OCS Report
MMS 93-0039

Investigation of 30-inch Pipeline Rupture and Fire, Trunkline Gas Company, in Ship Shoal Block 90, Off the Louisiana Coast

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U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Regional Office

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U.S. Department of the Interior
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Authority and Procedures for the Investigation and Public Report

Authority

A serious pipeline rupture and fire occurred on November 3, 1992, in Ship Shoal Block 90, involving right-of-way Pipeline OCS-G 4635, operated by Trunkline Gas Company (Trunkline), in the Gulf of Mexico, offshore the State of Louisiana. Pursuant to Section 208, Subsection 22(d), (e), and (f), of the Outer Continental Shelf (OCS) Lands Act, as amended in 1978, and the Department of the Interior Regulation, 30 CFR Part 250, the Minerals Management Service (MMS) is required to investigate and prepare a public report of this accident. By memorandum dated November 19, 1992, the following MMS personnel were assigned to the investigative panel:

F. V. Patton	New Orleans
C. J. Schoennagel	New Orleans
W. D. Terrebonne	New Orleans

Procedures

Personnel from the MMS Houma District office flew to the area of the pipeline rupture shortly after it occurred, and photographed the resulting fire. (For photographs of fire, see attachment 1.) They then proceeded to the Ship Shoal Block 139 T-25 Platform, a valve and pipeline crossover platform operated by Trunkline, to ensure that the ruptured pipeline had been shut in.

Investigative Panel members visited an Amelia, Louisiana, storage yard on November 13, 1992, to view the pieces of the ruptured pipeline recovered from the seafloor. (For photographs of ruptured pipeline, see attachment 2.) They also obtained information from personnel familiar with the accident.

The Investigative Panel met on December 16, 1992, at the MMS Gulf of Mexico Regional office in Jefferson, Louisiana, with Mr. Bill Bertges of the Office of Pipeline Safety (OPS), U.S. Department of Transportation, to review and exchange information supplied by Trunkline to each agency and to determine what additional information was needed.

Introduction

Background

A right-of-way for Trunkline's 30-inch gas pipeline, Permit No. OCS-G 4635 (Segment 6071), was approved in May 1981 and amended in June 1981. The 30-inch gas pipeline goes from Ship Shoal Block 139 to shore. The maximum allowable working pressure of the pipeline is 1,200 pounds per square inch (psi).

An as-built drawing of September 1981 was submitted to verify its location. A revised drawing of December 1981 verified that the 30-inch pipeline was buried 6 feet below the mudline except where it crossed a 26-inch Transco pipeline in Ship Shoal Block 70 and an 8-inch Odeco pipeline in Ship Shoal Block 115.

On August 28, 1992, the 30-inch gas pipeline was shut in due to Hurricane Andrew. The pipeline was put back in service on September 9, 1992.

Description of Incident

On November 3, 1992, at approximately 7:45 a.m., the 30-inch gas pipeline ruptured at a point in Ship Shoal Block 90, in about 25 feet of water. The gas from the pipeline caught fire with flames rising several hundred feet above the water.

The pipeline was shut in at both onshore and offshore locations. The fire then extinguished itself when the contents of the pipeline depleted. A light sheen caused by condensate in the pipeline was visible on the water.

Damage was limited to the 30-inch gas pipeline. No injuries were reported and minimal pollution was observed.

Findings

Preliminary Activities

On August 9, 1992, the 30-inch gas pipeline was operating at 1,088 psi gauge (psig). This was the highest operating pressure of the pipeline just prior to its shut-in on August 28, 1992, because of Hurricane Andrew. Trunkline began putting the pipeline back in service on September 9, 1992.

On September 14, 1992, Trunkline submitted a request for a departure from the requirement to have pipelines buried 3 feet in water depths less than 200 feet. The 30-inch gas pipeline had become exposed at a location where it crosses Odeco's 4 1/2-inch pipeline in Ship Shoal Block 93 in a water depth of 25 feet. Odeco had notified Trunkline that they had discovered 145 feet of exposed pipeline in July 1992 while running a survey for a new pipeline they were to lay. In a subsequent survey run by Trunkline in September 1992, it was discovered that 793 feet of the 30-inch pipeline was now exposed in the Ship Shoal Block 93 area. By letter dated October 14, 1992, the MMS approved Trunkline's proposal to cover the 793 feet of exposed pipeline with 40 interlocking articulated precast concrete mats. This work had not begun prior to the pipeline rupture.

