Oil & Gas Well
Cementation

Cementation

Oil Well cementing is the process of mixing a slurry of cement and water and displacing it down the casing, tubing or drill pipe to a pre specified point in the well

Primary cementing → Casing Cementation

The cementing takes place soon after the lowering of casing is called primary cementation.

Secondary cementing →

Any other operations where cement is pumped in a well either during drilling operation or in production phase

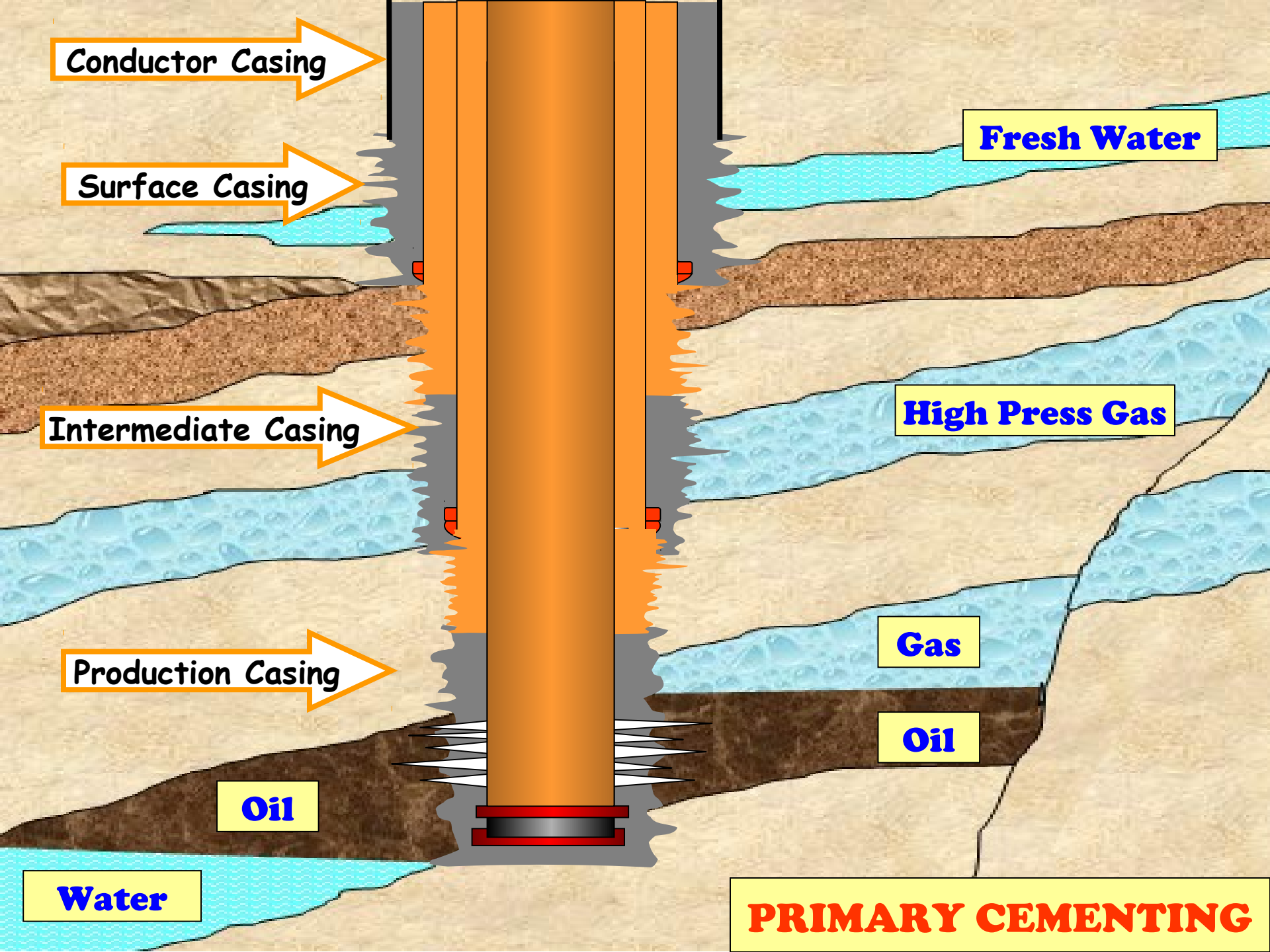
Primary Cementation

Q. Why we need to pump cement in a well?

- An oil/gas well is completed in stages.
- Each stage is secured /completed by lowering a suitable size steel pipe (casing).
- The casing pipes are held in its position by an adequate length of cement bond between pipe and annulus.
- Cement is mixed with water to form a cement slurry of desired density and pumped into the pipe and displaced in the annulus between casing and open hole.

Main Functions

- Bond and support the casing
- Protect the casing from corrosion.
- Protect the casing from shock loads
- Sealing-off problematic zones.
- Restrict fluid movement between formations


Conductor Casing
Surface Casing
Intermediate Casing
Production Casing
Fresh Water
High Press Gas
Gas
Oil
Oil
Water
PRIMARY CEMENTING

Primary Cementing Techniques

1. Single stage cementation
2. Multi stage cementation
3. Liner cementation

Single Stage Cementing

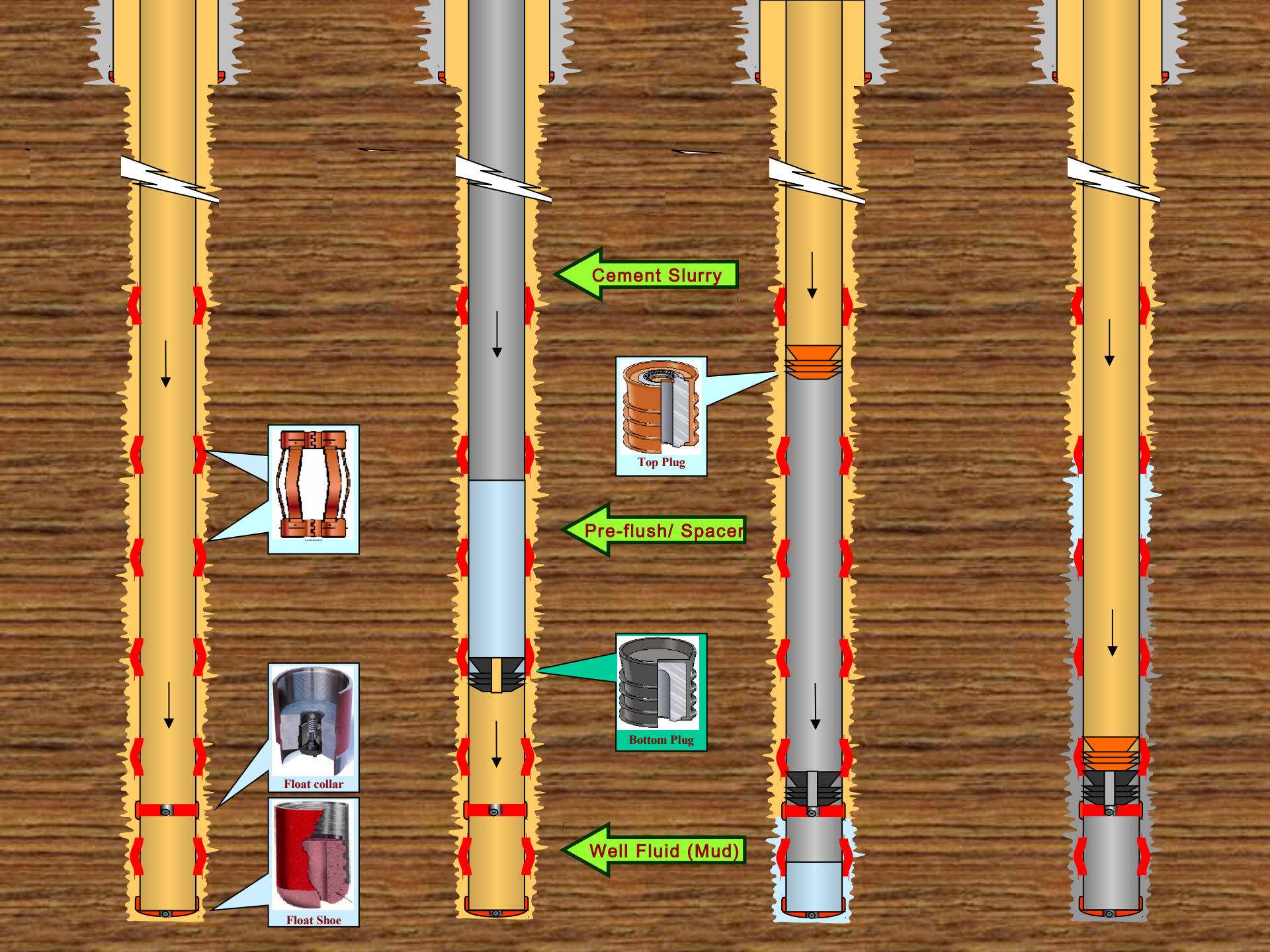
It is the Most common technique

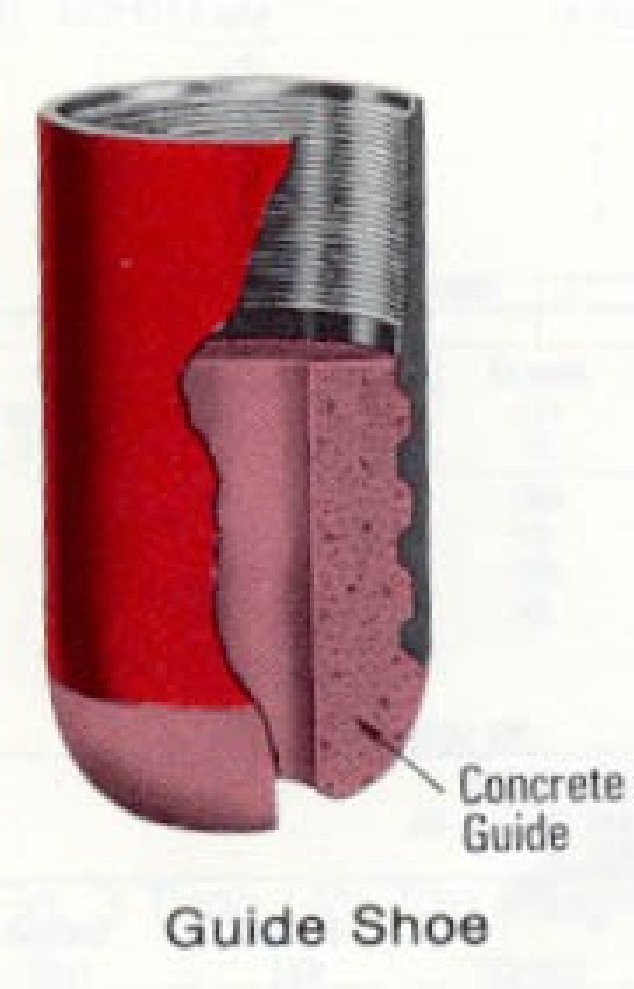
Normally accomplished by pumping one batch of cement down the casing between two rubber plugs.

