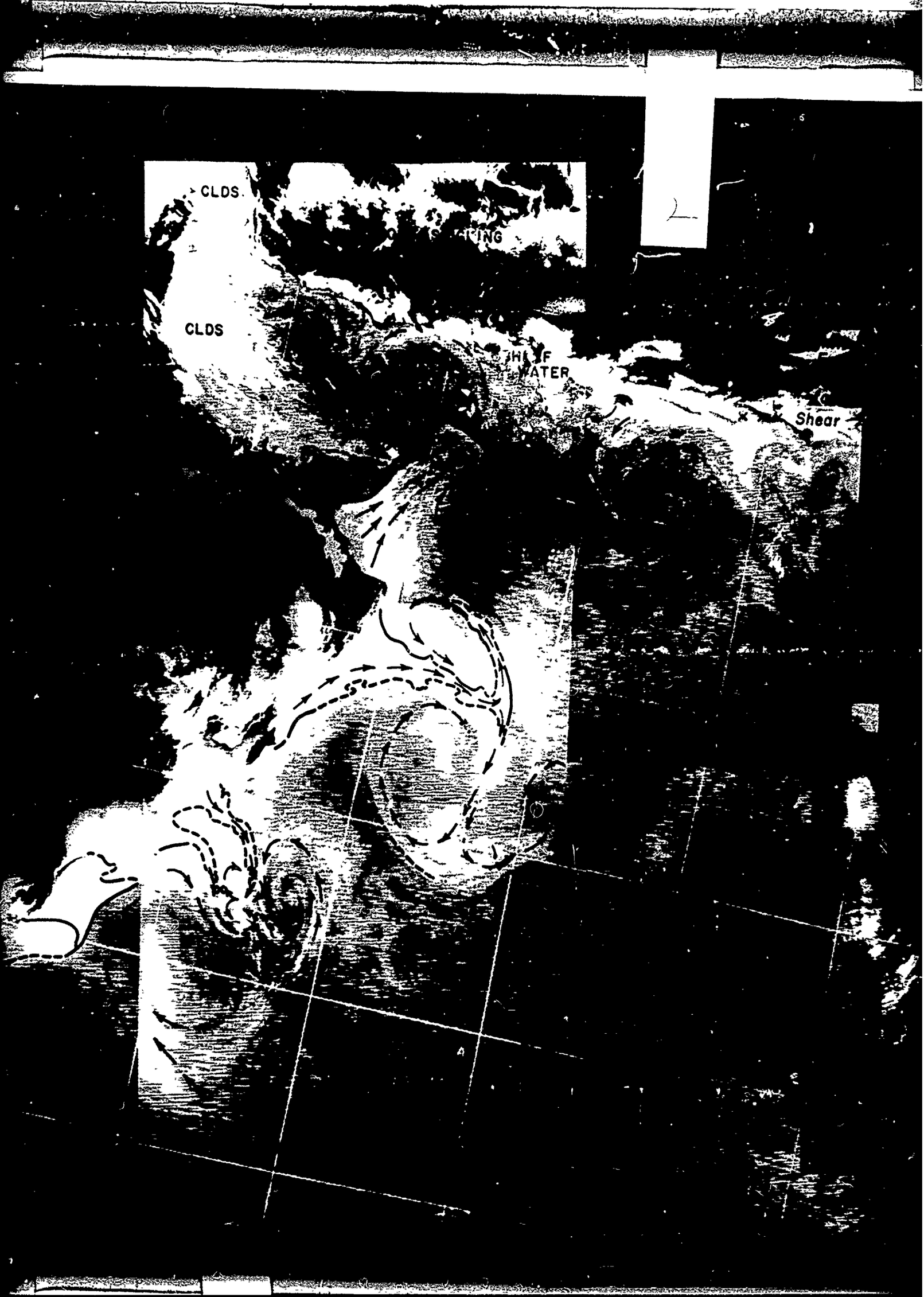
6

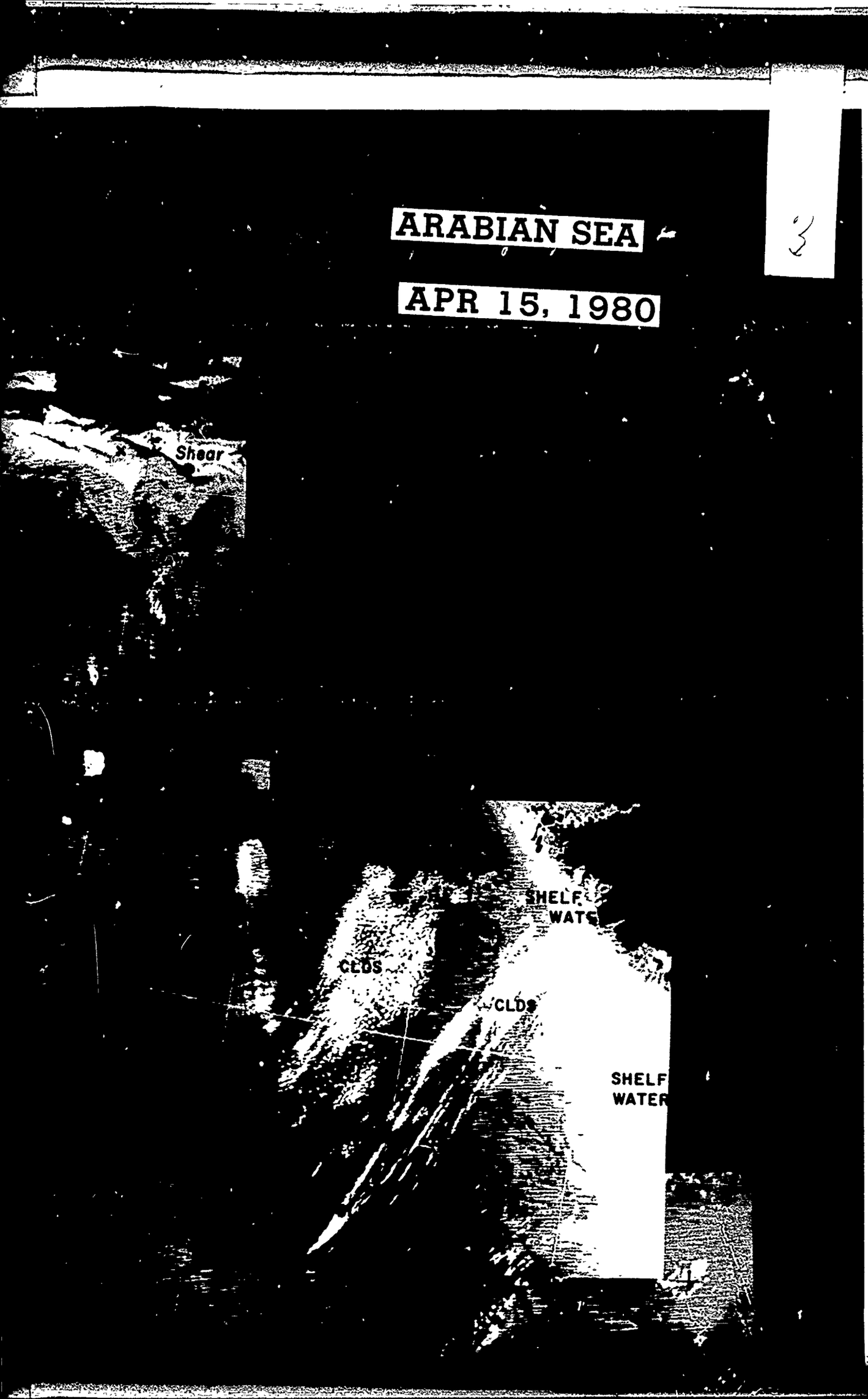
Figure 36. Arabian Sea Mosaic with Interpretation, 28 March 1980.

The composite of enhanced images shown in Figure 26 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. Shear flow is indicated by a [illegible] of "x's". Slicking from daytime heating appears [illegible]re there has been little surface mixing.



SATELLITE VIEW


CLDS
CLDS
Shear


ARABIAN SEA
APR 15, 1980
3
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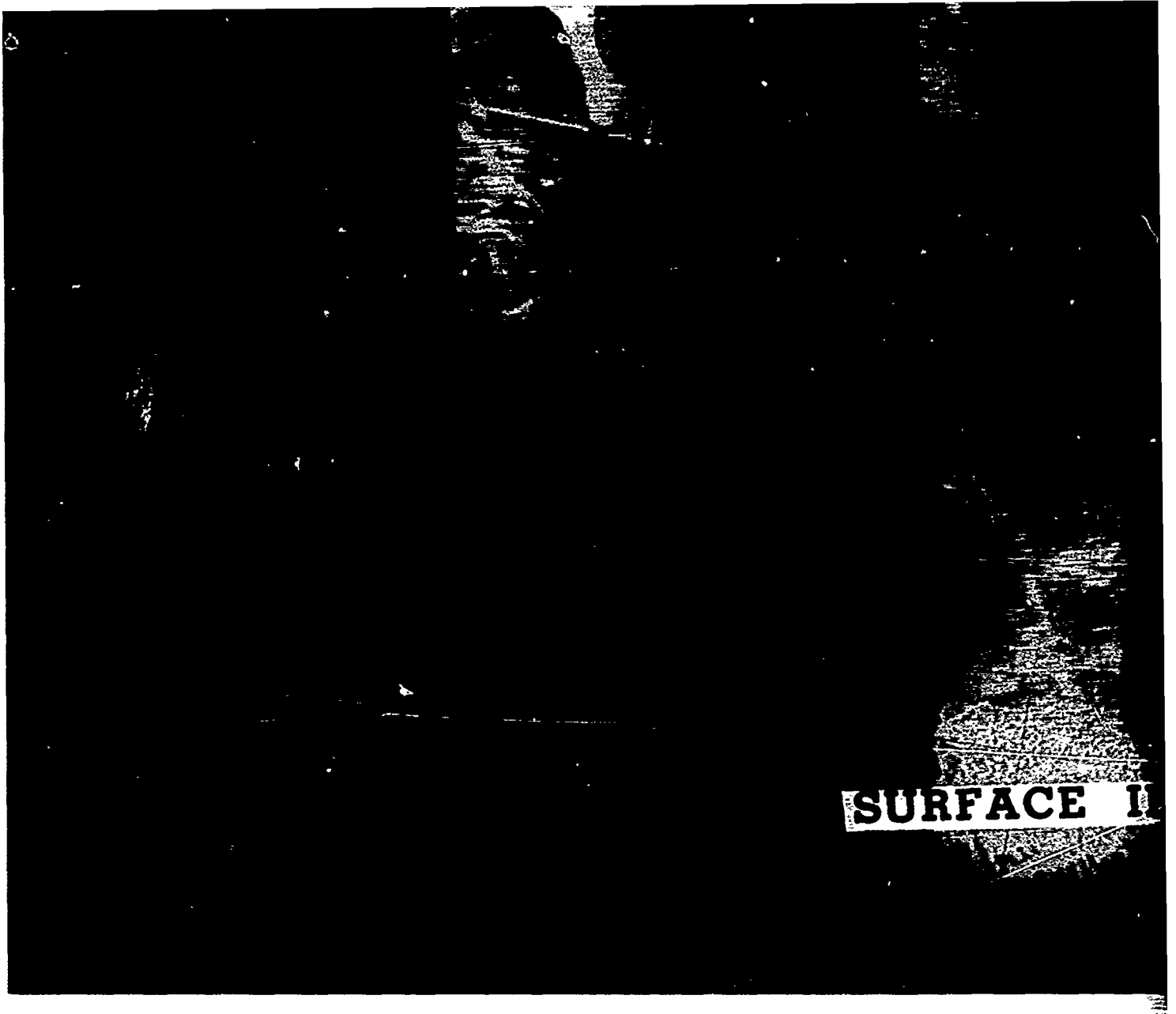
SHELF
WATS
CLDS
CLDS
SHELF
WATER



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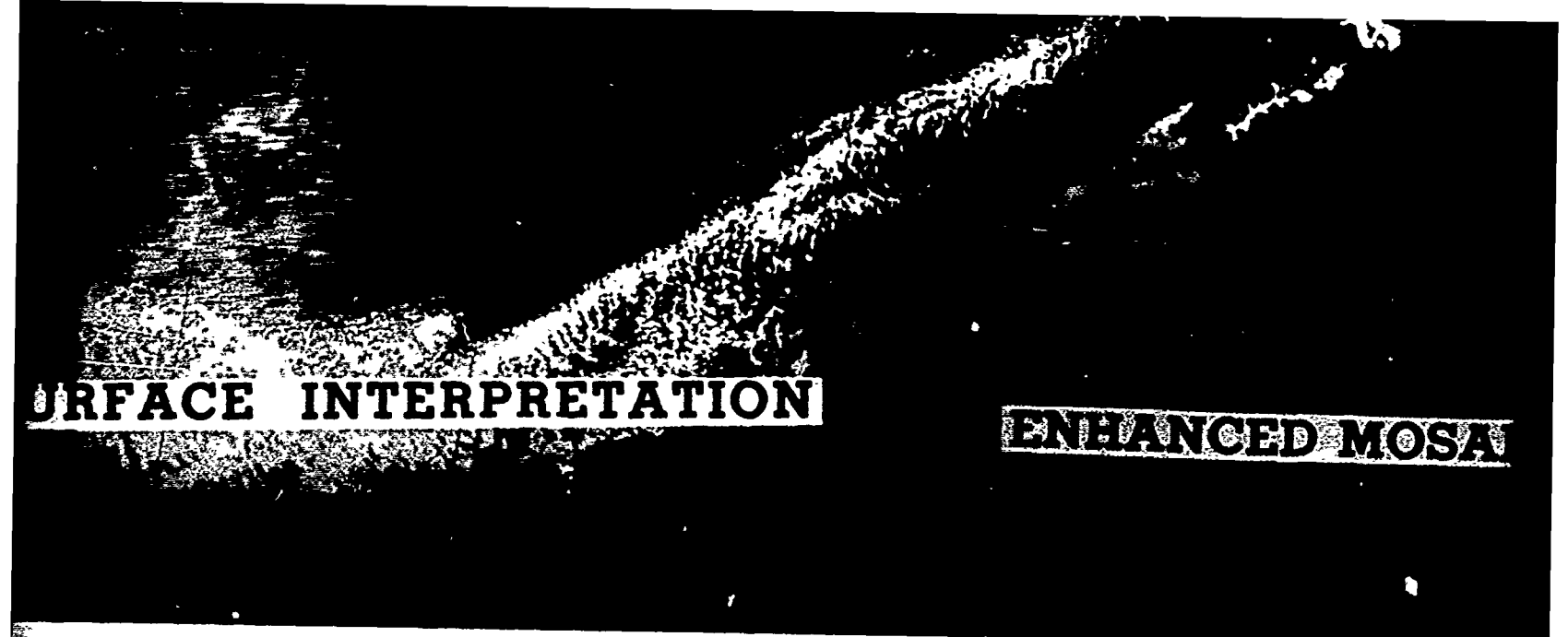