Pipeline Rupture

As Trunkline was in the process of bringing the 30-inch gas pipeline back into service, an operating pressure of 1,070 psig, the highest since Hurricane Andrew, was obtained on November 3, 1992. At approximately 7:45 a.m. on the morning of the same day, Trunkline received a report from the derrick barge *DB-2* that an explosion and fire had occurred in the area of Trunkline's T-25 valve and pipeline crossover platform located in Ship Shoal Block 139. From this platform Trunkline has two 30-inch gas pipelines, 300-1 and 300-2, departing for Trunkline's station in Patterson, Louisiana.

The flames from the resulting fire were reported to be rising several hundred feet into the air. An initial report from a helicopter pilot indicated that a fishing vessel was in the vicinity of the pipeline when it ruptured. The pilot indicated that after the resulting explosion and fire he could not locate the vessel. An initial search by the United States Coast Guard and a subsequent search by divers turned up no wreckage or debris, indicating that a vessel was not involved in the accident.

Initiation of Pipeline Shut-in

Trunkline dispatched personnel at 8:10 a.m. to their T-25 platform and to Gate Valve 318, which is located at the beach, to check out the reported incident. (For schematic of the 30-inch pipeline, see attachment 3). At 8:15 a.m. Trunkline's personnel at Gate Valve 315, located at Patterson, had noticed a slight drop in pressure in Trunkline's 30-inch Gas Pipeline 300-2. By 8:30 a.m. personnel had closed Gate

Valve 319-1, the valve shutting in the 30-inch Gas Pipeline 300-1, at the T-25 platform. They were having problems shutting in Gate Valve 319-2, the valve shutting in the 30-inch Gas Pipeline 300-2, at the T-25 platform. Pressure was reported as holding at 895 psig on both pipelines at the T-25 platform.

By 8:45 a.m. Trunkline had received notification that Gate Valves 318-1 and 318-2, which are located at the beach, were both closed. At the same time, personnel at Patterson reported that both pipelines were retaining about 870 psig.

Completion of Pipeline Shut-in

At approximately 9:05 a.m., Trunkline personnel were able to close Gate Valve 319-2, thereby shutting in the 30-inch Gas Pipeline 300-2, at the T-25 platform. Almost immediately, the pressure on the 300-2 pipeline dropped to 300 psig and continued to fall, while the pressure on the 300-1 pipeline was holding at 895 psig on the T-25 platform. Within 5 minutes the pressure on the 300-2 pipeline had dropped to 50 psig and the fire on the water was almost out. The pressure on the 300-1 pipeline continued to hold at 895 psig. At this time it became apparent that the break was in the 300-2 pipeline.

At the time of the incident Gate Valve 319-2 was being repaired due to Hurricane Andrew damage. Therefore, the T-25 platform equipment that would shut in the pipeline in case of a line break was not in service.

The equipment that would shut in the pipeline at Gate Valve 318-2 was set at 700 psig. Since the pipeline pressure stayed above the low pressure setting, the valve did not close automatically.

The equipment out of service at the T-25 platform delayed the closure of Gate Valve 319-2. Therefore, when Trunkline personnel arrived at the platform, all block valves for the incoming pipelines to the T-25 platform were shut in until Gate Valve 319-2 could be closed.

Recovery of Damaged Pipe

By the afternoon of the accident, Trunkline had mobilized the vessel *American Diver* to jump divers to investigate the pipeline rupture. Initial dives located both ends of the pipeline and revealed that there was an approximate 450-foot section of pipeline missing.

Prior to the commencement of salvage operations, the vessel *Geodetic Surveyor* was used to inspect the seafloor with sidescan sonar. The derrick barge *DB-2* arrived on location on November 4, 1992, to conclude the underwater inspection and to initiate salvage operations.