The bottom plug is placed in the casing, followed by cement slurry.

When the batch of cement has been pumped into the casing, a top plug is released.

The top plug is pumped down until it lands on the top of float collar, thus completing the cement job.

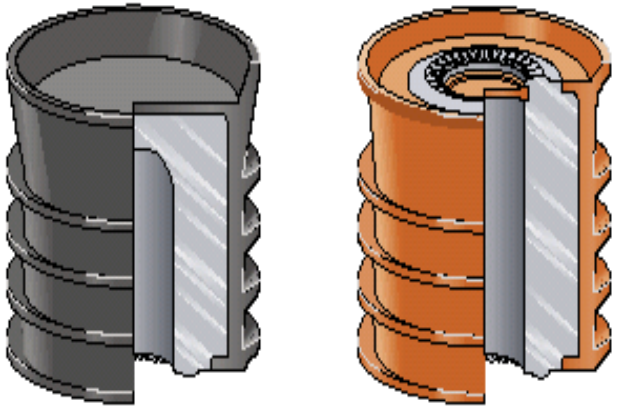

Cement Slurry
Top Plug
Pre-flush/ Spacer
Bottom Plug
Well Fluid (Mud)
Float collar
Float Shoe



Guide Shoe

Float Collar

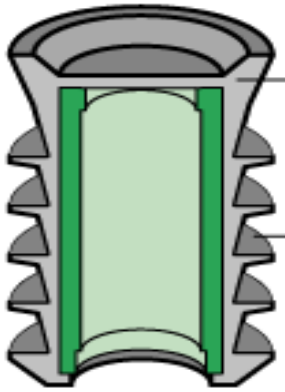
Rubber Plugs

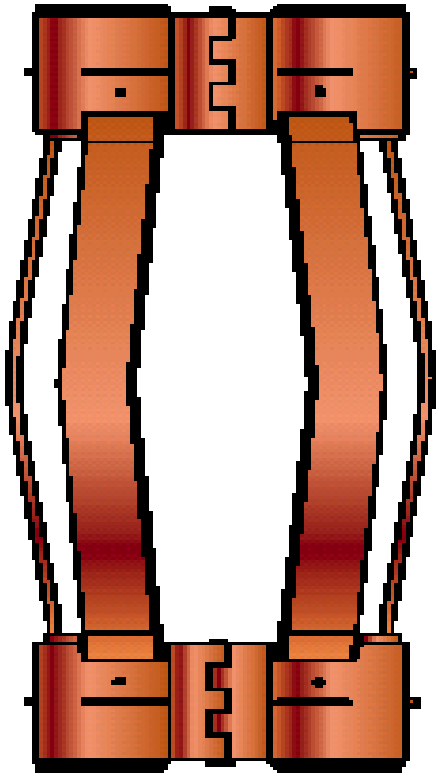


Halliburton Nonrotating (NR) Cementing Plugs

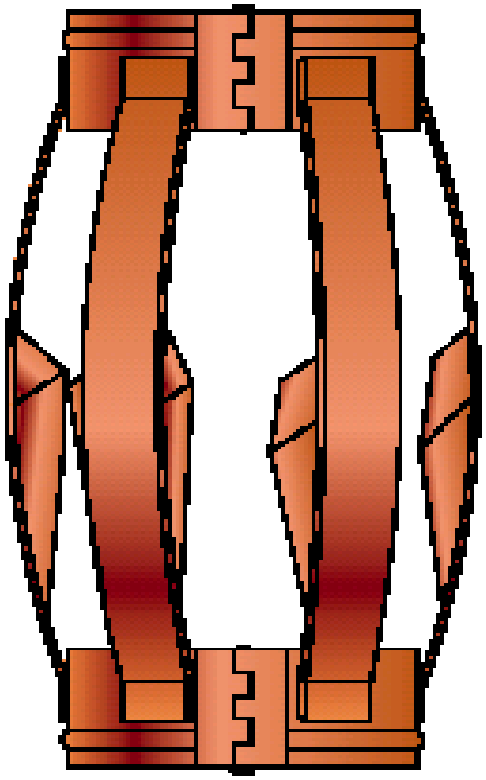
Top plug

Bottom plug





Halliburton
Nonwelded Bow-Spring
Centralizer



Halliburton
Welded Centralizer
with Turbofins

Stage Cementation: Reasons

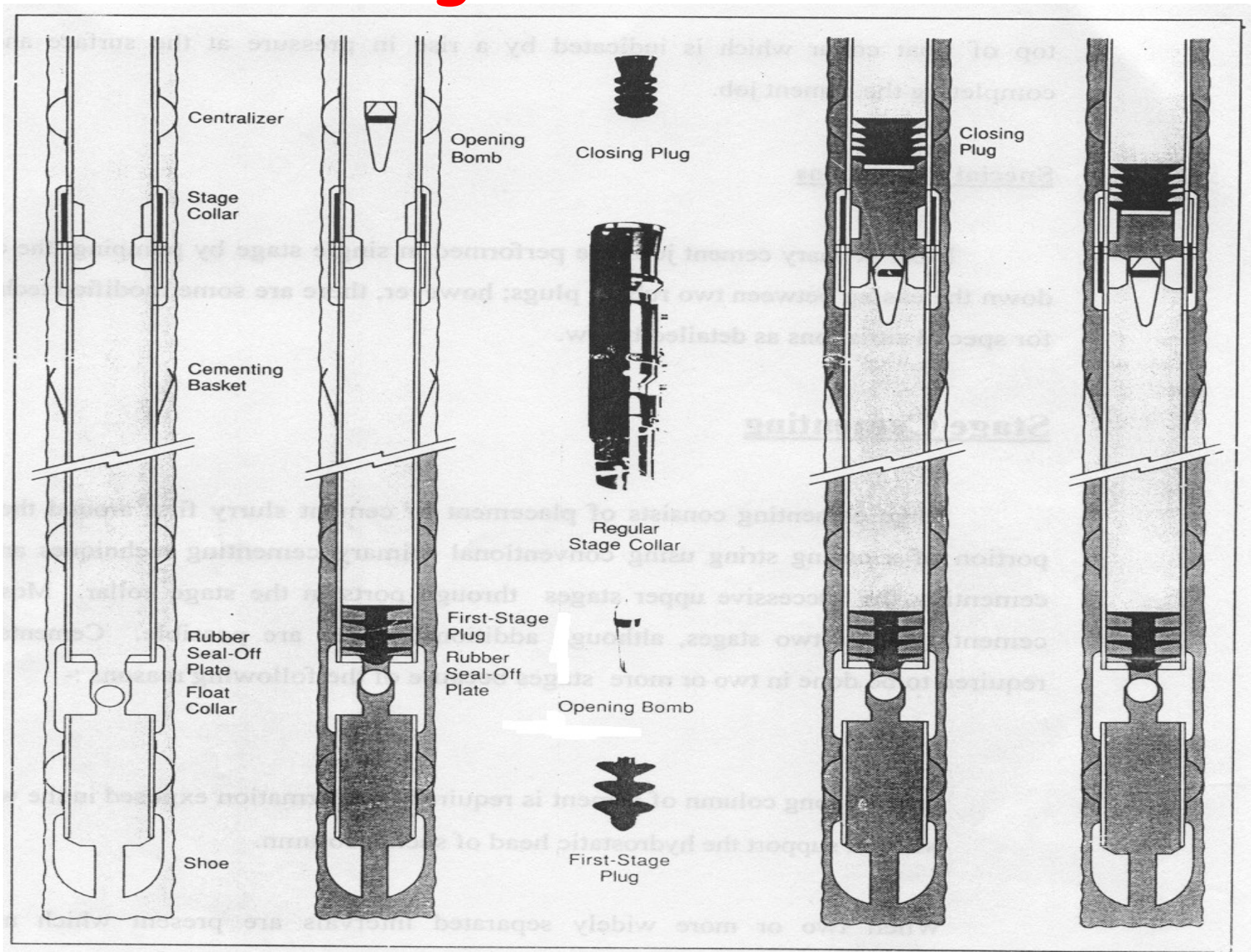
a.Down hole formations unable to support hydrostatic pressure exerted by a long column of cement

b.To cement wells having two or more zones of interest separated by long intervals

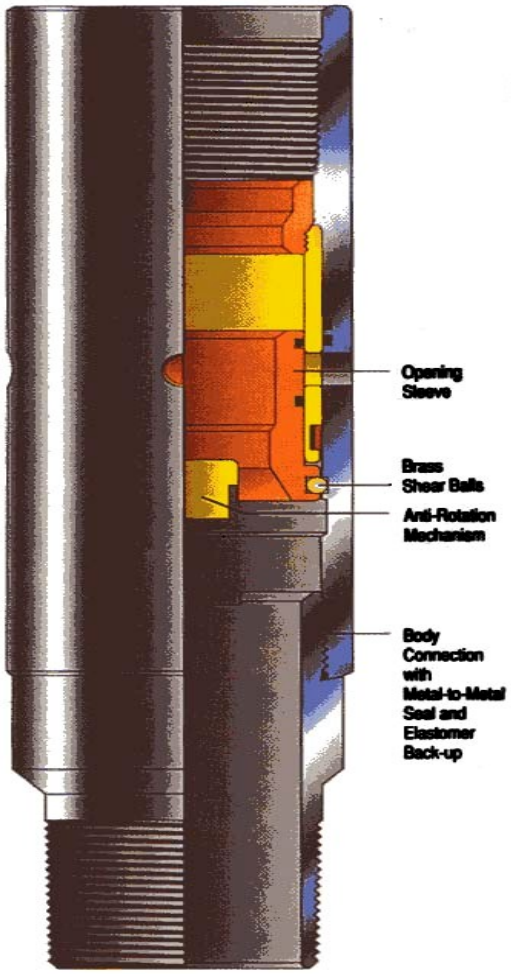
c.Limitations of cementing equipments

d.Cementing of high pressure gas zones & water producing horizons.