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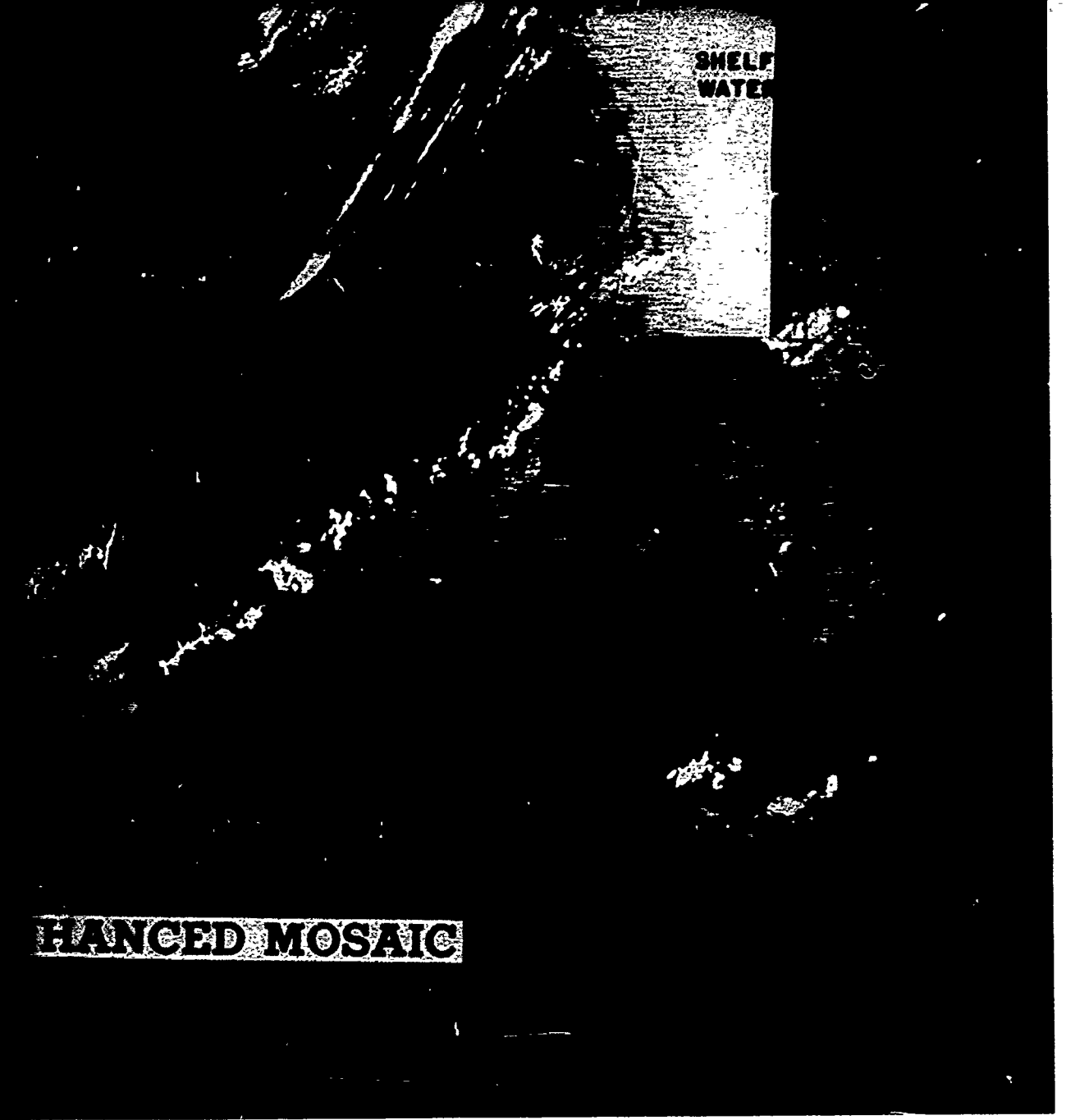
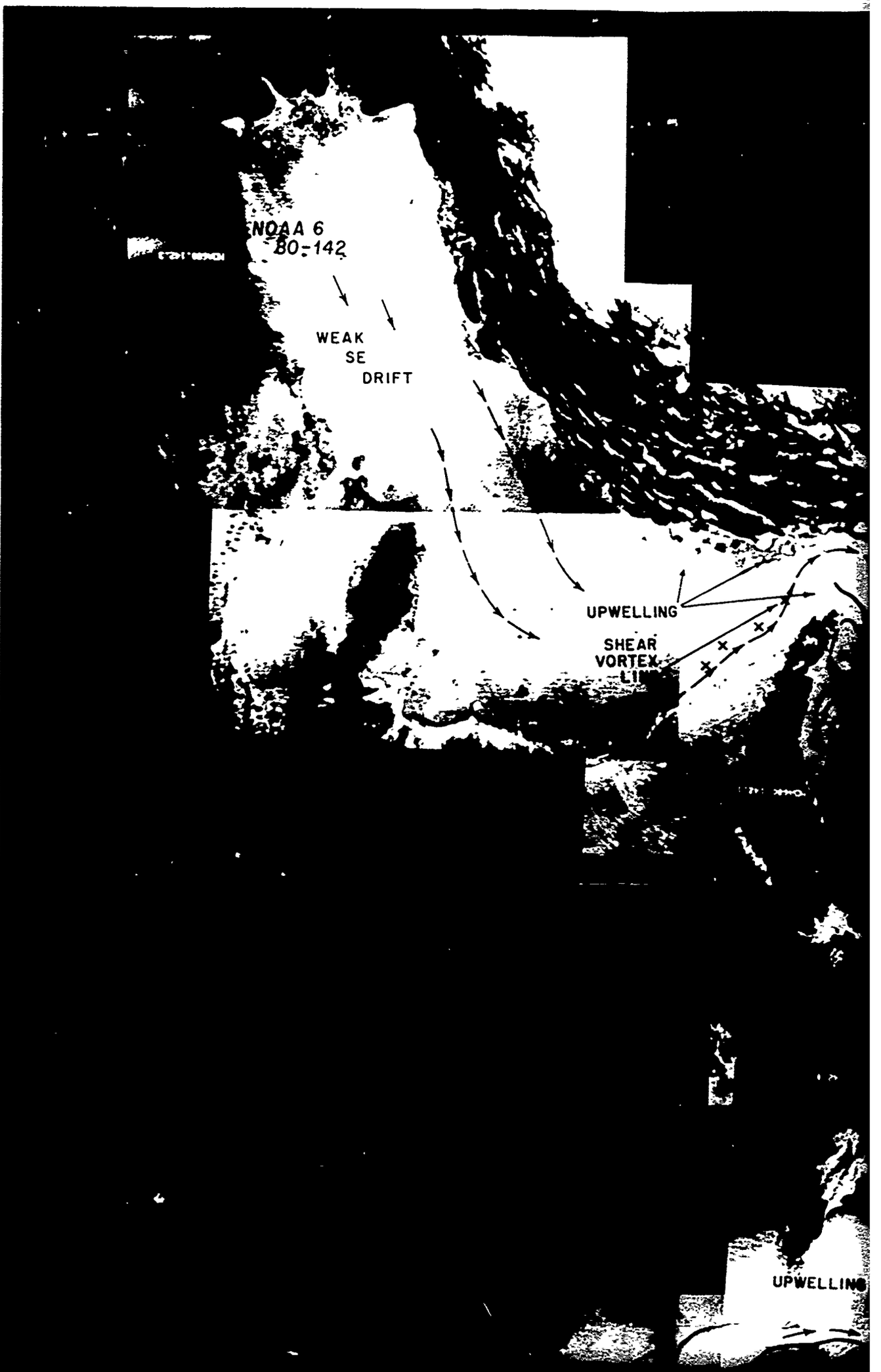

SHELF
WATE
HANCED MOSAIC

Figure 37. Arabian Sea Mosaic with Interpretation, 15 April 1980.

The composite of enhanced images shown in Figure 27 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. (A poor alignment of lines indicating fronts occurred in the printing process.)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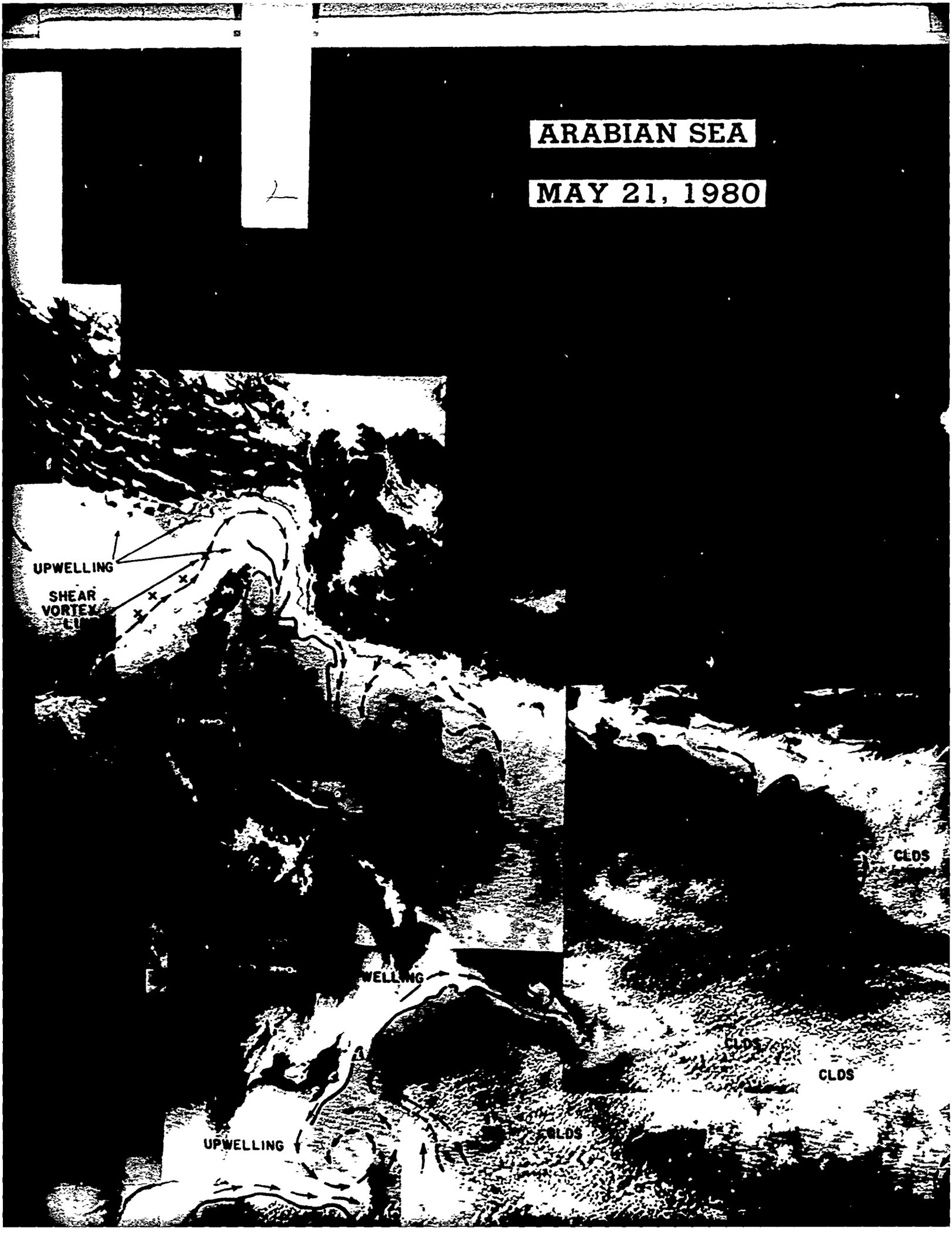
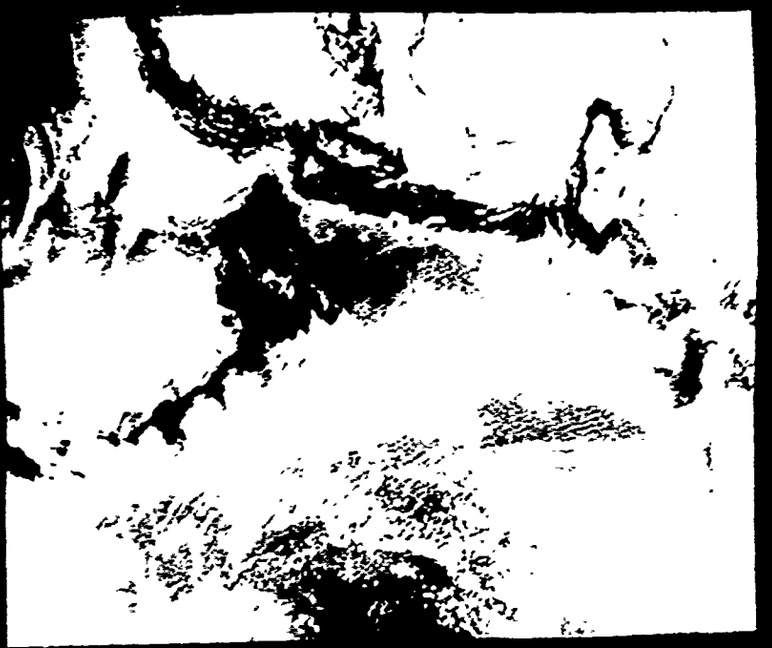
UPWELLING
SHEAR
VORTEX
UPWELLING