The sidescan sonar data and Mesotech Equipment were utilized to locate and recover the damaged pipe. In all, 13 pieces of pipe, representing 386 feet of the 431 feet of pipe damaged, were recovered. The *DB-2* moved off location on November 11, 1992, and proceeded to a storage yard in Amelia, Louisiana, to offload the damaged pipe.

Analysis of Damaged Pipe

The damaged pipe was sent to a laboratory for analysis. The 13 pieces of pipe, representing 11 joints of the initial pipeline affected by the incident, were repositioned as they were prior to the rupture so that an attempt could be made to locate the origin of the failure. (For schematic of 11 joints damaged pipe, see attachment 4.)

The origin of the failure was identified as a fracture in a piece of Joint No. 4 of the recovered pipe. (For photograph of origin piece of Joint No. 4, see attachment 5.) A large dent, which is continuous across the fracture, exists on the top of the pipe, indicating mechanical damage such as that caused by a large, blunt object being dropped from above or dragged over the top.

Barnacles were attached to both the concrete coating of pieces of the recovered pipe and to the coal-tar coating in the vicinity of the identified origin in Joint No. 4. (For photograph of barnacles on the concrete coating, see attachment 5.) The concrete coating was missing from a large intact portion of Joint No. 4 and, at the origin location of Joint No. 4, the coal-tar coating was also missing.

Repair of Damaged Pipeline

The lay barge *Cherokee* moved on location simultaneously with the departure of the *DB-2.* The south end of the ruptured pipeline was lifted, and pretested pipe and a new weld flange were installed. The

north end of the pipeline was then elevated onto the lay barge and a swivel flange was installed. The pipeline was then lowered back to the seafloor and the two ends of the pipeline were aligned and torqued. Repair of the pipeline was completed on November 23, 1992, and preparation was made for the hydrostatic testing of the repaired pipeline.

Testing of Repaired Pipeline

Testing of the repaired pipeline began at 4:45 p.m. on November 24, 1992. The pipeline was to be tested for eight continuous hours to 125 percent of its maximum allowable operating pressure or 1,618 psig (+0, -25 psig.) At 11:55 p.m., after 7 hours and 10 minutes of testing, a failure occurred while the pipe was holding 1,609 psig. The point of this failure was located in Ship Shoal Block 39; but, as of this report, an analysis of the damaged pipe has not been completed.

Subsequent Activities

Repair work on this failure began on November 27, 1992, and was completed on December 6, 1992, with two joints of pipe being replaced. A hydrostatic pressure test was successfully completed on December 8, 1992, and the 30-inch gas pipeline was placed back in service on December 9, 1992.

Damages

Damage was limited to the 30-inch gas pipeline. The total estimated cost associated with the failure was $4,400,000, with $400,000 of that

amount attributed to gas loss. Minimal pollution and no injuries or fatalities were associated with the accident.

Conclusions

Probable Cause of Incident

The probable cause of the incident was that the 1,070 psig at which the pipeline was operating on November 3, 1992, exceeded the pressure that the pipeline could withstand at the point of origin of the rupture.

Possible Cause of Origin

A possible cause of origin of the pipeline rupture is that the pipeline was struck and weakened by something during the passage of or subsequent to Hurricane Andrew. The pipeline operated at higher pressures prior to its shut-in for Hurricane Andrew than at the pressure at which it failed.

Contributing Causes

The following were possible contributing causes:

1. The segment of pipeline in the vicinity of the origin may have been unburied, as indicated by the barnacles on both the cement coating and coal-tar coating.
2. The segment of pipeline in the vicinity of the origin could have become unburied during the passage of Hurricane Andrew. The segment of pipeline unburied in the Ship Shoal Block 93 area was 145 feet in July 1992, and 793 feet in September 1992, after the passage of Hurricane Andrew.

3. The equipment that could shut-in the pipeline at the T-25 platform was not in service. This allowed the flow in the pipeline to continue until the pipeline was manually shut in.

Possible Causes of Ignition

The following were possible causes of ignition:

1. Static electricity.
2. Sparking from the ruptured pieces of pipe.

Recommendations

Regulatory Requirements

The MMS should require the following:

1. All pipelines in an area where a major hurricane has passed should be hydrostatically tested prior to being put back into service.