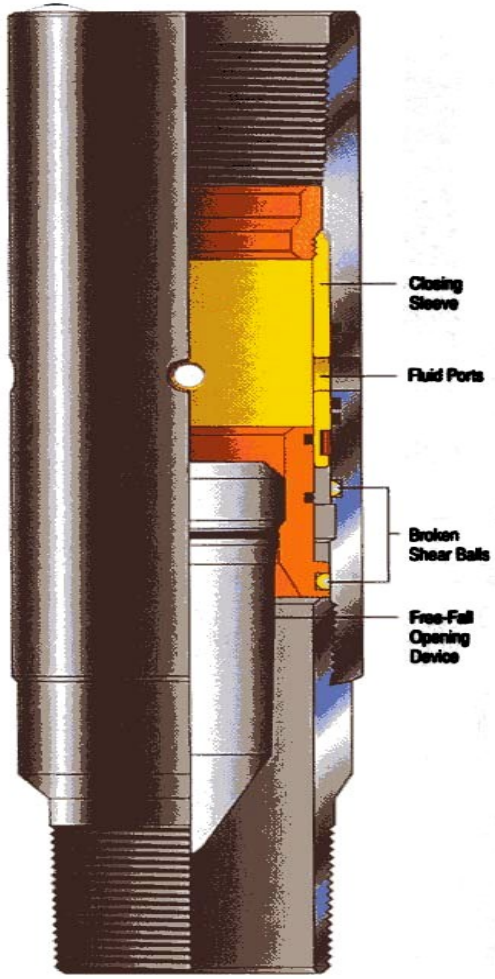
Stage Cementation



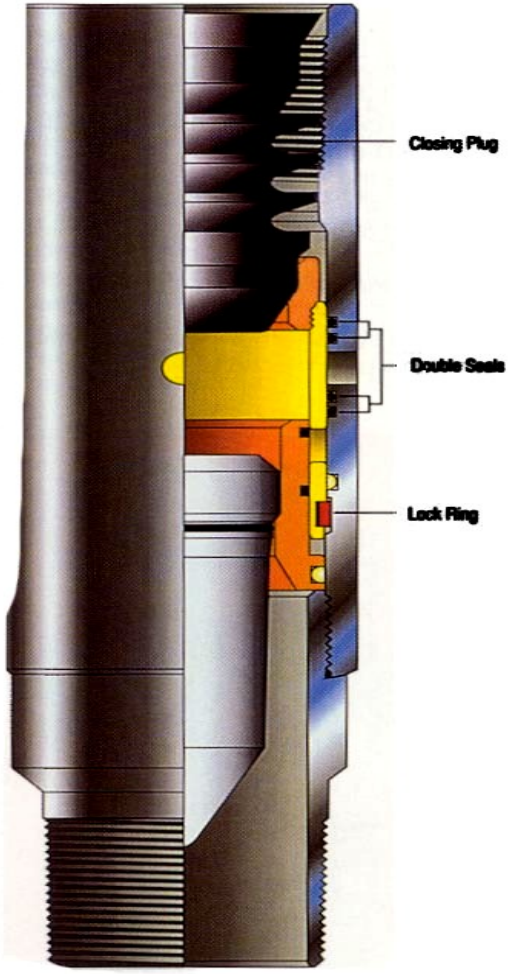
Stage Collar for Multi-stage Cementation



Running Position
Pin and Box threads are identical to the casing threads. Stage collar integral connection is designed for gas tightness. Seals on opening sleeve provide internal and external pressure integrity across the fluid ports.



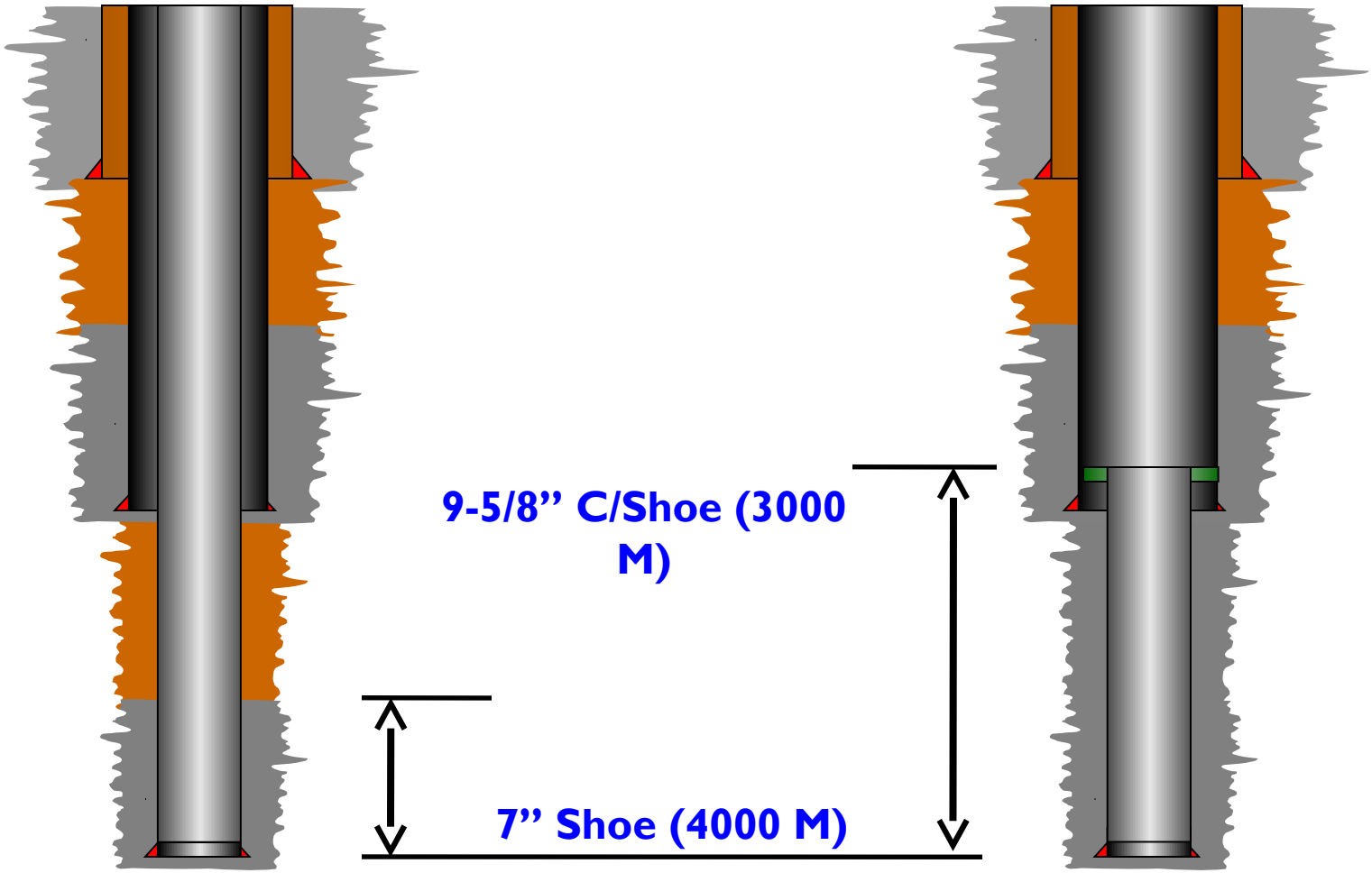
Opened Position
Opening device has landed and, after pressure is applied, the lower set of shear balls is broken and the sleeve shifts downward to uncover the fluid ports. Pumping operations can now be conducted through the stage collar.



Closed Position
The closing plug has landed and, after pressure is applied, the upper set of shear balls is broken and the sleeve shifts downward, shutting off the fluid ports. Double seals above and below the ports provide pressure integrity.

Liner Cementation

A liner is a standard string of casing, which does not extend all the way to surface, but is hung off inside the previous casing string.



Post Job Consideration

Waiting on cement

Compressive strength

500psi → Resuming drilling

2000psi → Perforation

Secondary Cementation

Any Cementing operation other than Primary Cementing Operation (Casing/ Liner Cementation) is referred to as "**Secondary Cementation**"

Types:

- → **Plug Cementing**
- → **Squeeze Cementing**

Plug Cementing

A cement plug of a specified length is placed across a selected interval in an open or a cased hole. The cement is normally pumped through open-ended drill pipe or tubing.

Reasons for setting a cement

1. To stop lost circulation during drilling.
2. Directional drilling and side tracking.
3. To plug back a depleted zone.
4. Abandonment.

Plug Job Application

Directional Drilling & Side-tracking

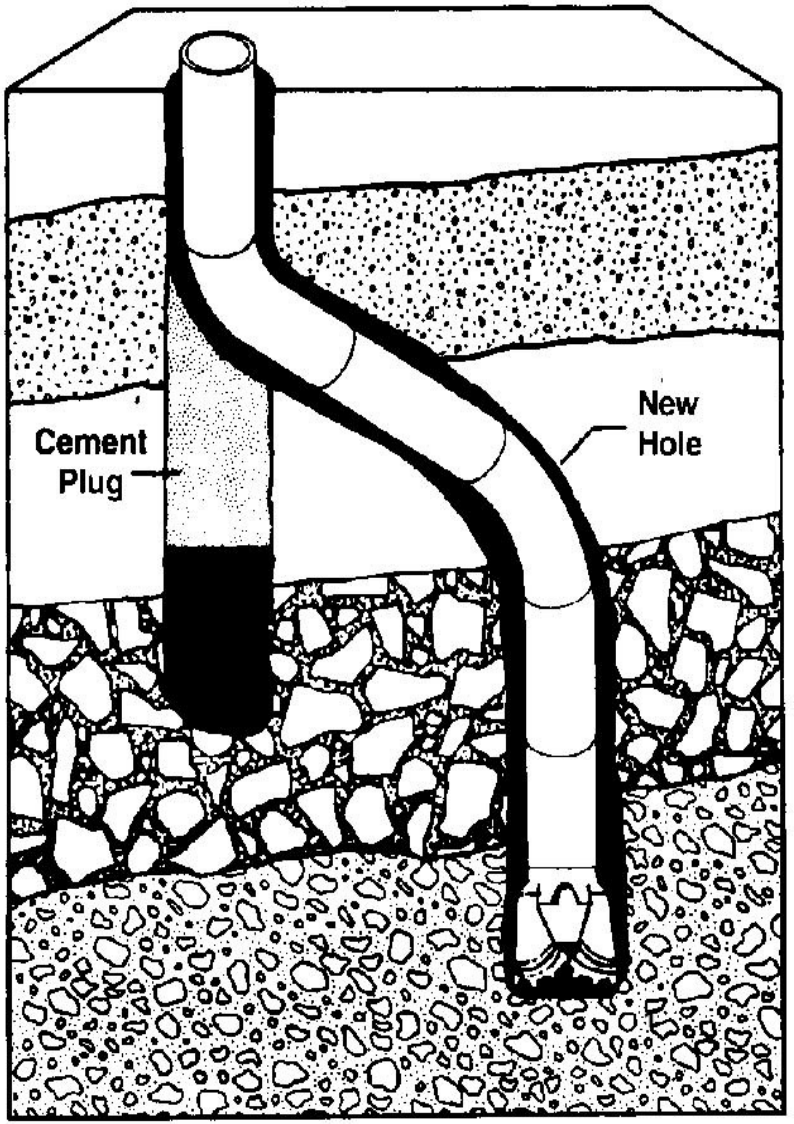


Fig. 1 —Directional drilling and sidetracking/ whipstocking.