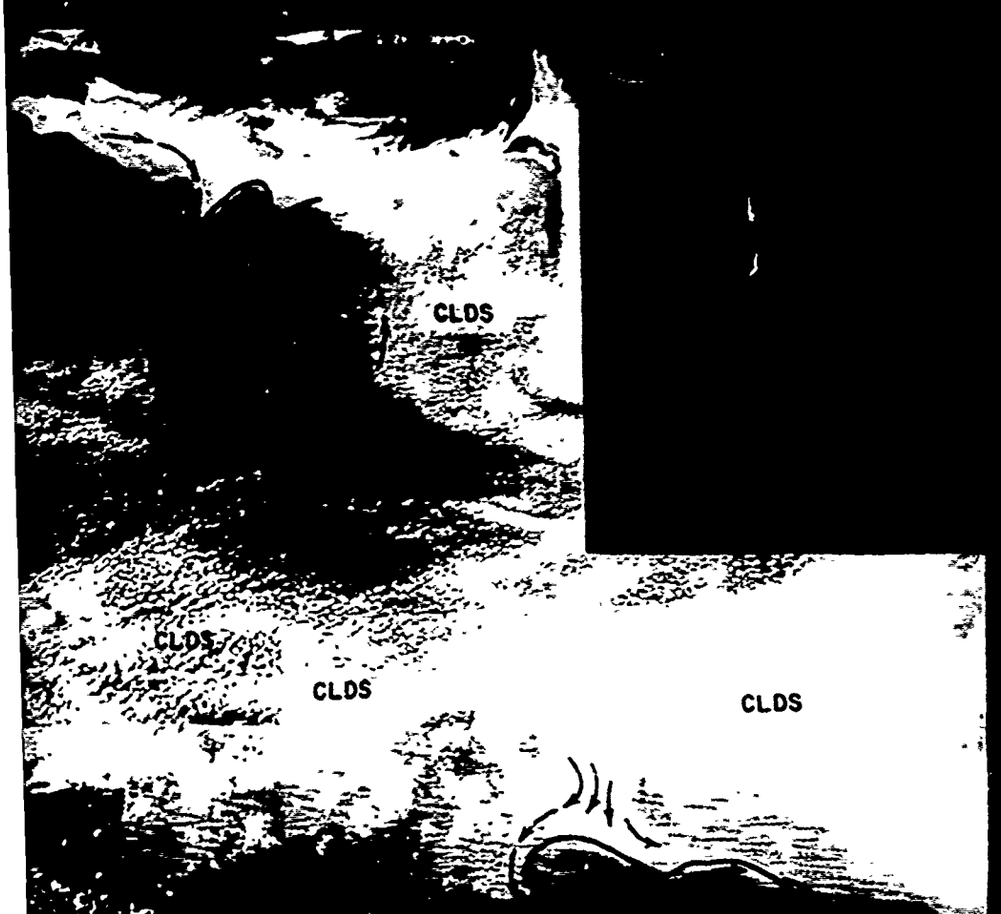

ARABIAN SEA
MAY 21, 1980
UPWELLING
SHEAR
VORTEX
CLDS
CLDS
CLDS
CLDS
UPWELLING

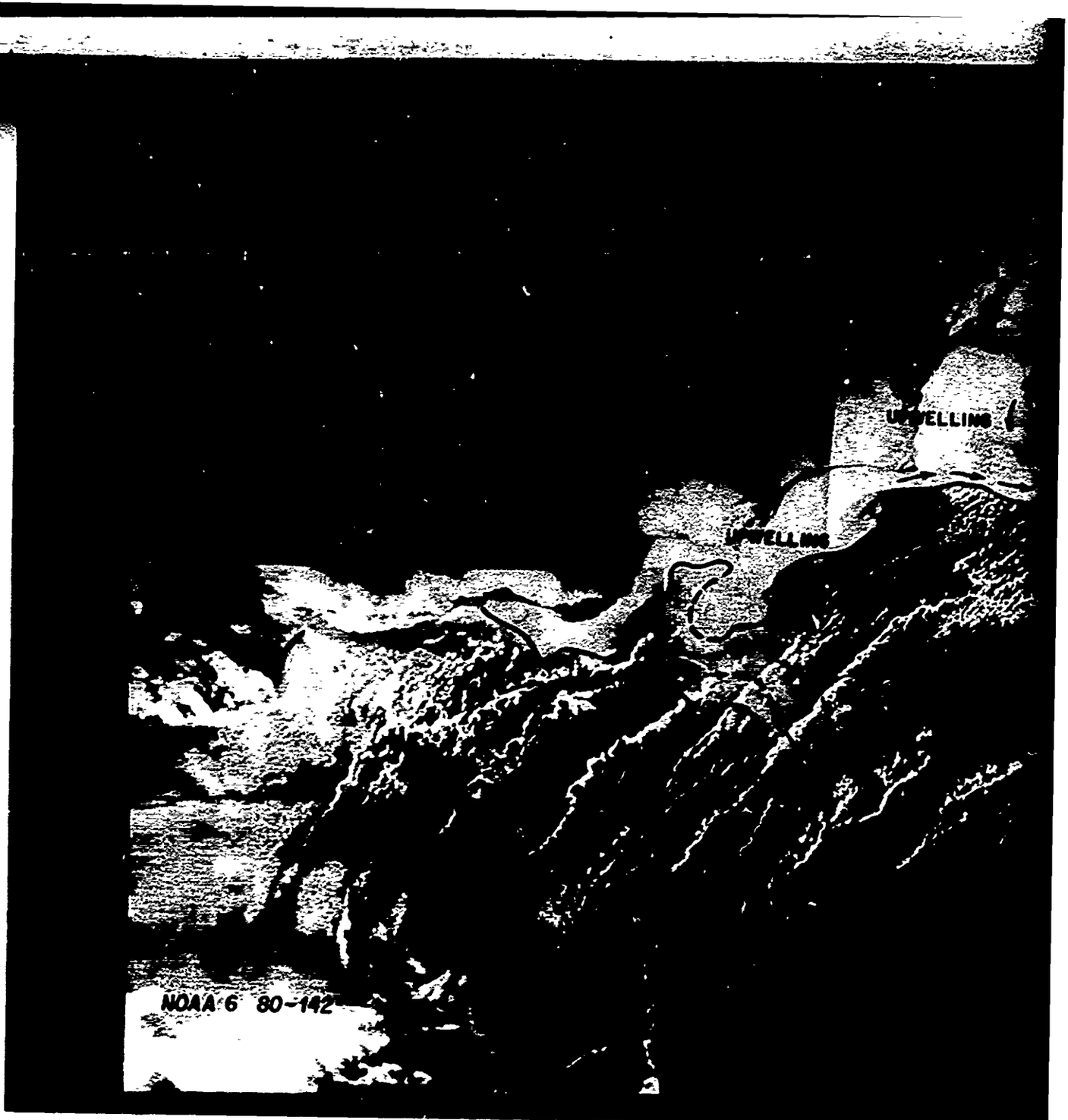
AN SEA

1, 1980



SATELLITE VIEW





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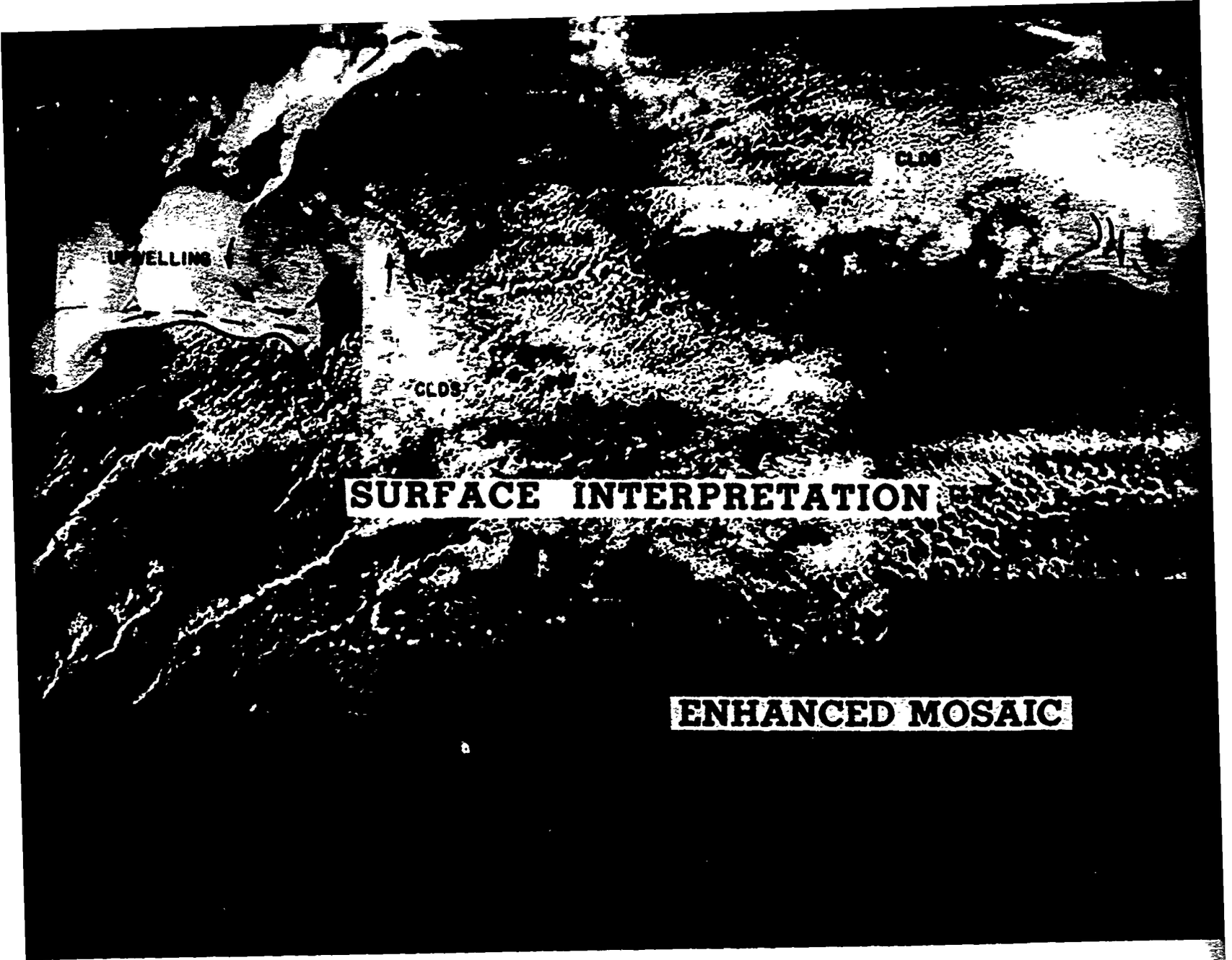
CLDS
UPWELLING
CLDS
SURFACE INTERPRETATION
ENHANCED MOSAIC

5

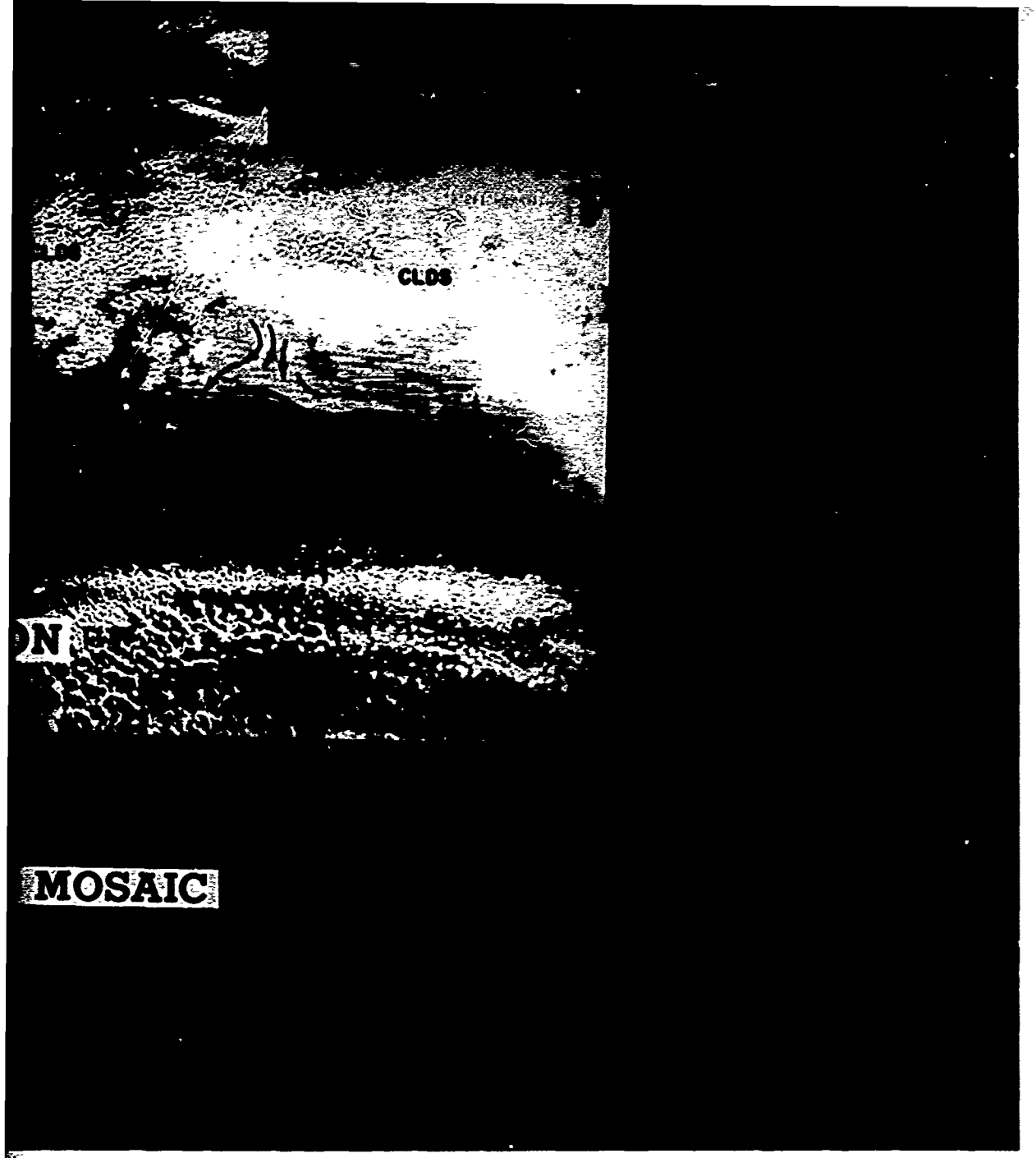

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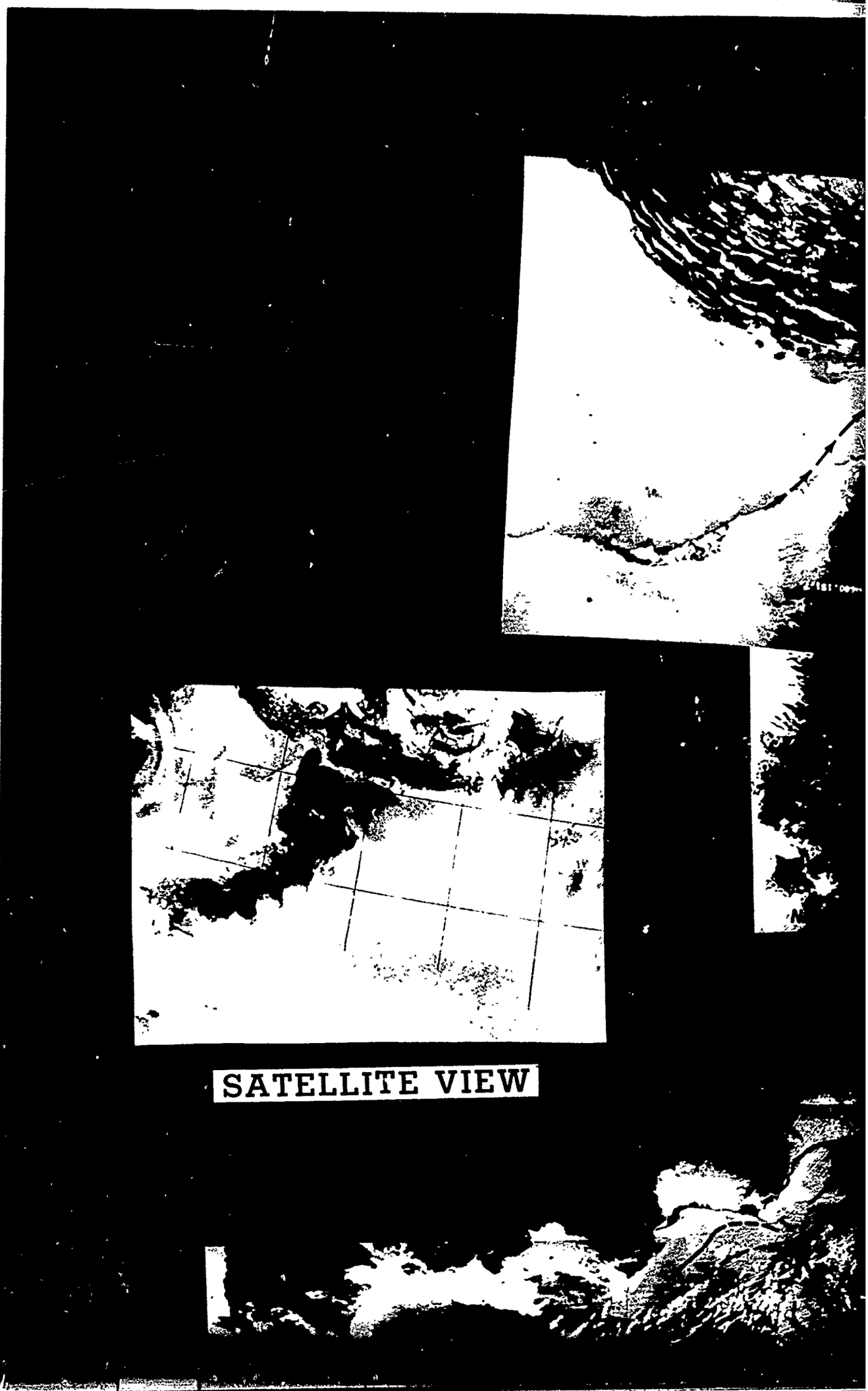
Figure 38. Arabian Sea Mosaic with Interpretation, 21 May 1980.

The composite of enhanced images shown in Figure 28 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. Shear flow is indicated by a row of "x's". Upwelling regions are designated.