2. All pipelines in water depths less than 200 feet should be surveyed every five years or after the passage of a major hurricane, if the pipelines are in the area of passage, to ensure that the pipelines have not become exposed above the seafloor. A copy of the survey should be submitted to the MMS along with a plan to rebury or re-cover the pipeline if it has become exposed.

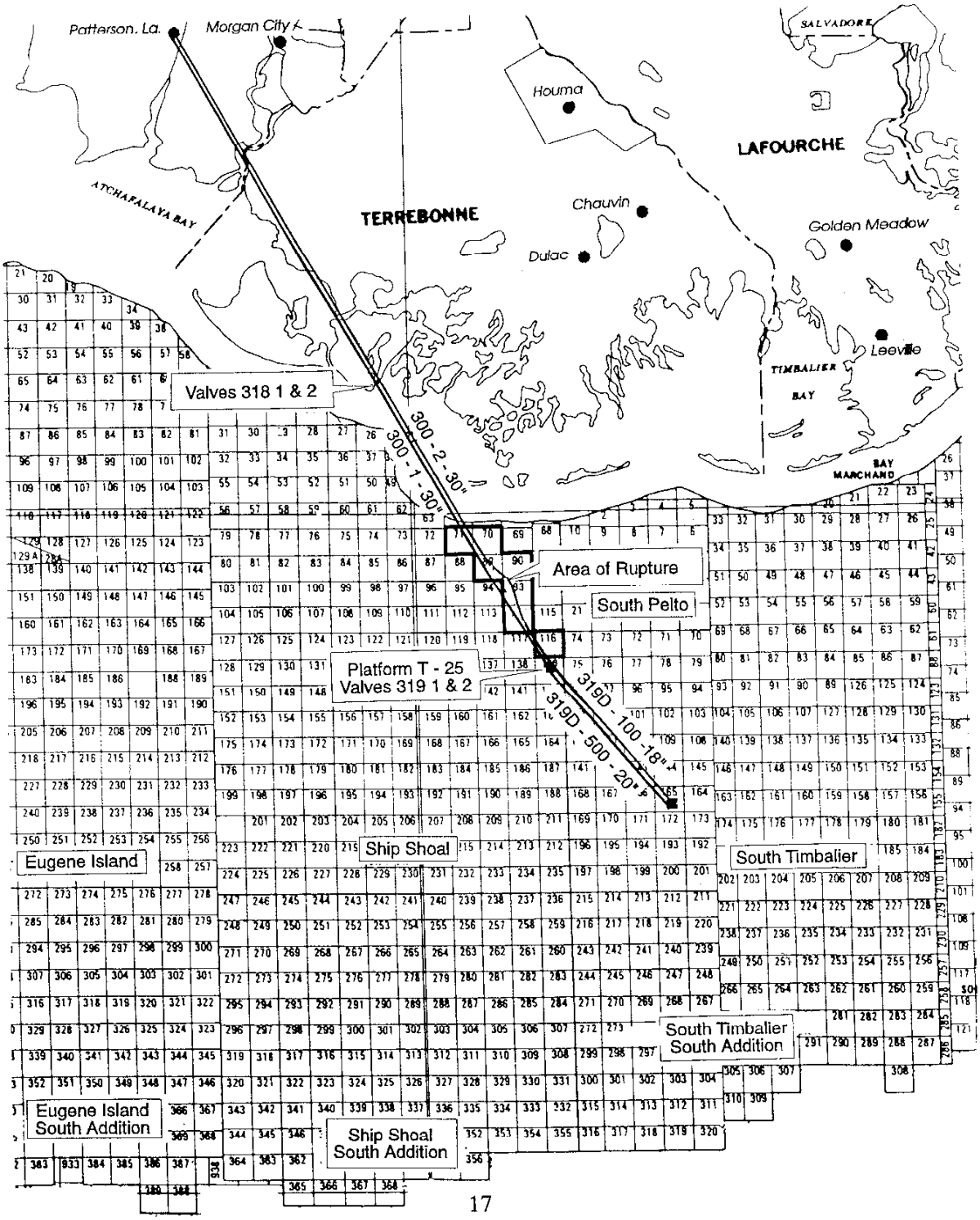
Attachment 1

Photographs of Fire

Attachment 2

Photographs of Damaged Pipe

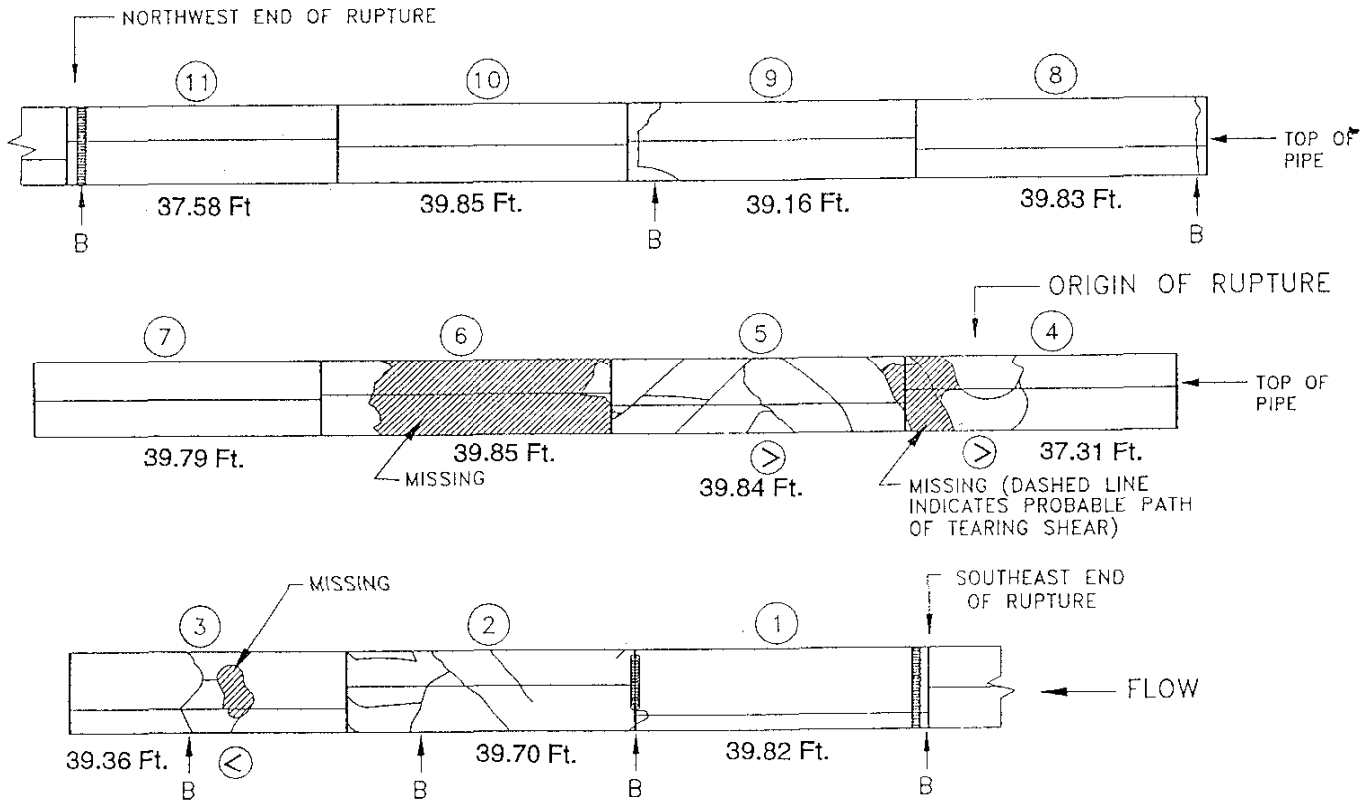
Schematic of the 30-inch Pipeline



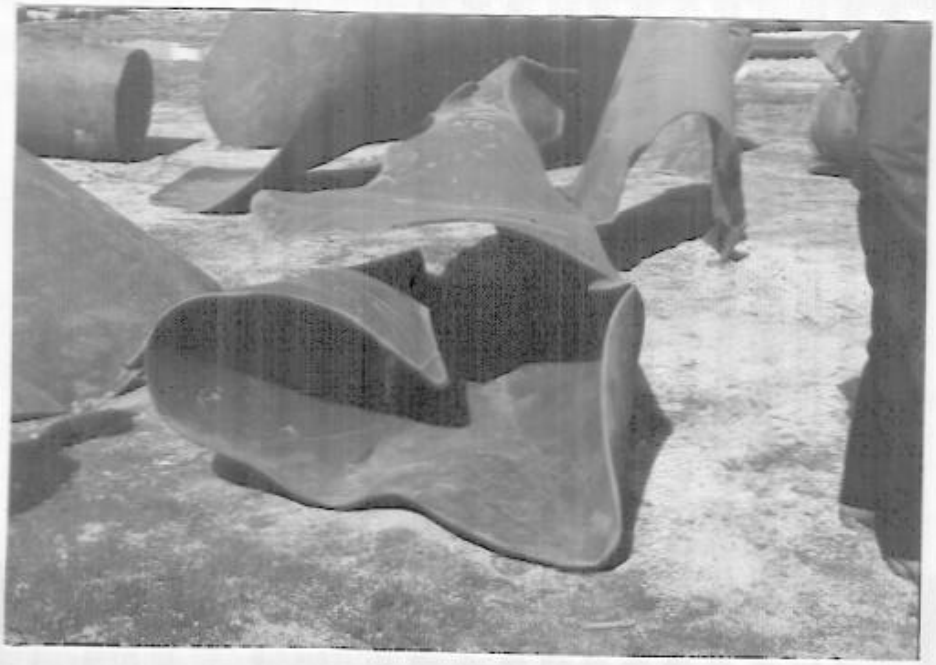
Schematic of 11 Joints of Damaged Pipe

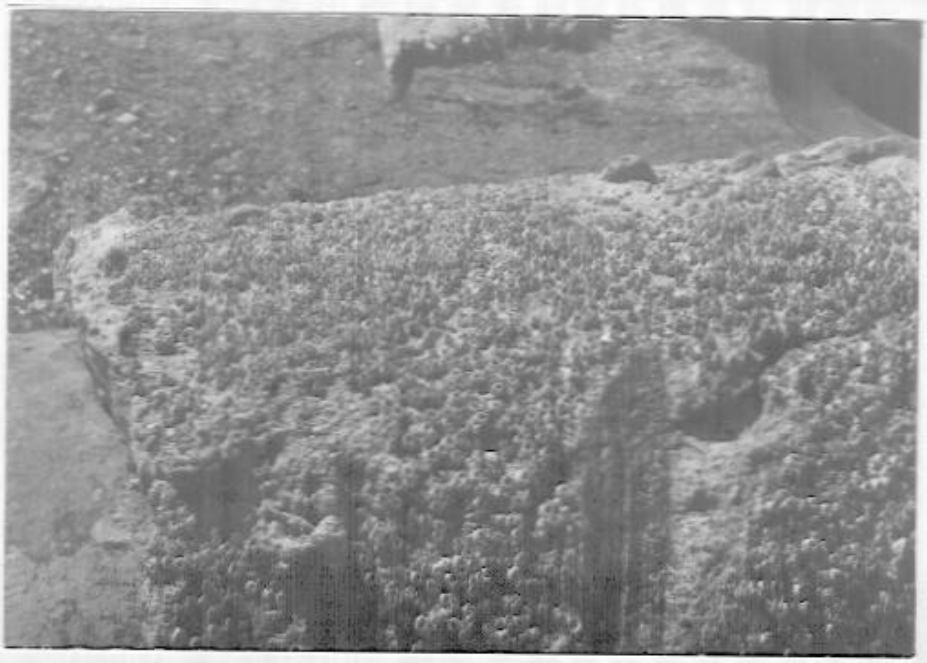
Symbols:

- Badly Distorted Buckle, Fracture Path Not Drawn
- B — Buckled and Completely Severed
- (>) Cleavage Fracture



Photographs of Origin Piece of Joint No. 4 and Barnacles on the Concrete Coating





As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally-owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.