Plug Job Application

Stopping Lost circulation

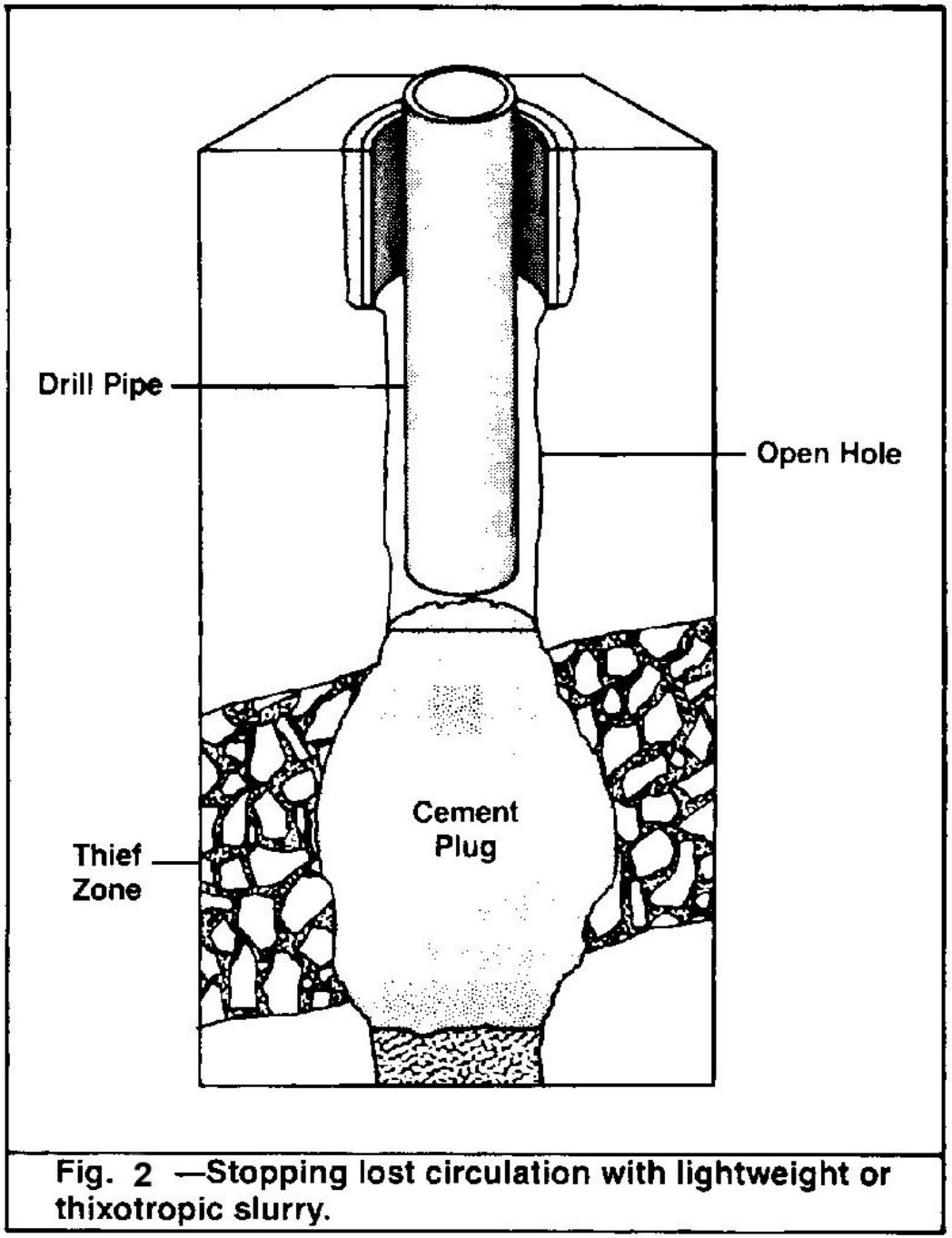


Fig. 2 —Stopping lost circulation with lightweight or thixotropic slurry.

Plug Job Application

Zonal Isolation

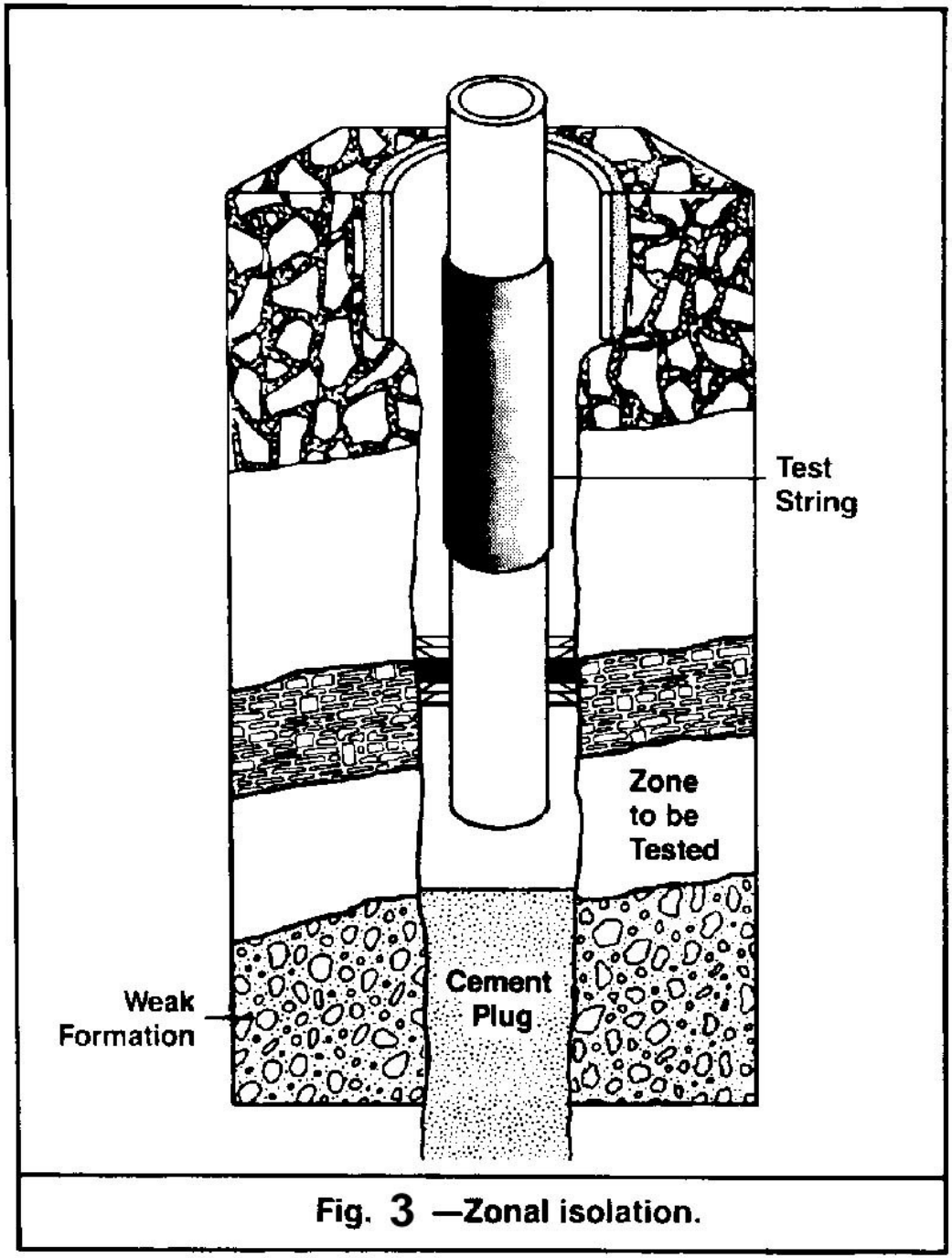


Fig. 3 —Zonal isolation.