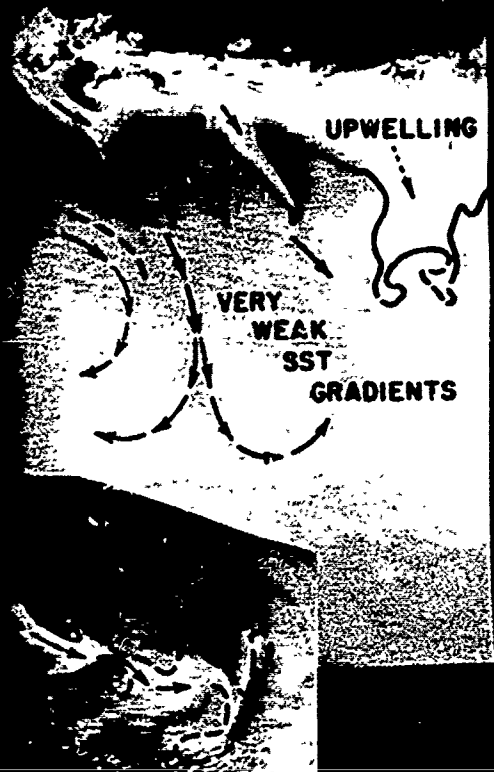


SATELLITE VIEW


ARABIAN SEA
MAY 30, 1980
UPWELLING
VERY WEAK SST GRADIENTS
UPWELLING
UPWELLING
SURFACE INTERPRETATION

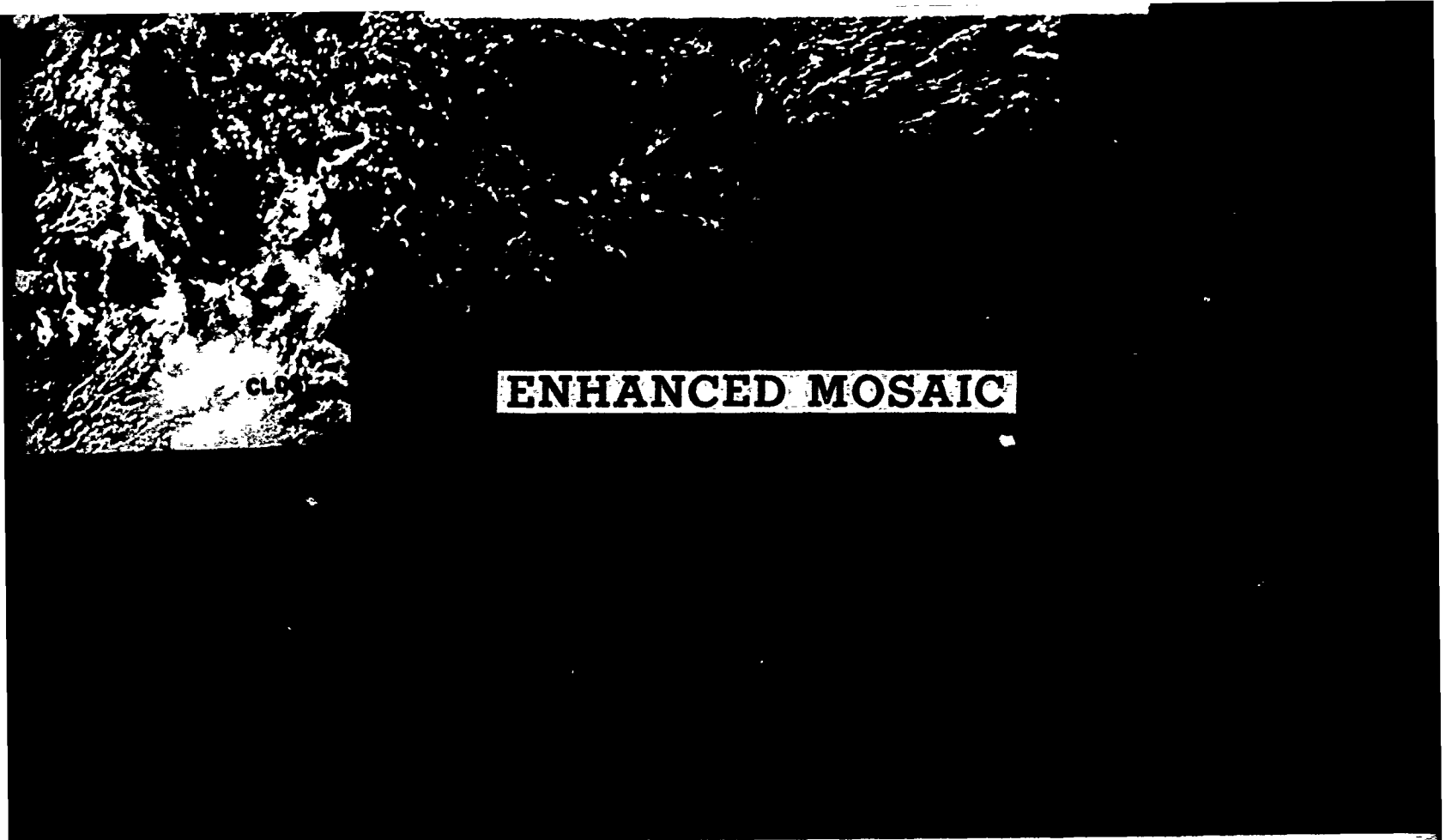
RABIAN SEA

AY 30, 1980



SATELLITE VIEW

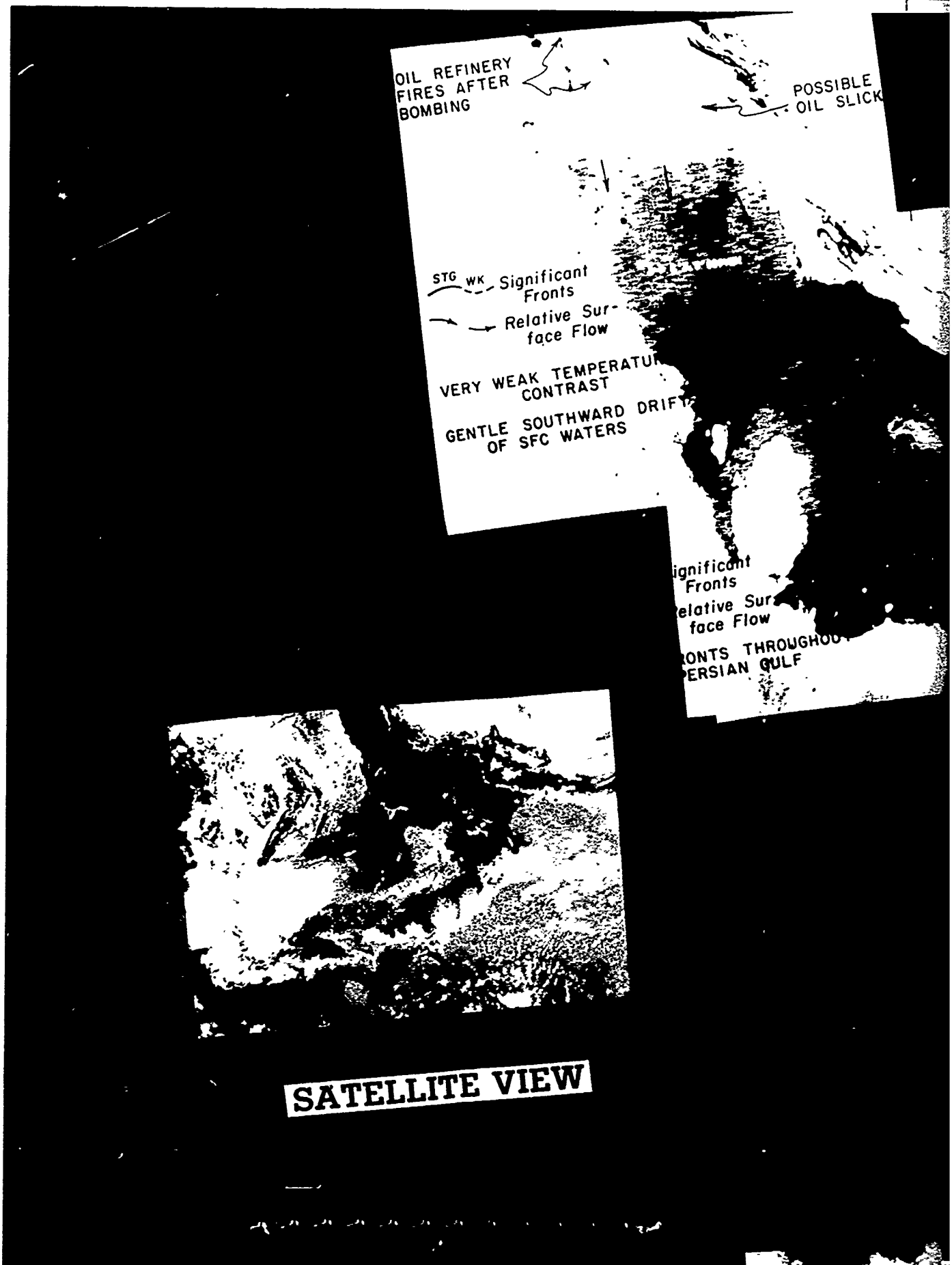
4

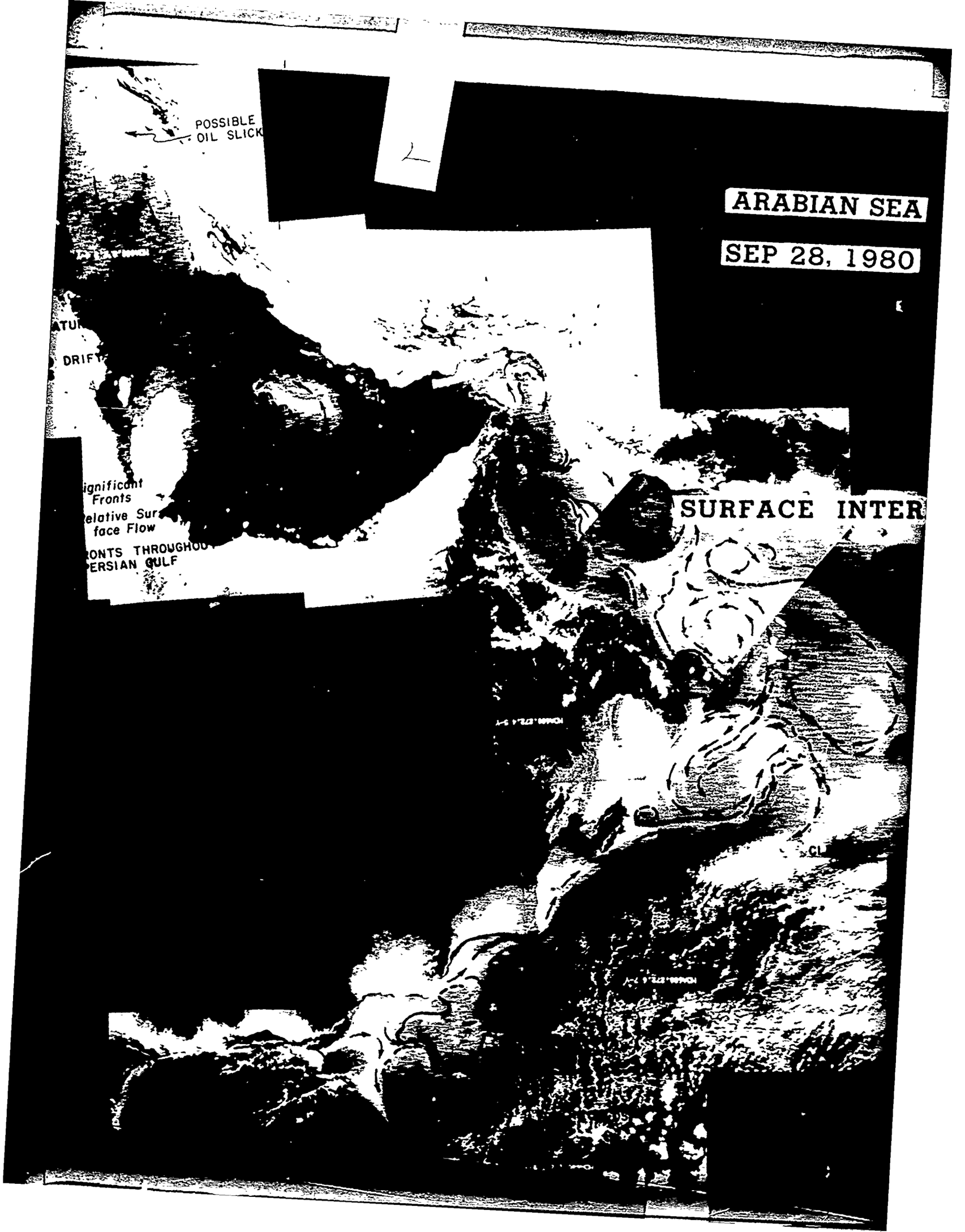


5

Figure 39. Arabian Sea Mosaic with Interpretation, 30 May 1980.

The composite of enhanced images shown in Figure 29 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. Shear flow is indicated by a row of "x's". Upwelling is designated. (A poor alignment of lines indicating fronts occurred in the printing process.)


OIL REFINERY FIRES AFTER BOMBING
POSSIBLE OIL SLICK
STG WK Significant Fronts
Relative Surface Flow
VERY WEAK TEMPERATU CONTRAST
GENTLE SOUTHWARD DRIFT OF SFC WATERS
ignificant Fronts
elative Sur face Flow
ONTS THROUGHOU
ERSIAN GULF
SATELLITE VIEW


POSSIBLE
OIL SLICK
ARABIAN SEA
SEP 28, 1980
SURFACE INTER
ignificant
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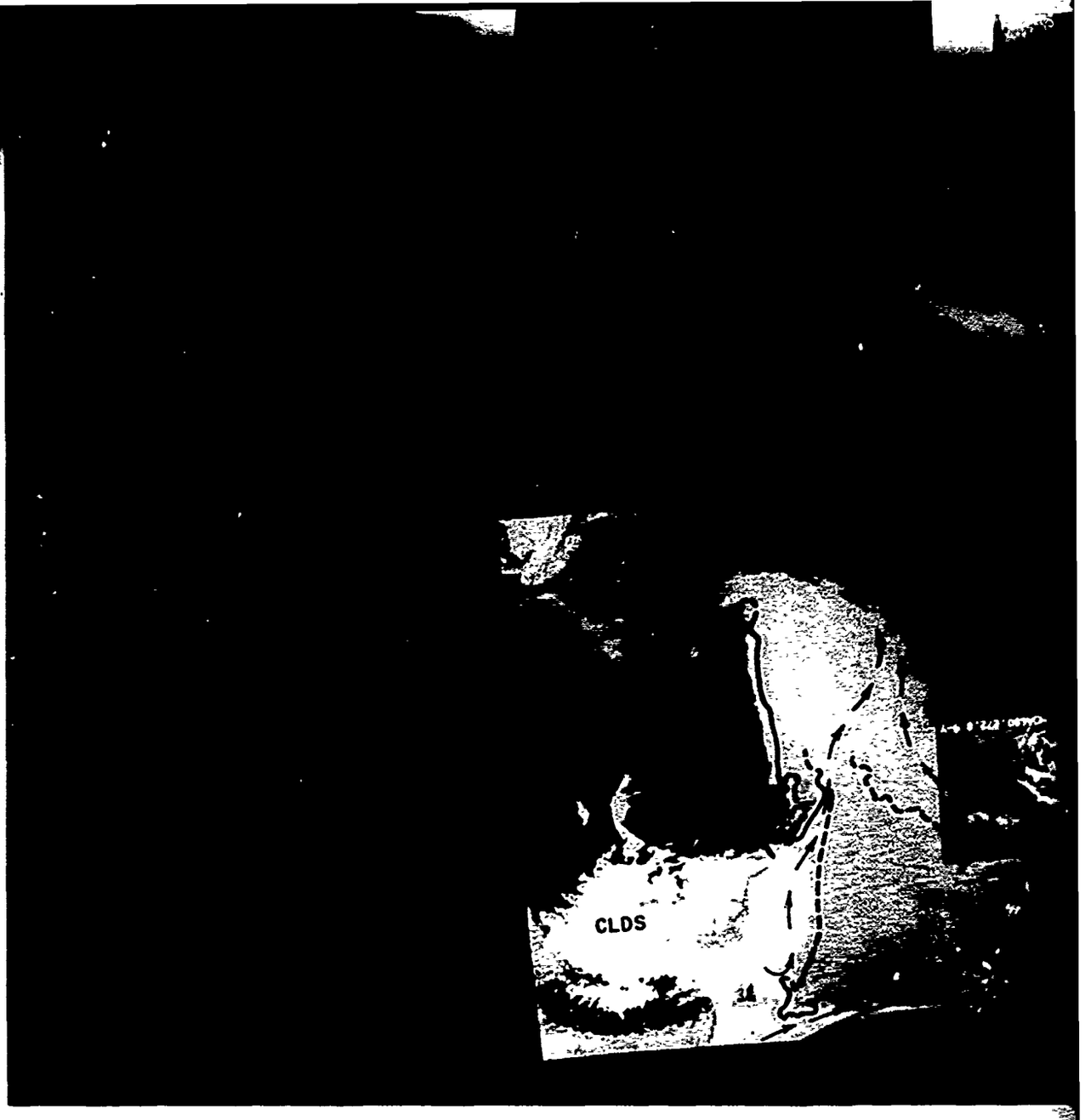
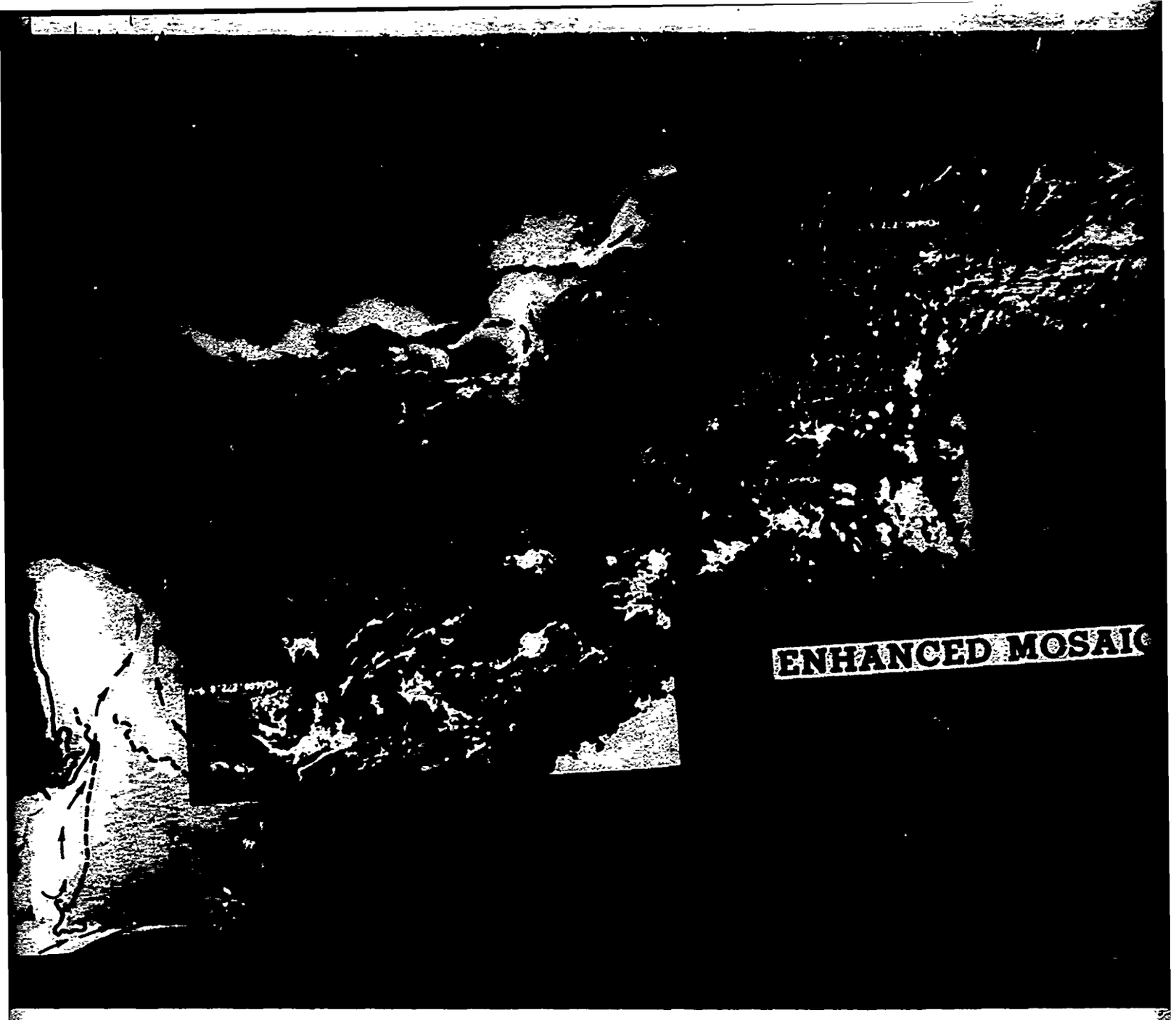
face Flow
ONTS THROUGHOU
ERSIAN GULF

ARABIAN SEA

SEP 28, 1980

SURFACE INTERPRETATION


CLDS



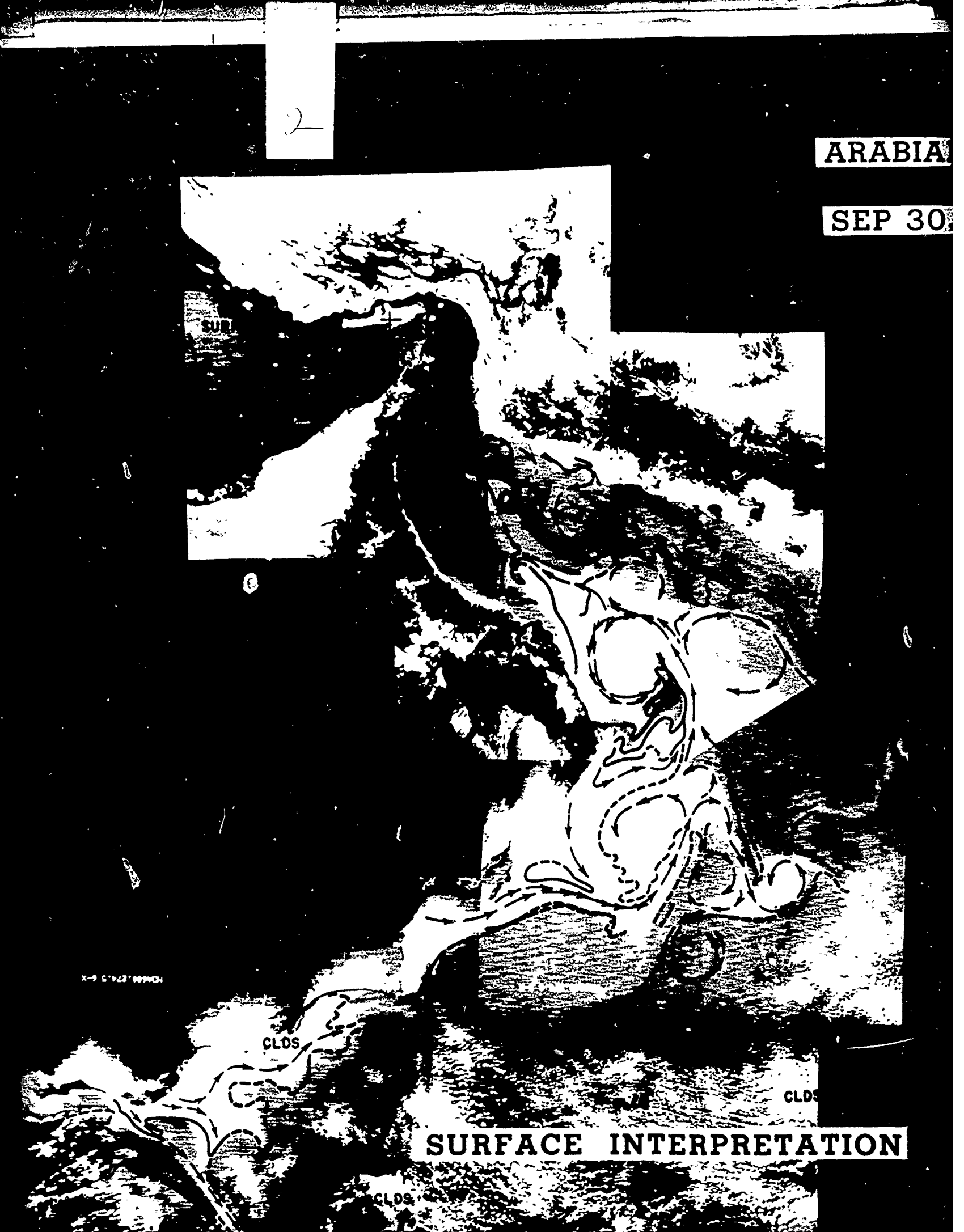
5

CED MOSAIC

Figure 40. Arabian Sea Mosaic with Interpretation, 28 September 1980.

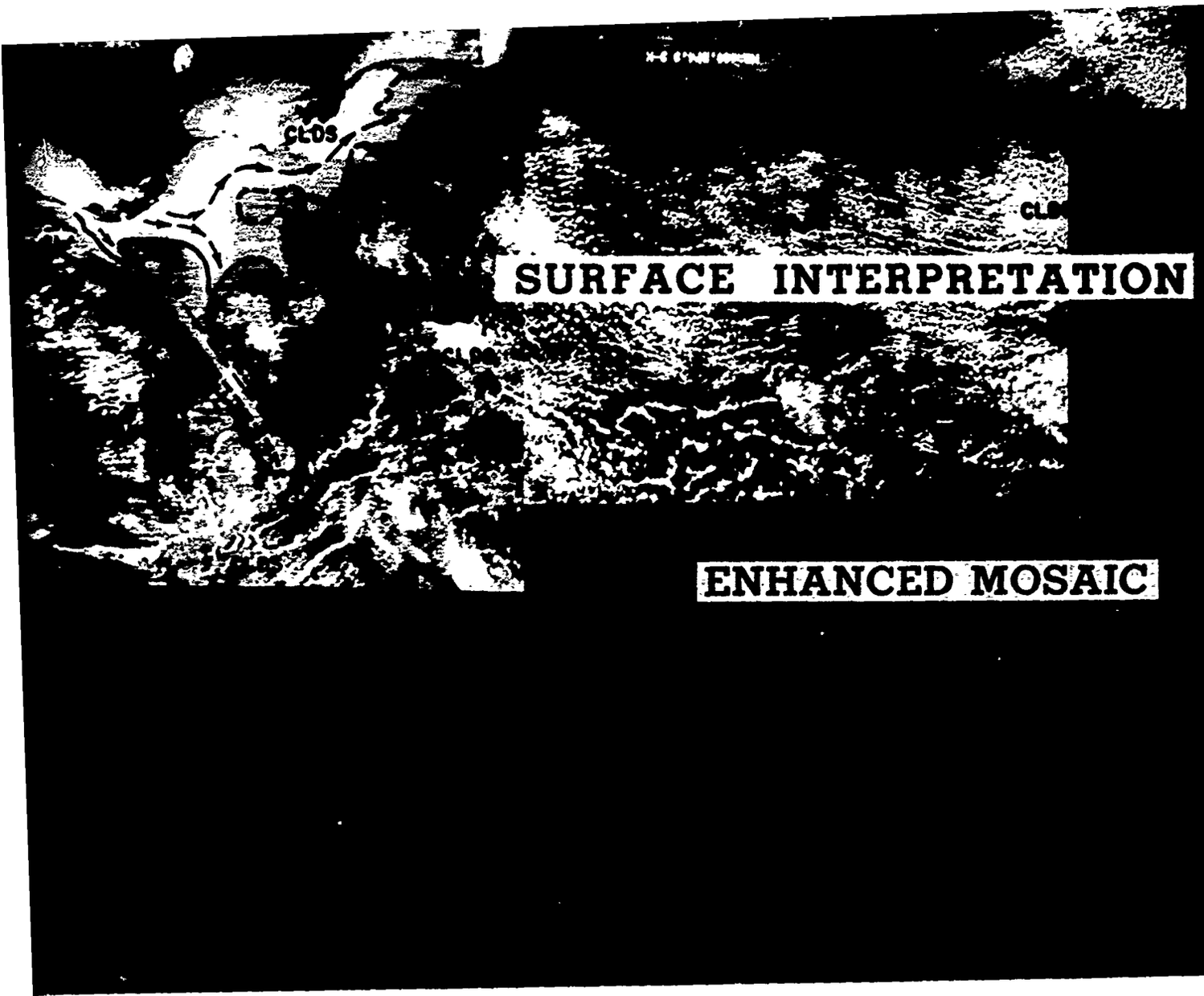
The composite of enhanced images shown in Figure 30 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively.

SATELLITE VIEW


2
ARABIA
SEP 30
CLDS
CLDS
CLDS
SURFACE INTERPRETATION


ARABIAN SEA
SEP 30, 1980
CLDS
RETATION

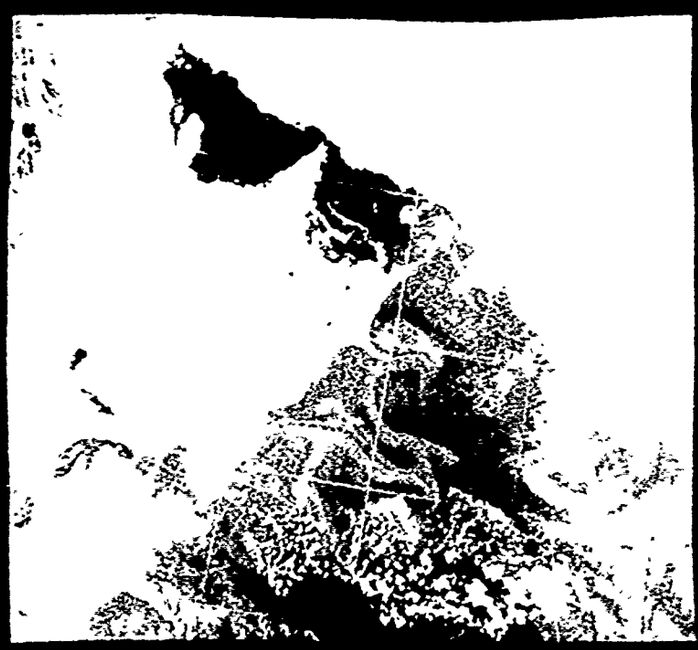
'4



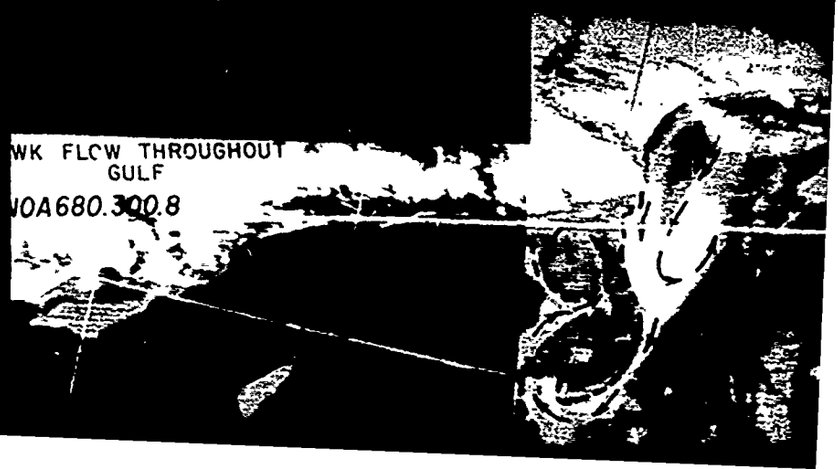
5

Figure 41. Arabian Sea Mosaic with Interpretation, 30 September 1980.

The composite of enhanced images shown in Figure 31 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively.



SATELLITE VIEW

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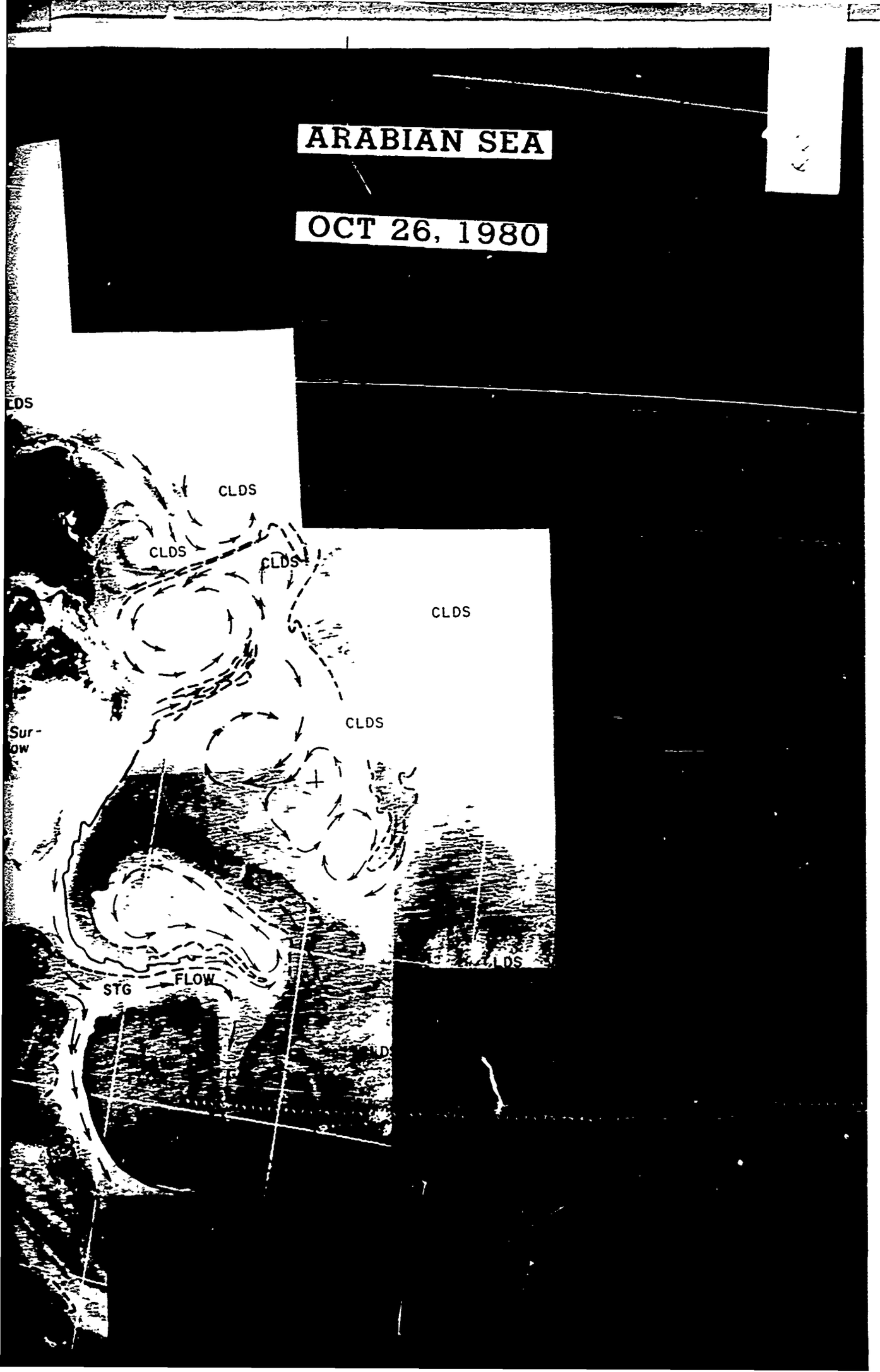
CLDS
STG WK Significant Fronts
Relative Surface Flow
STG FLOW
CLDS
CLDS


ARABIAN SEA
OCT 26, 1980
CLDS
CLDS
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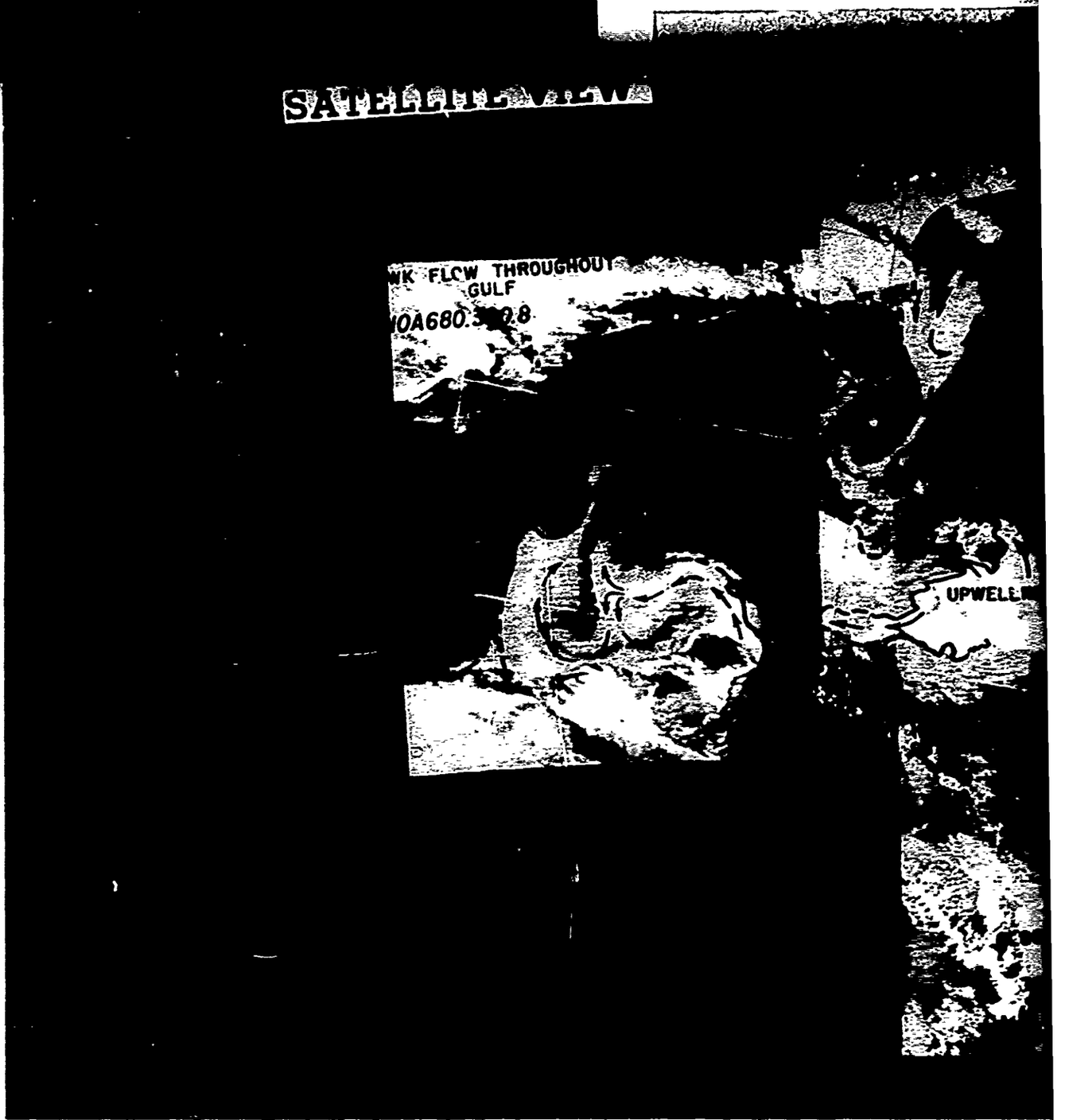
Sur-
ow
STG
FLOW