Plug Job Application

Abandonment

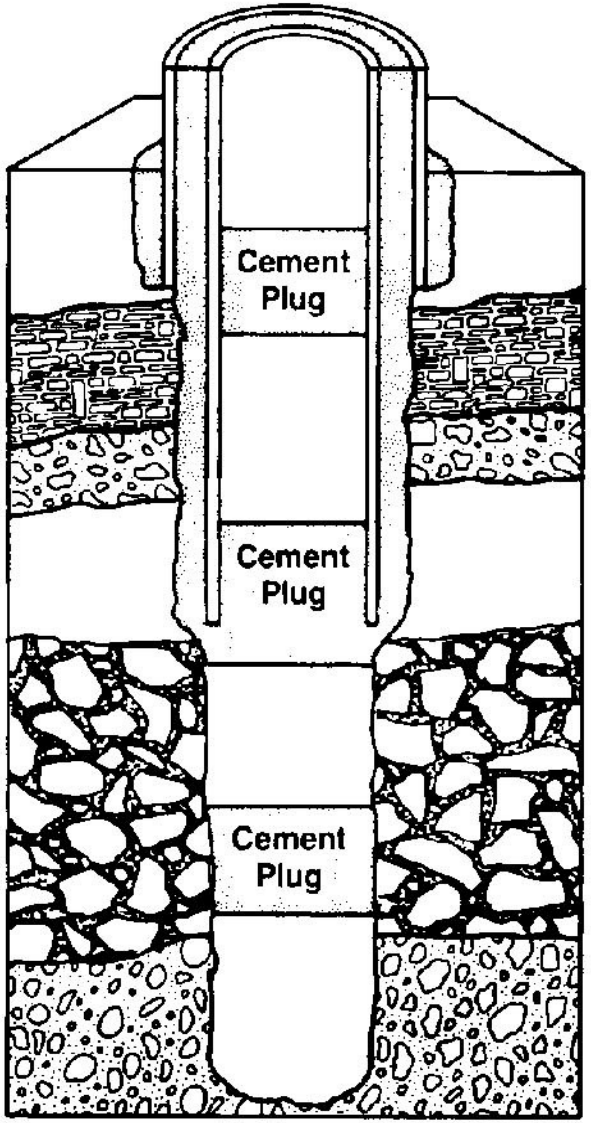
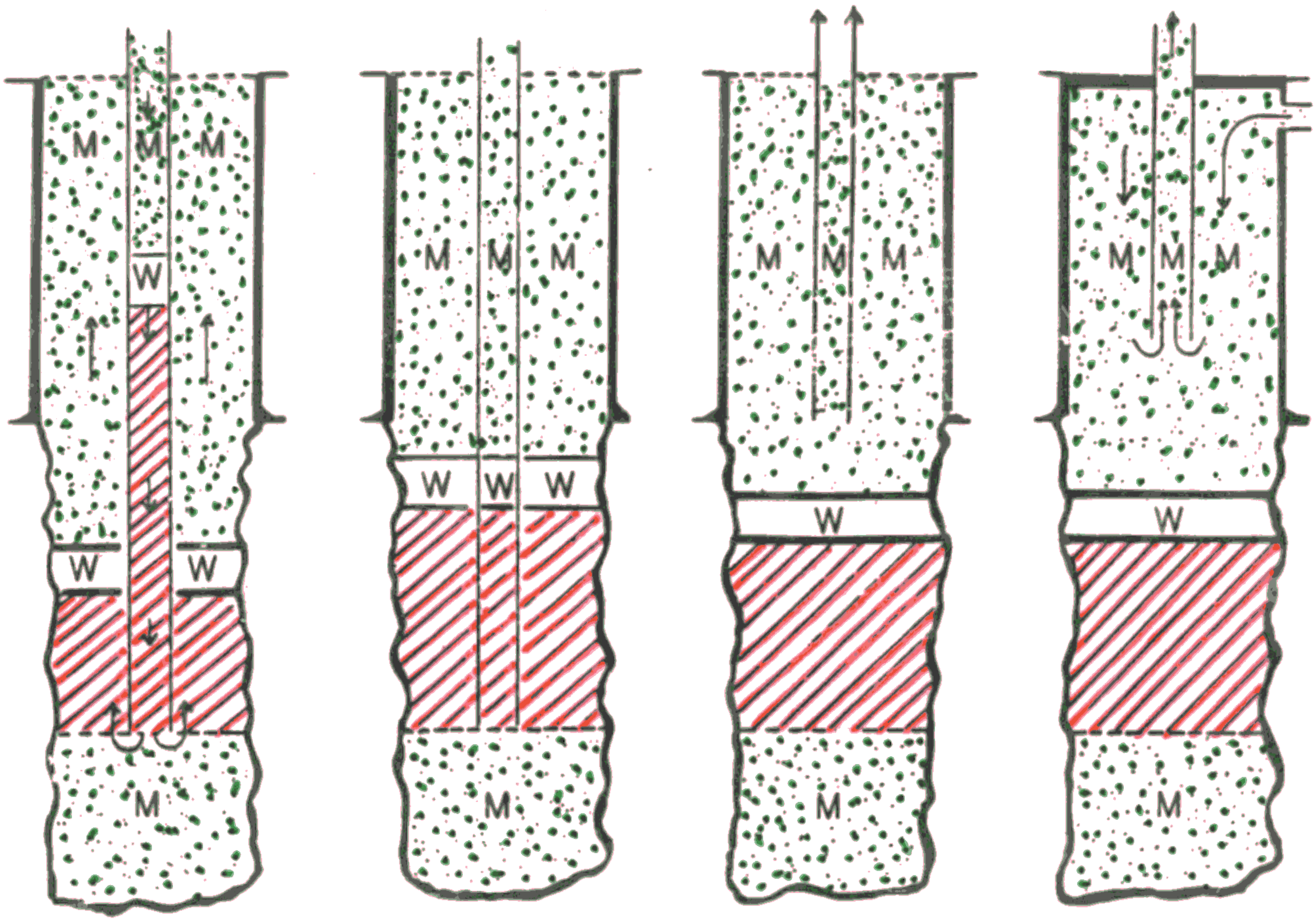


Fig. 4 —Abandonment.

Technique: Balance Plug Method



(a)Displacing

(b) Cement,water
and mud balanced

(c) Pulling string
above top of cement

(d) Reversing out

Squeeze Cementing

The most common remedial method used

The slurry is forced by pressure to a specified point in the annulus to cause a seal at the point of squeeze.