SATELLITE VIEW
WK FLOW THROUGHOUT
GULF
UPWELL

5

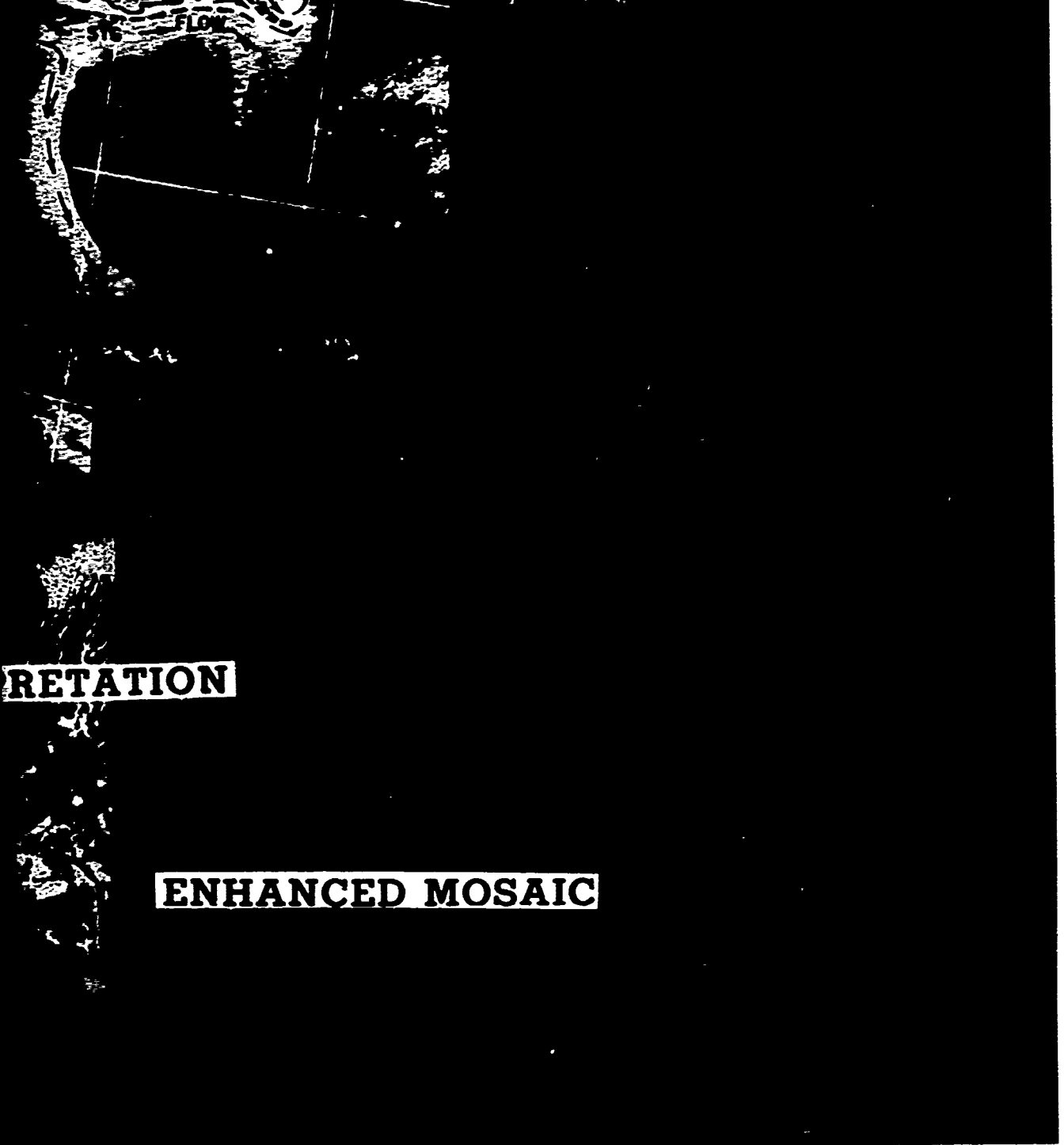
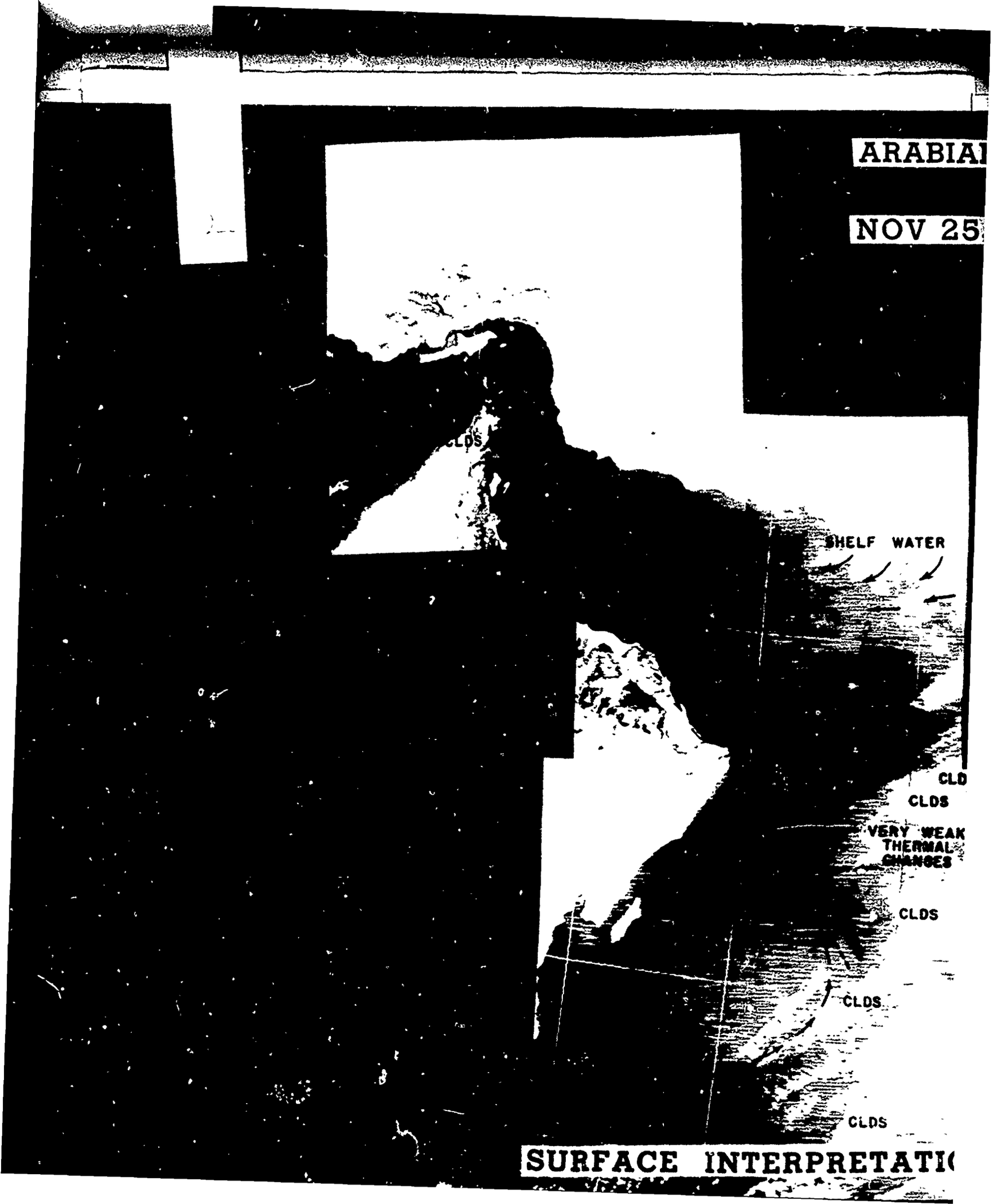
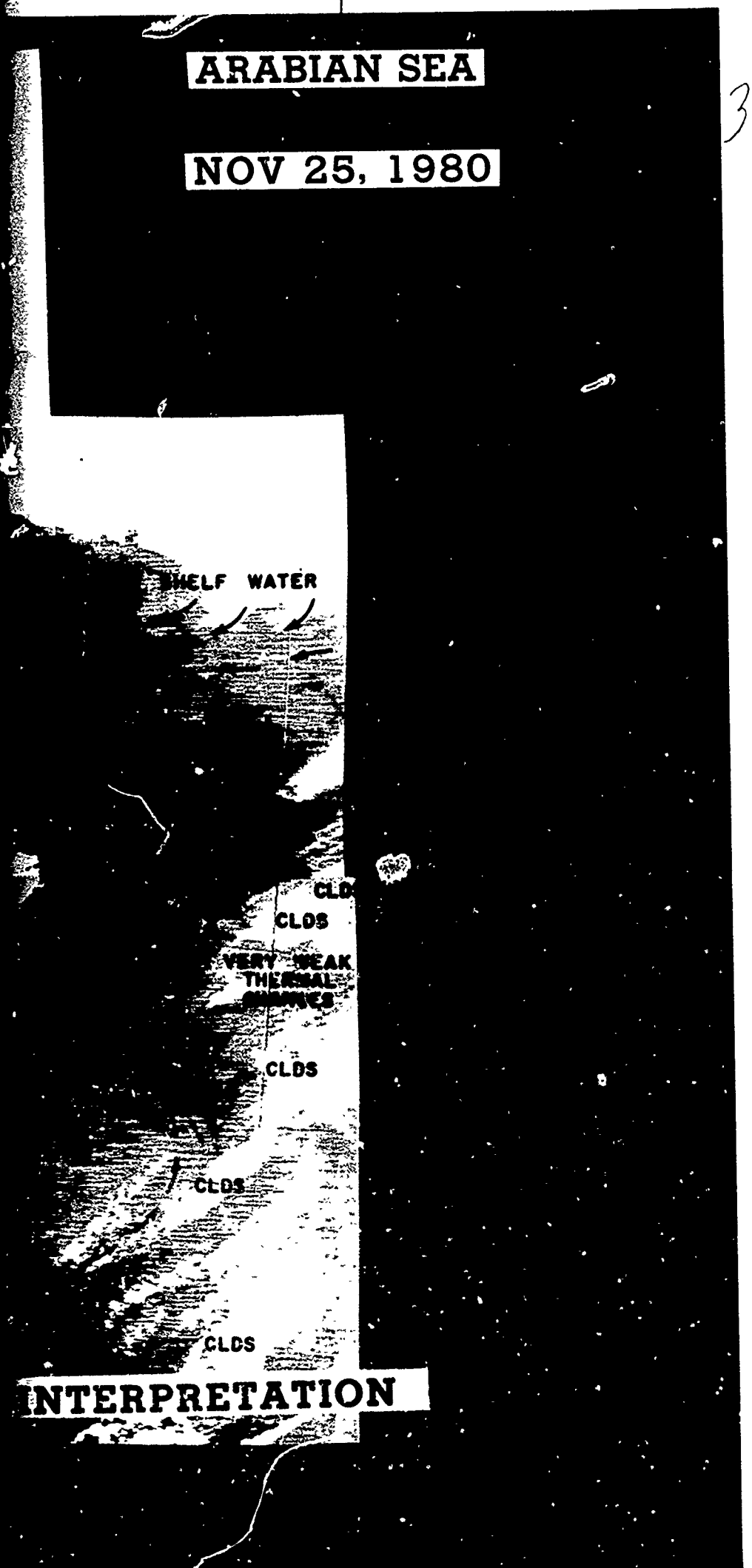

RETATION
ENHANCED MOSAIC

Figure 42. Arabian Sea Mosaic with Interpretation, 26 October 1980.

The composite of enhanced images shown in Figure 32 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. The interpretations in this mosaic are described in more detail in Figures 15 through 25.

SATELLITE VIEW


ARABIAI
NOV 25
CLDS
SHELF WATER
CLD
CLDS
VERY WEAK
THERMAL
CHANGES
CLDS
CLDS
CLDS
SURFACE INTERPRETATI


ARABIAN SEA
NOV 25, 1980
SHELF WATER
CLDS
CLDS
VERY WEAK
THERMAL
CLDS
CLDS
CLDS
INTERPRETATION

3

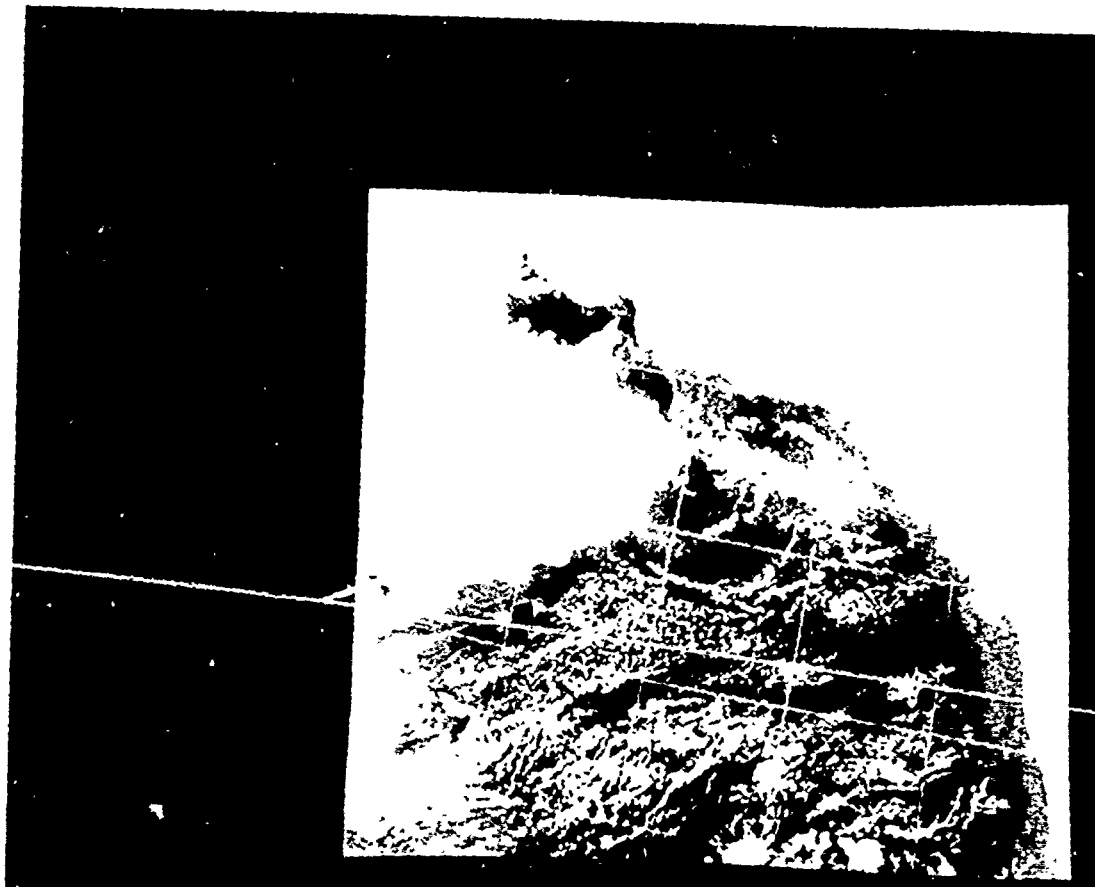
CLDS

SURFACE INTERPRETATION

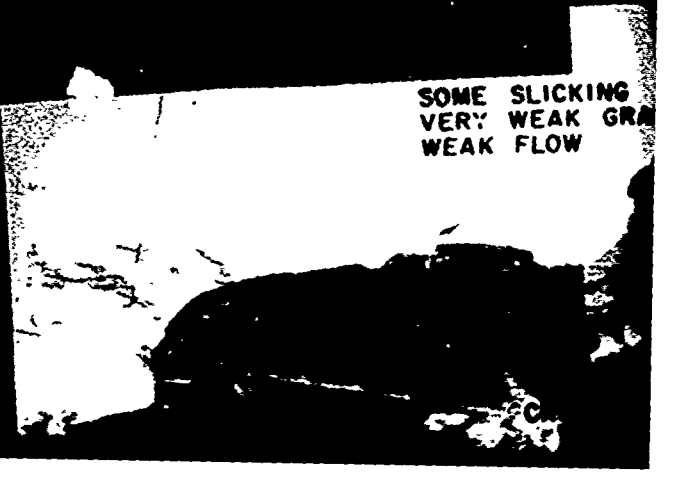
ENHANCED IMAGE

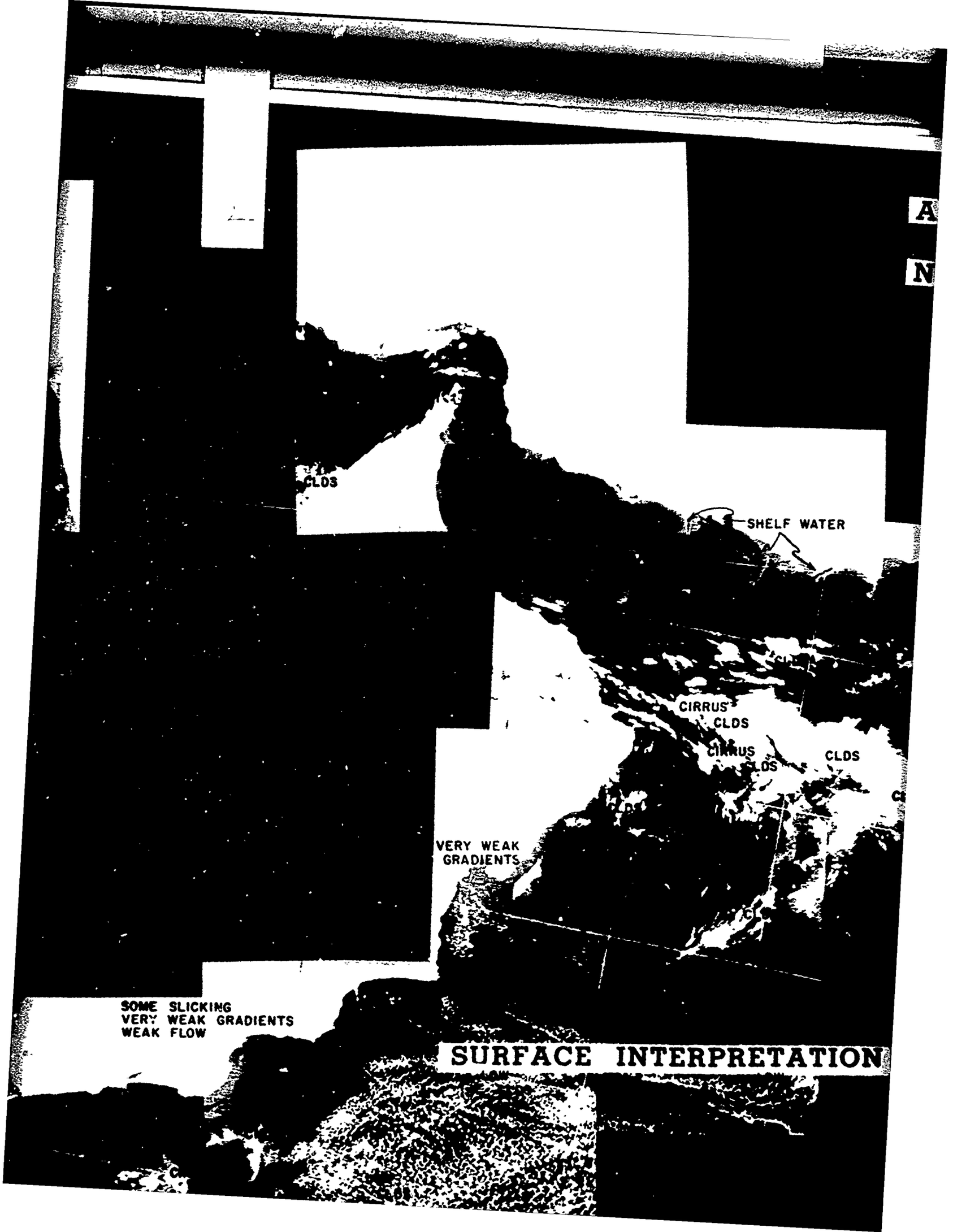
Figure 43. Arabian Sea Mosaic with Interpretation, 25 November 1980.

The composite of enhanced images shown in Figure 33 is shown here with a composite of surface interpretations for each image. Only weak surface features are indicated.



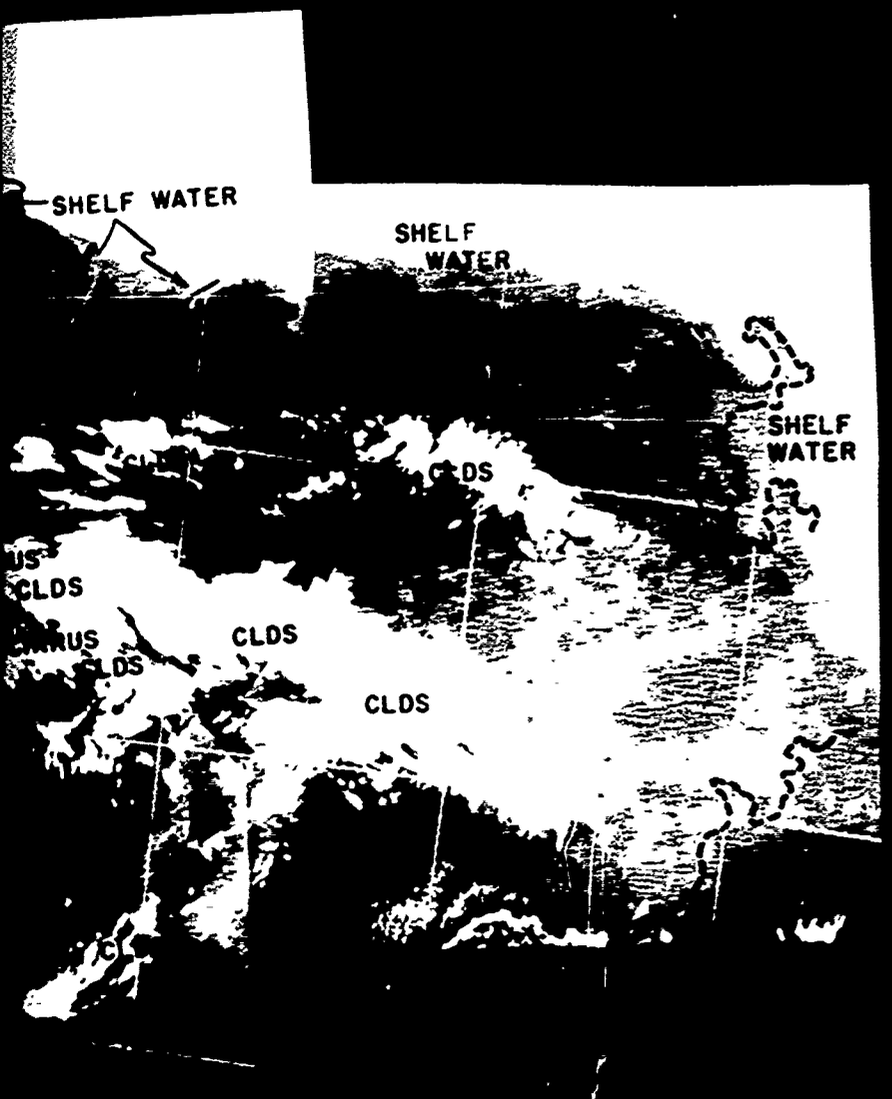
SATELLITE VIEW




A
N
CLDS
SHELF WATER
CIRRUS
CLDS
CIRRUS
CLDS
CLDS
VERY WEAK
GRADIENTS
SOME SLICKING
VERY WEAK GRADIENTS
WEAK FLOW
SURFACE INTERPRETATION

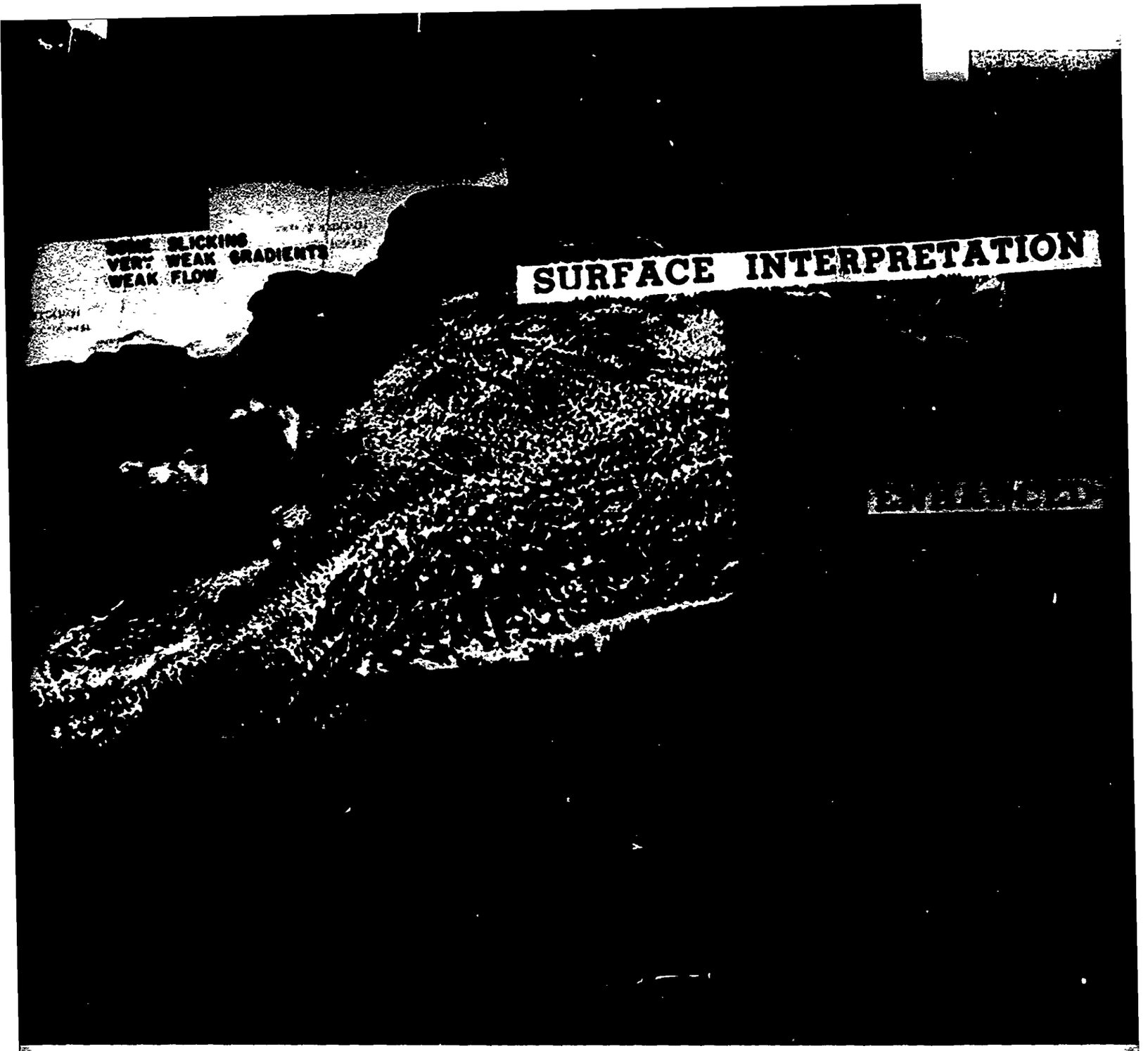
ARABIAN SEA

NOV 27, 1980



RPRETATION

4



5

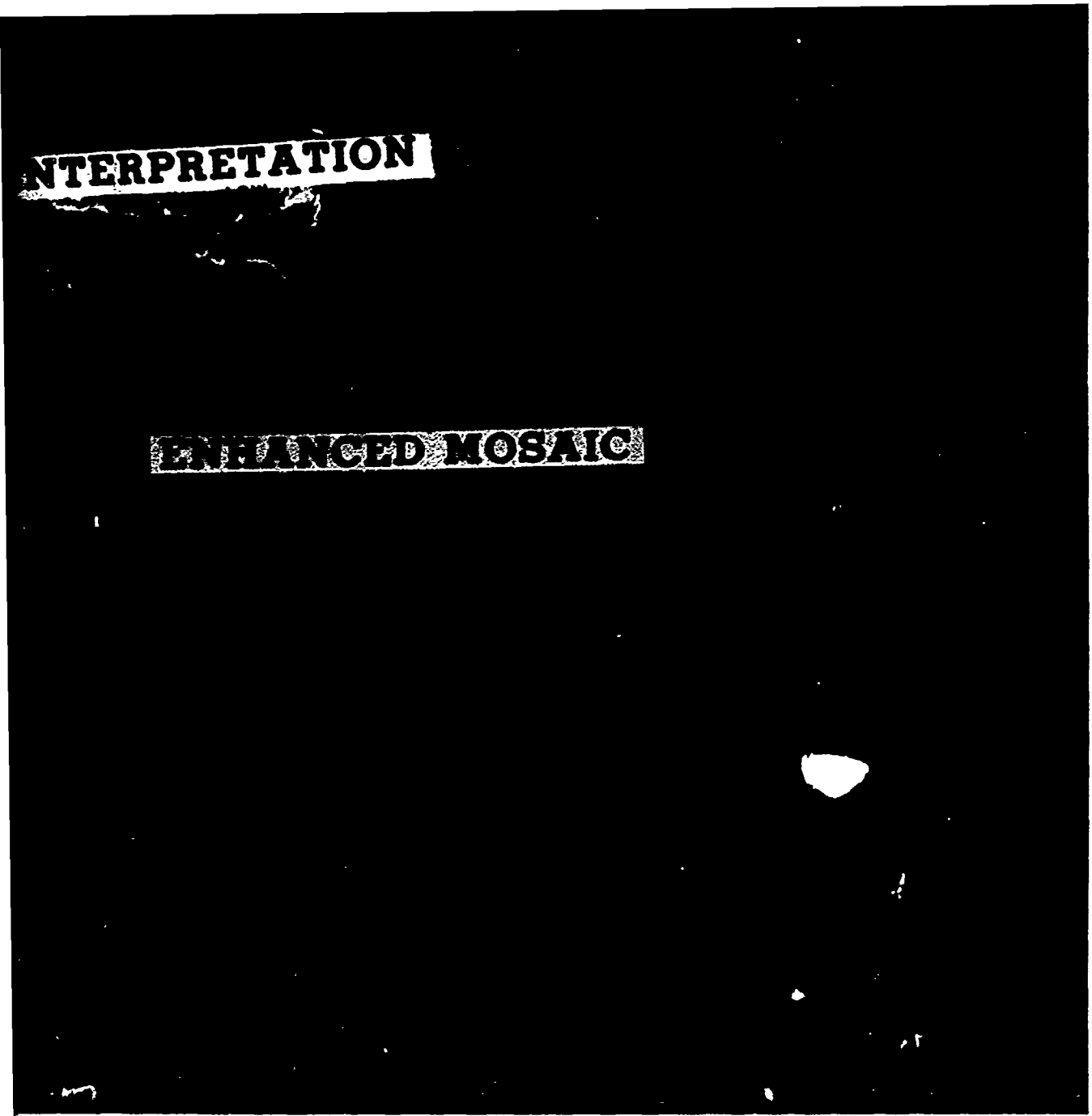

NTERPRETATION
ENHANCED MOSAIC

Figure 44. Arabian Sea Mosaic with Interpretation, 27 November 1980.

The composite of enhanced images shown in Figure 34 is shown here with a composite of surface interpretations for each image. Clouds dominate the field of view with some weak thermal features indicated on the ocean surface.