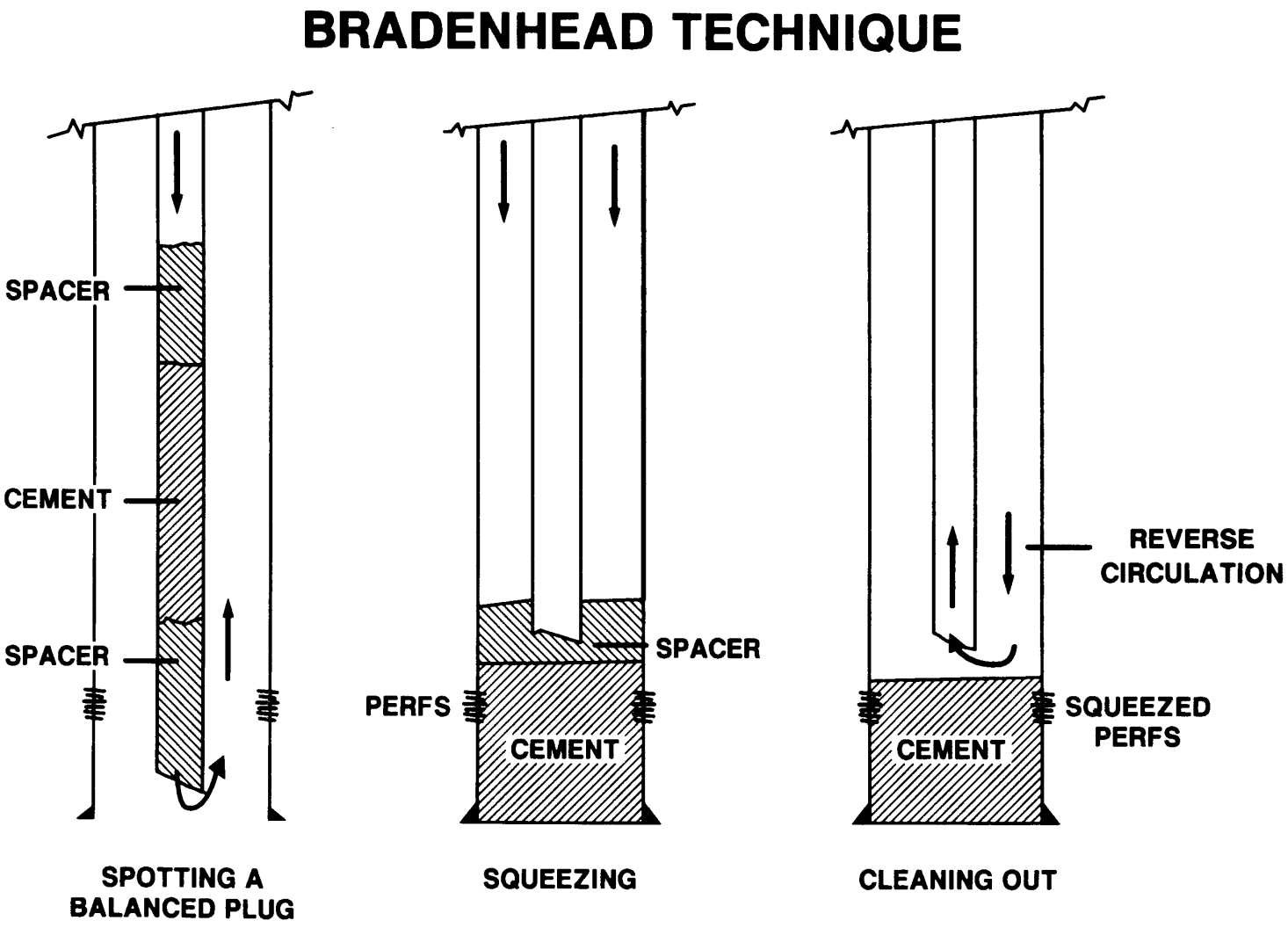
SQUEEZING TECHNIQUES

1. BRADENHEAD.
2. PACKER SQUEEZE.

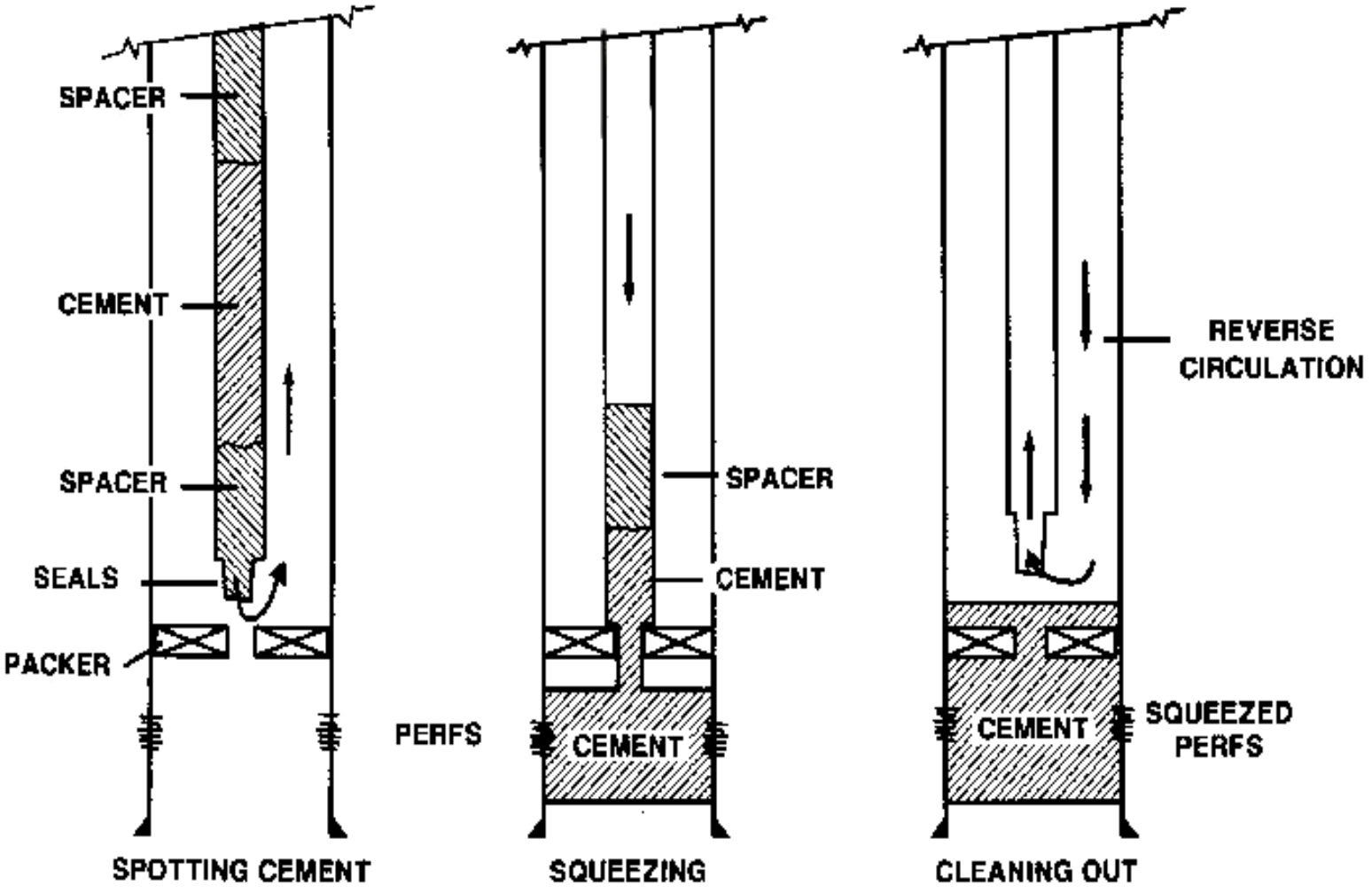
CLASSIFICATION BY PRESSURE

1. LOW PRESSURE SQUEEZING.
2. HIGH PRESSURE SQUEEZING.

Squeeze Techniques



Squeeze with Packer (Cement Retainer)



Squeezing Techniques

2.High Pressure squeezing

Injection press > Formation fracture press

1.Low Pressure Squeezing

Injection press < Formation fracture press

Injection press =

Hydrostatic head of the existing fluid + Pressure applied on the surface

Applications :

1. Supplement a faulty primary cement job.
2. Reduce water/oil, water/gas, or gas/oil ratio.
3. Repair casing leaks.
4. Stop lost circulation in open hole while drilling.
5. Supplement primary cement around a liner by squeezing the top of the liner (during primary cementation)
6. Sealing leakage of the liner top (in case of failure after primary cementation).
7. Abandonment of single zones.

APPLICATION - SQUEEZE JOB

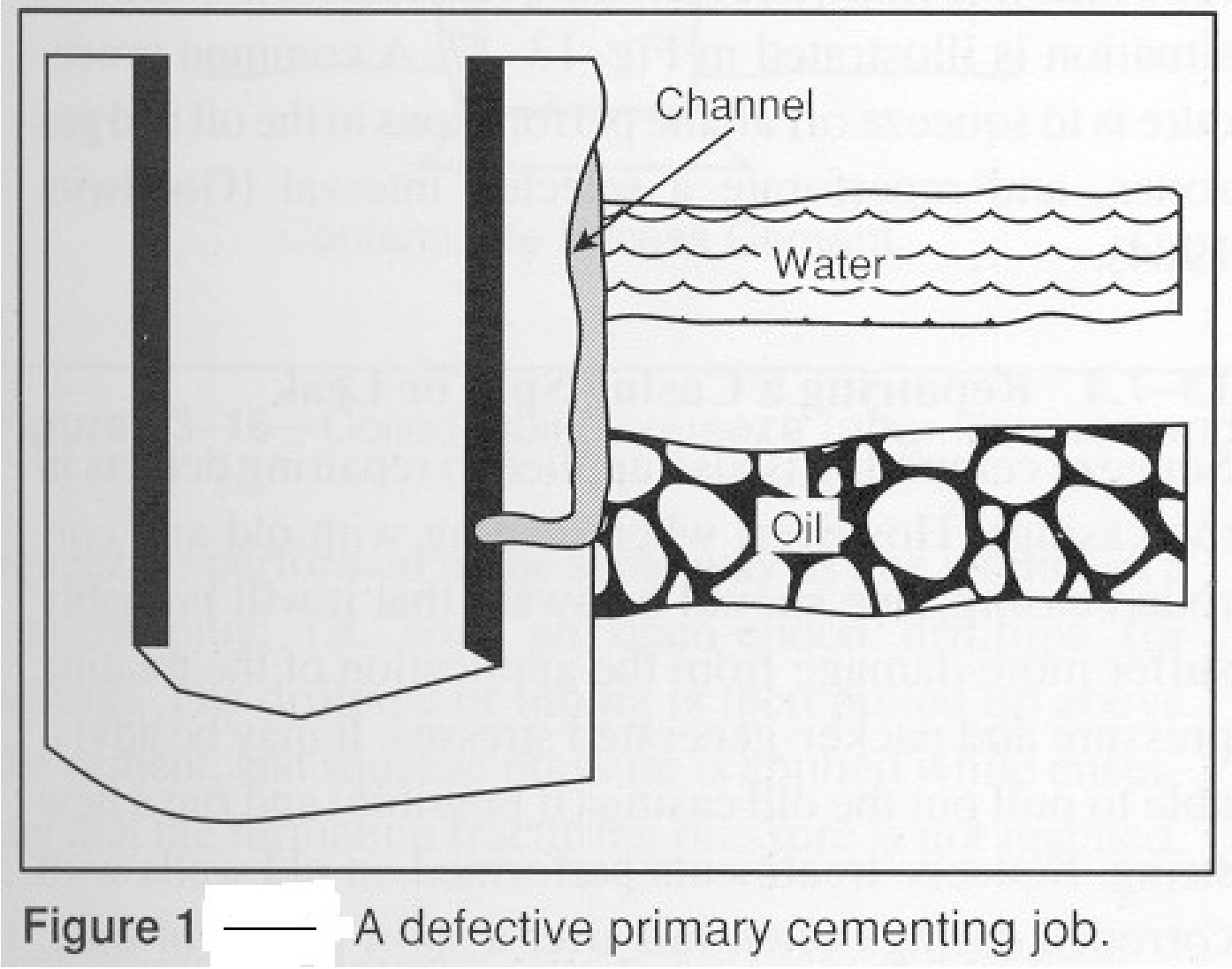


Figure 1 —— A defective primary cementing job.