ARABIAN SEA

NOV 30,1980

SATELLITE VIEW

WOA680.335.6

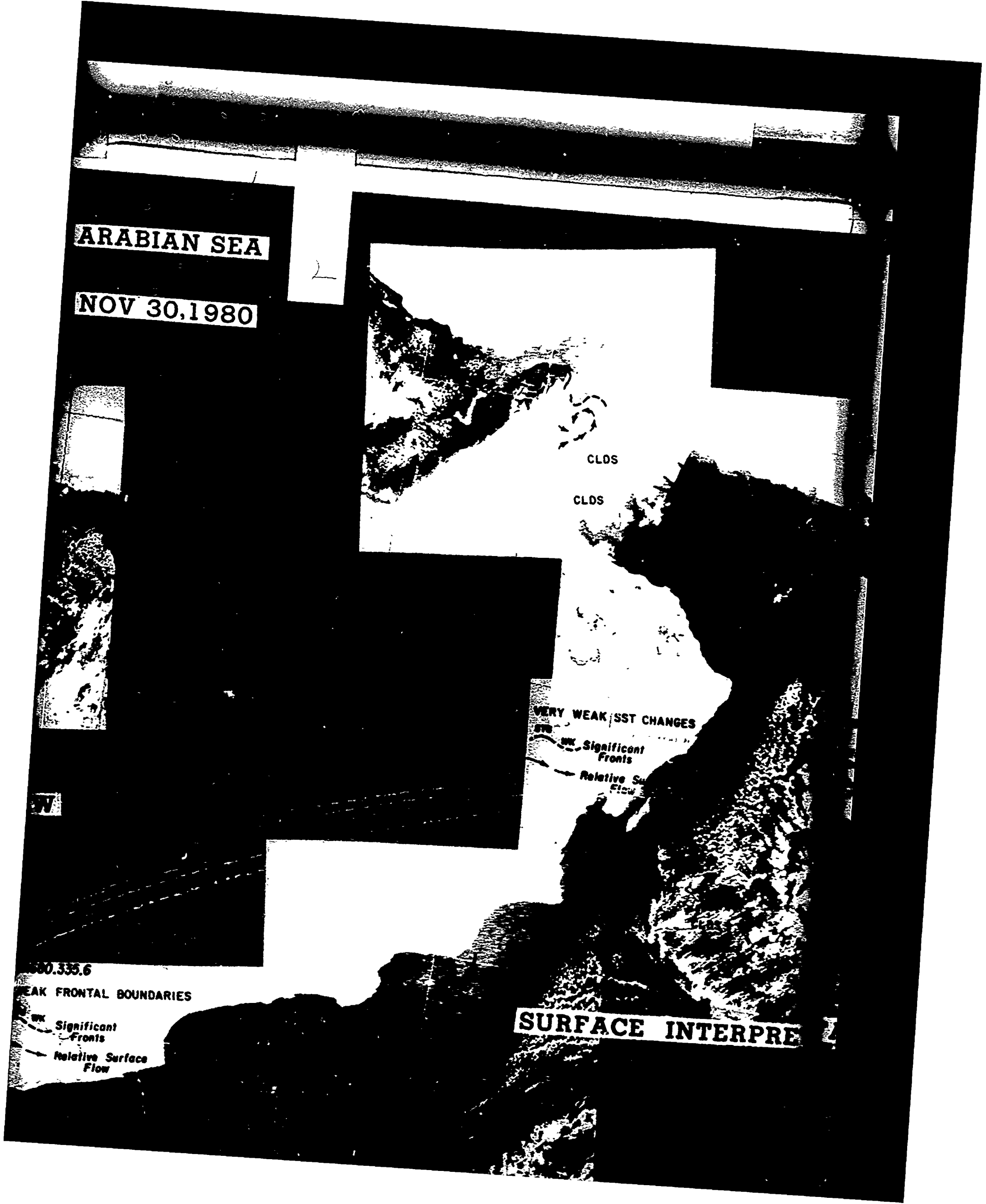
WEAK FRONTAL BOUNDARIES

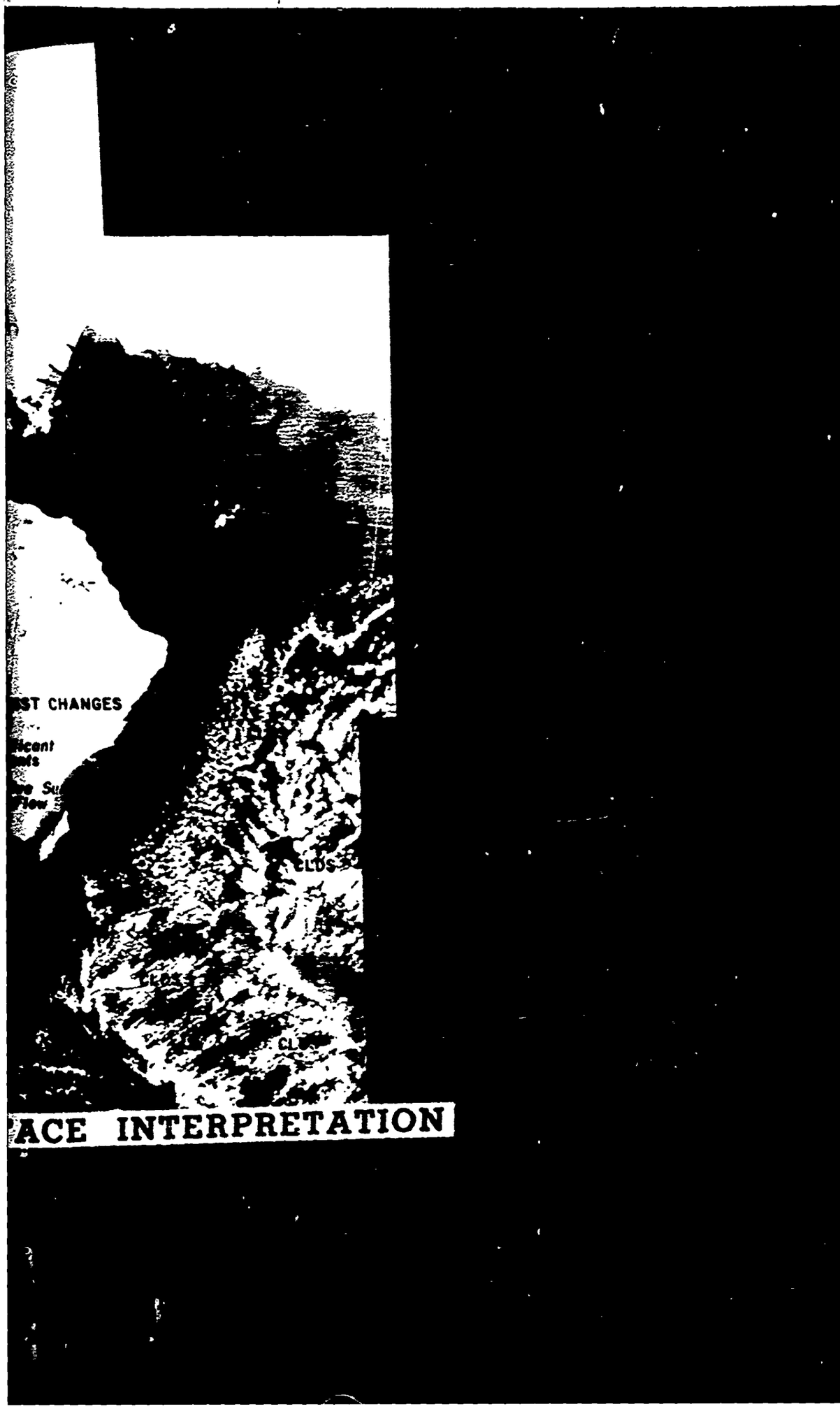
STS WK Significant Fronts

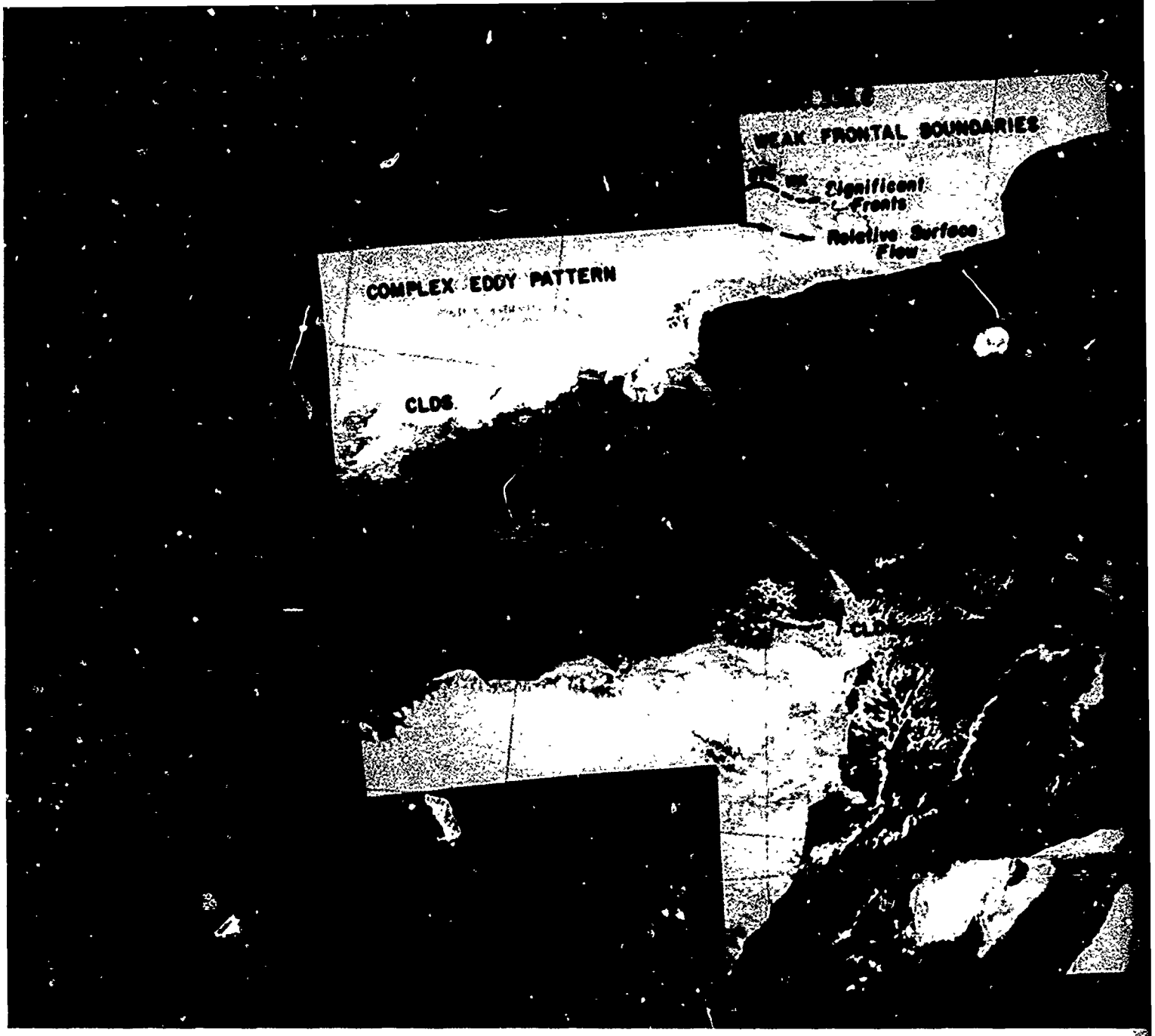
Relative Surface Flow

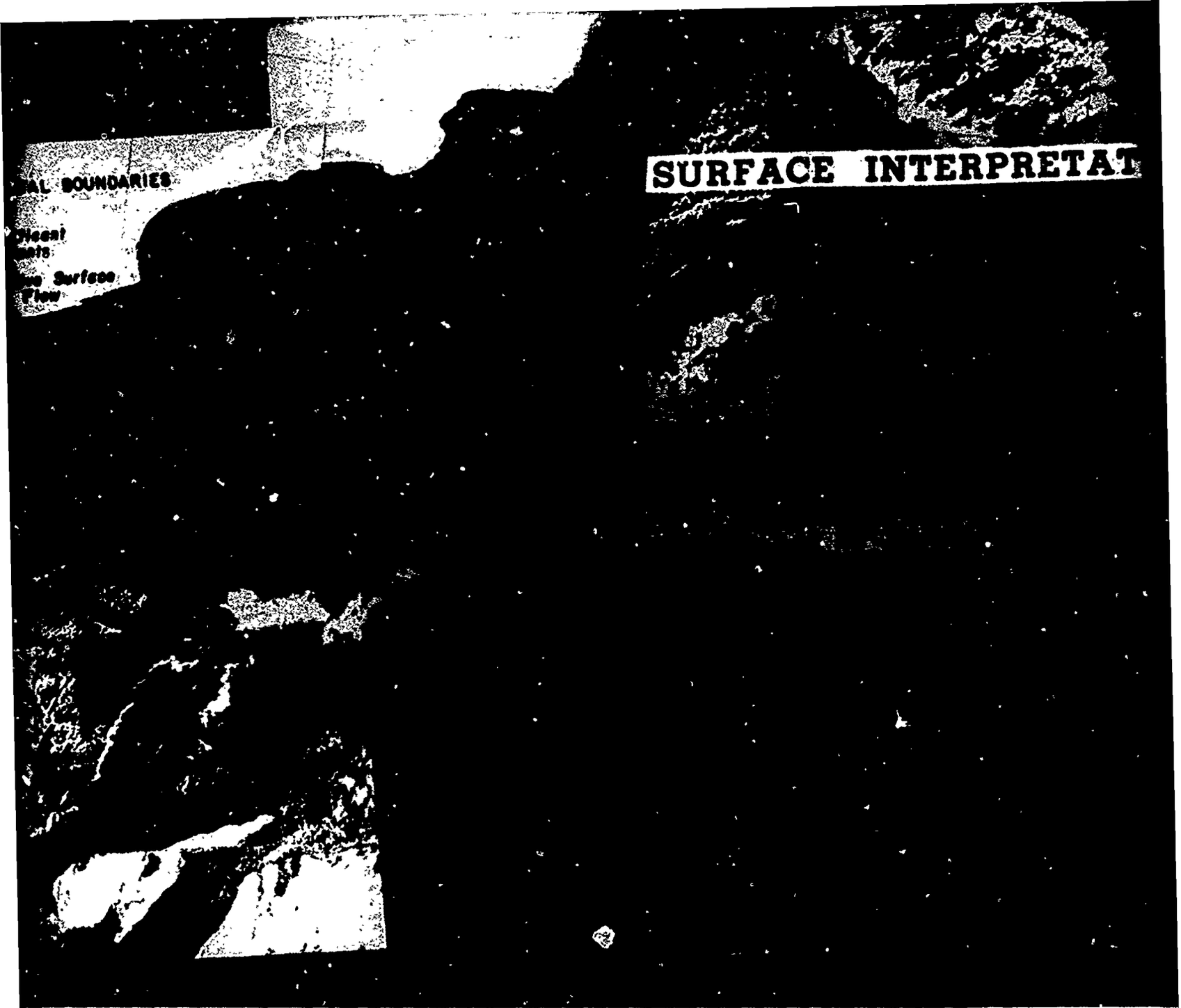
COMPLEX EDDY PATTERN

CLPS

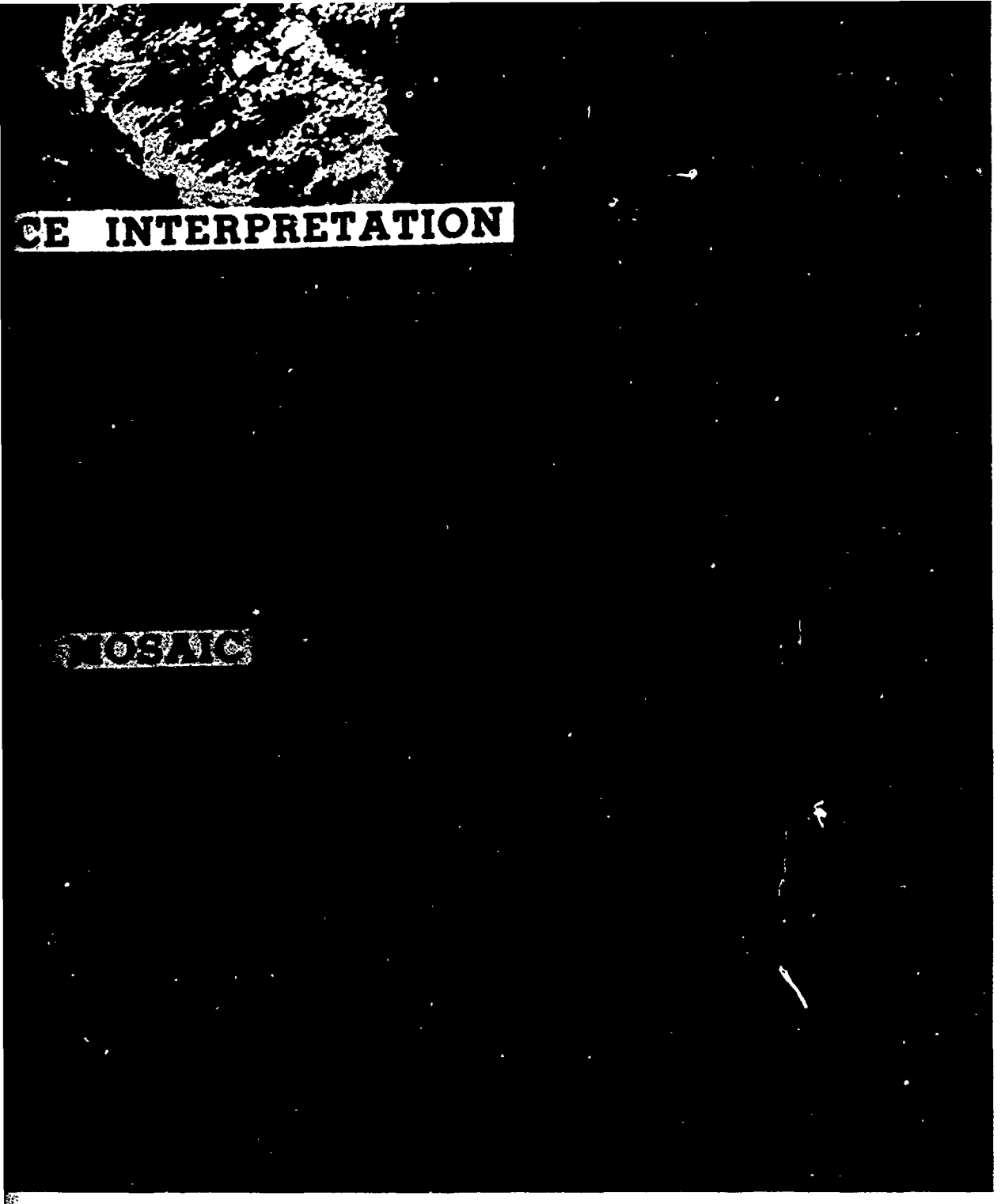

ARABIAN SEA
NOV 30,1980
CLDS
CLDS
VERY WEAK SST CHANGES
WK Significant Fronts
Relative Surface Flow
0.335.6
EAK FRONTAL BOUNDARIES
WK Significant Fronts
Relative Surface Flow
SURFACE INTERPRE


ST CHANGES
CLOS
CL
ACE INTERPRETATION


WEAK FRONTAL BOUNDARIES
Significant Fronts
Relative Surface Flow
COMPLEX EDDY PATTERN
CLDS.



5



6

6

Figure 45. Arabian sea Mosaic with Interpretation, 30 November 1980.

The composite of enhanced images shown in Figure 35 is shown here with a composite of surface interpretations for each image. Relative flow is indicated by arrows, and strong and weak fronts are indicated by solid and dashed lines respectively. (A poor alignment of lines indicating fronts occurred in the printing process.)