APPLICATION - SQUEEZE JOB

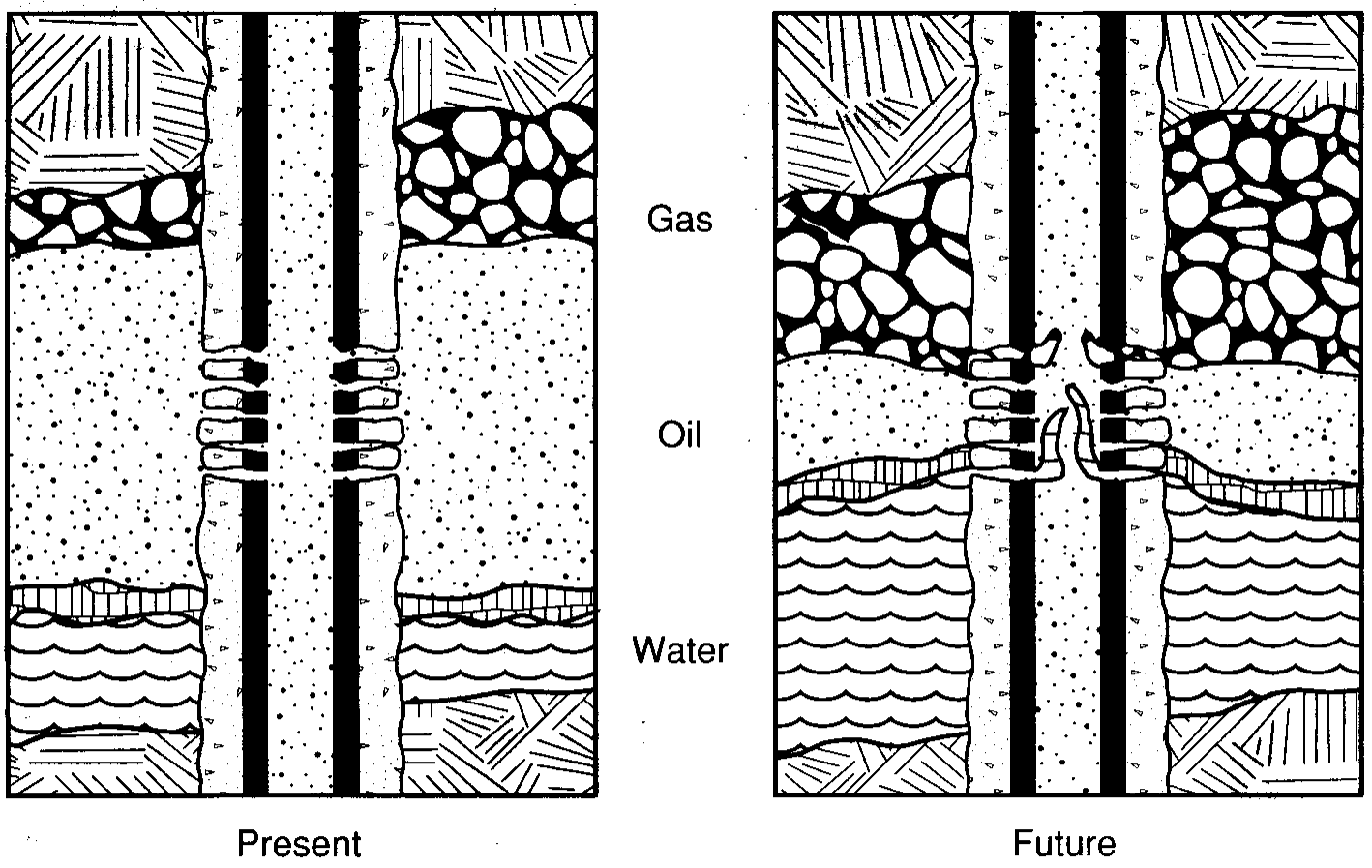
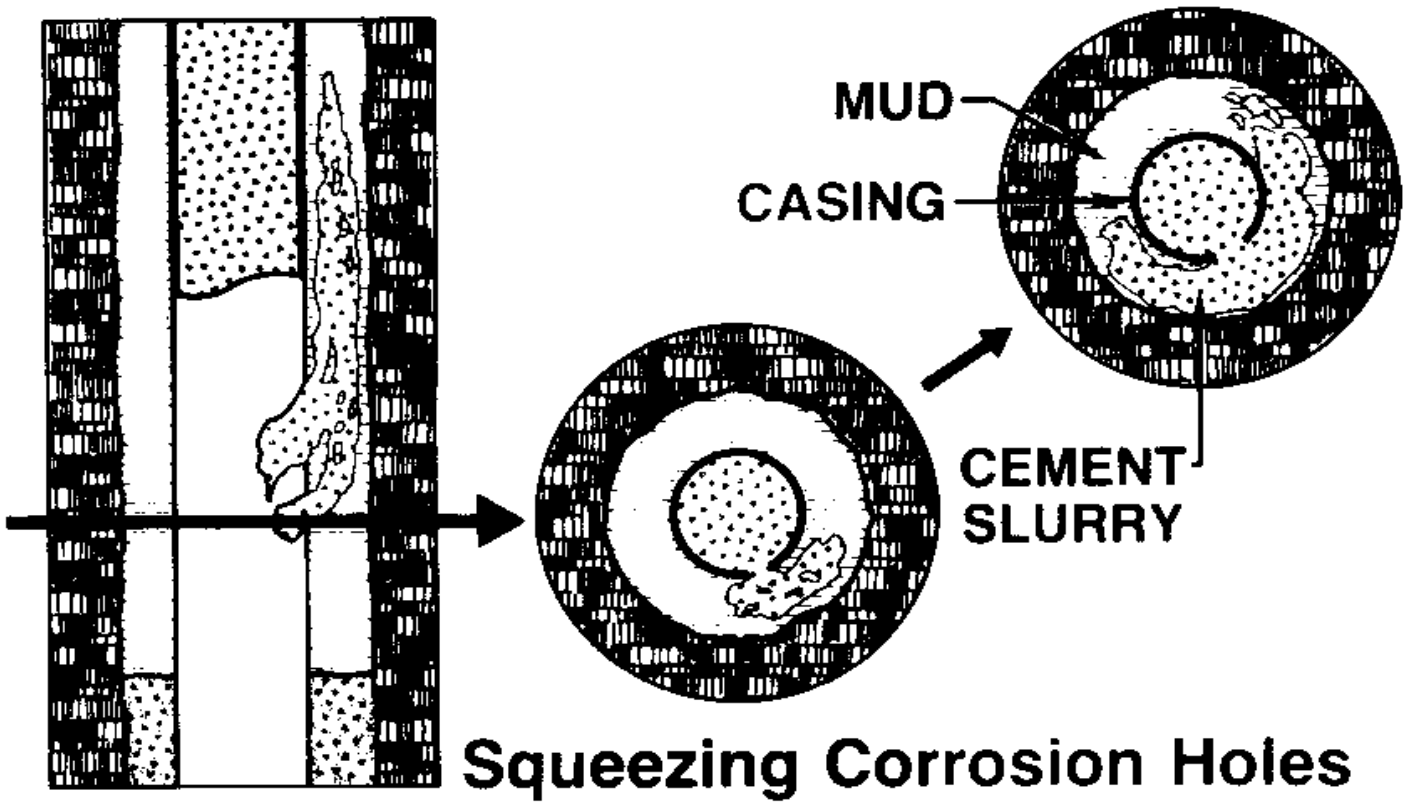


Figure 2 —Water or gas invasion into oil zone

APPLICATION - SQUEEZE JOB



Squeezing Corrosion Holes

Incomplete Coverage of Annulus Around Holes

FIG. 3

SQUEEZE JOB - TYPES

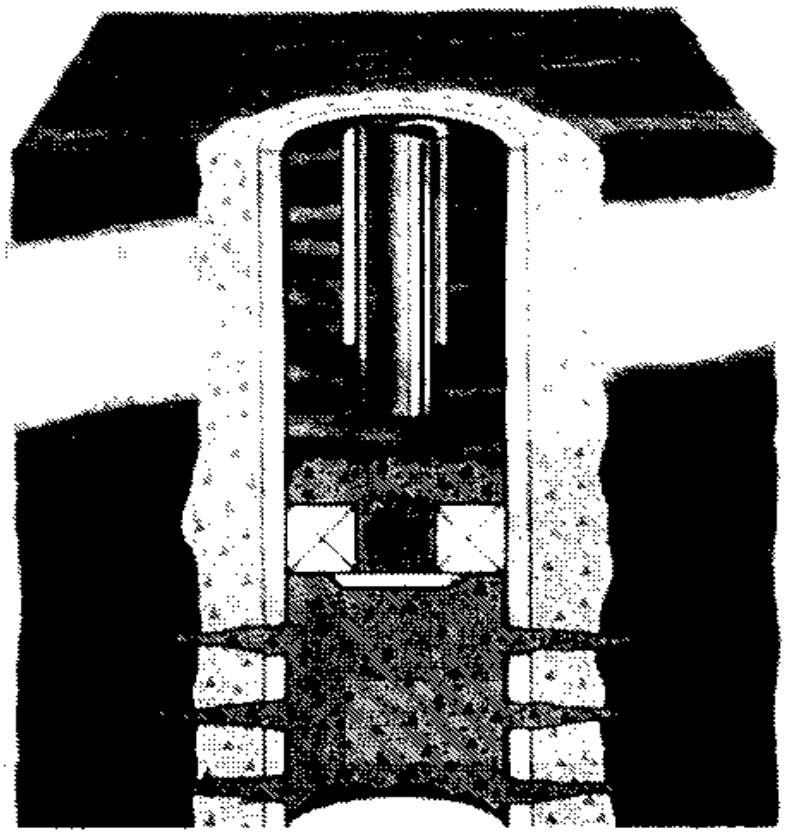
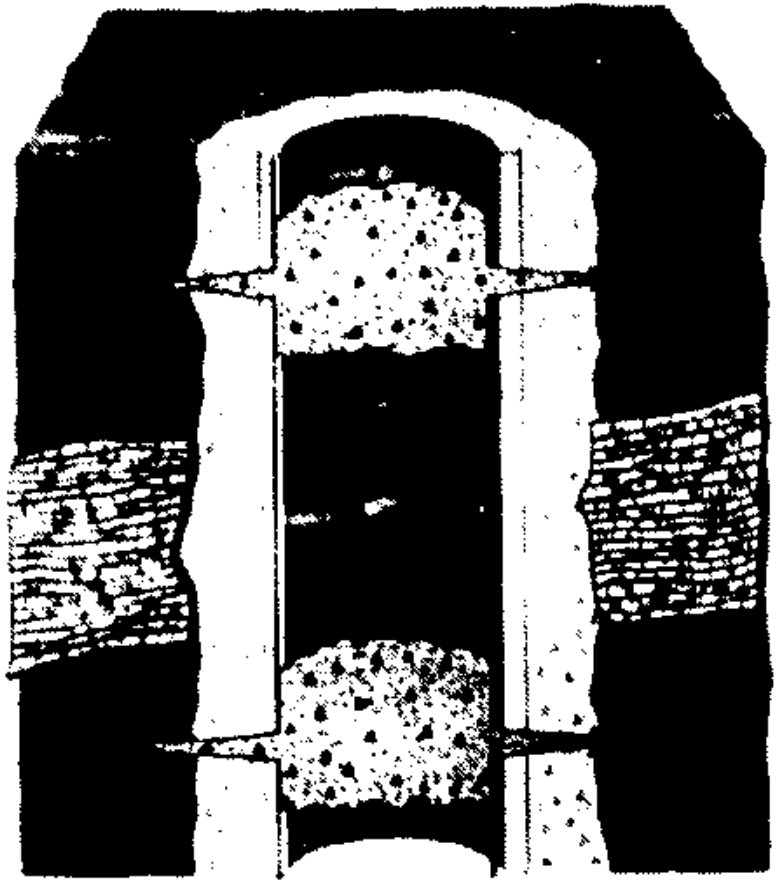


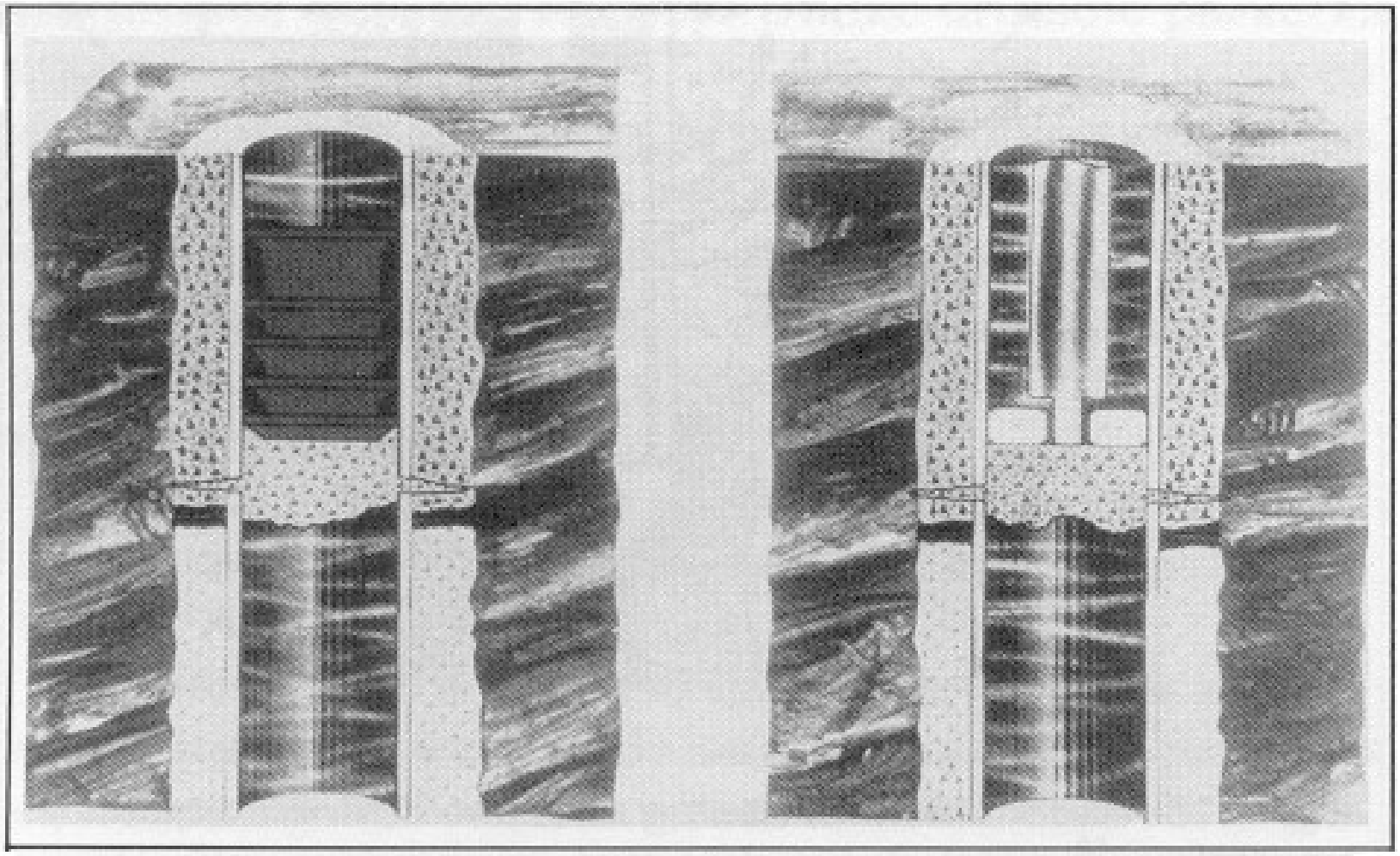
Fig. 4 —Abandonment.

SQUEEZE JOB - TYPES



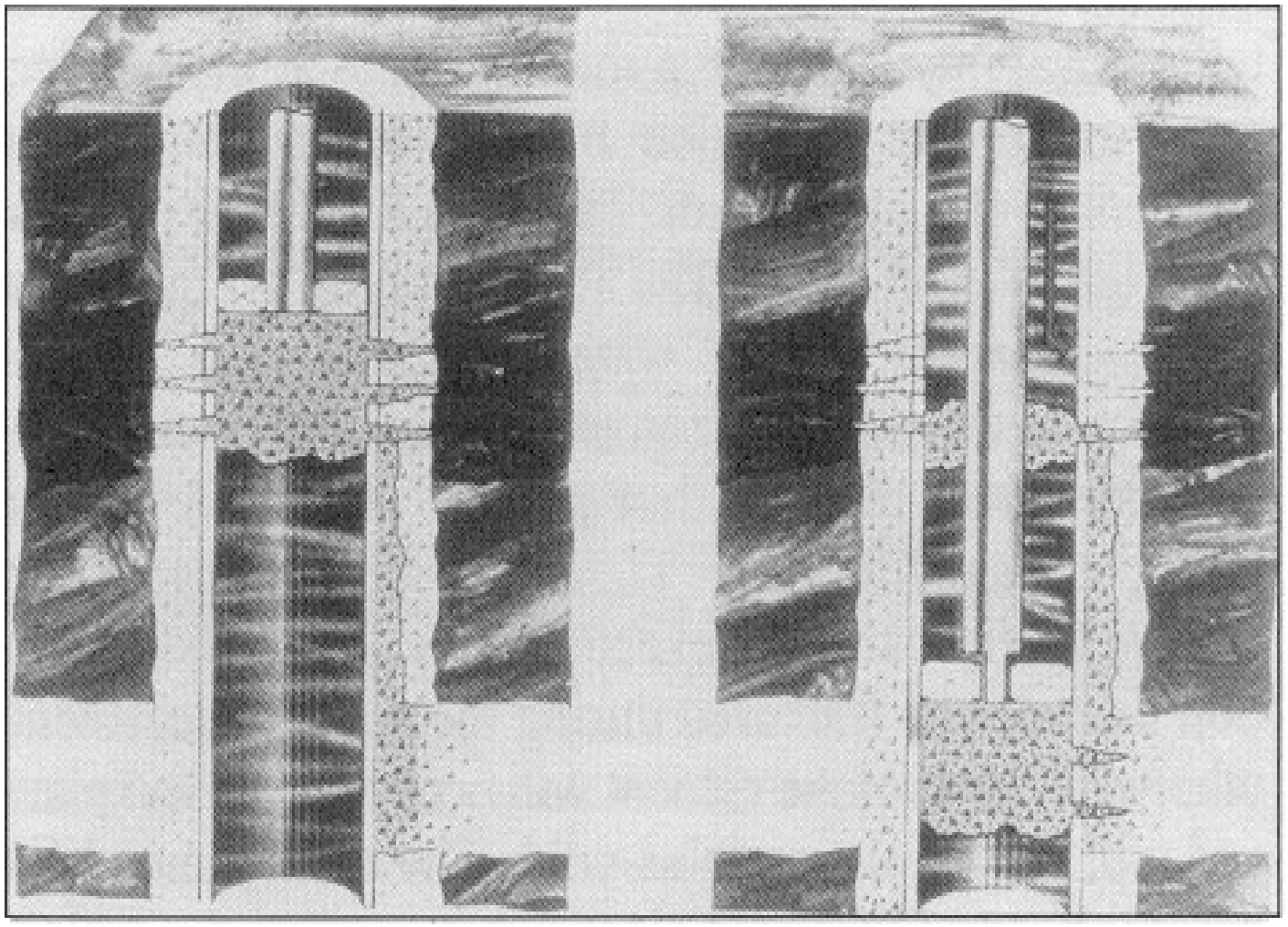
Block squeeze

SQUEEZE JOB - TYPES



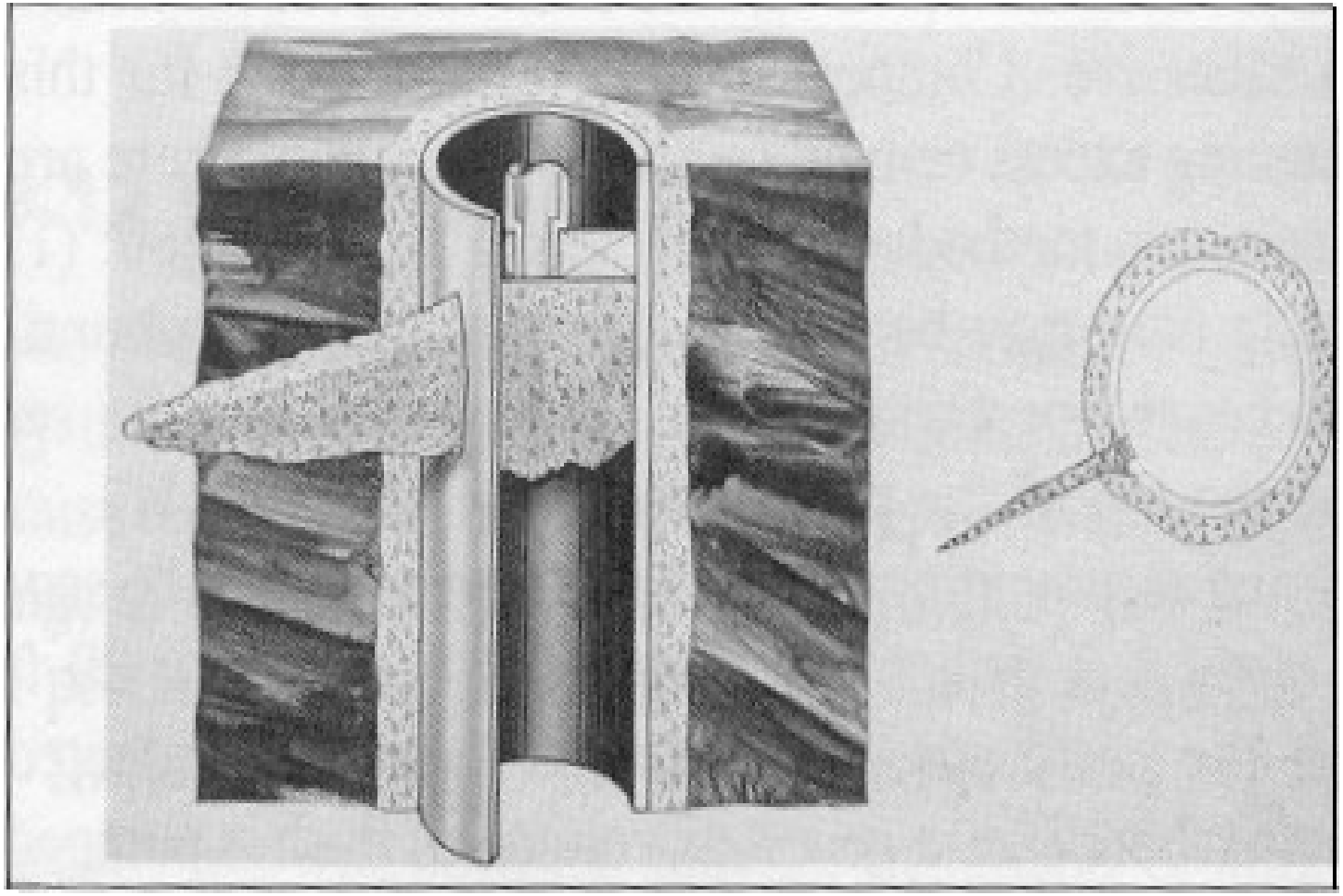
RE-CEMENT SQUEEZE

SQUEEZE JOB - TYPES



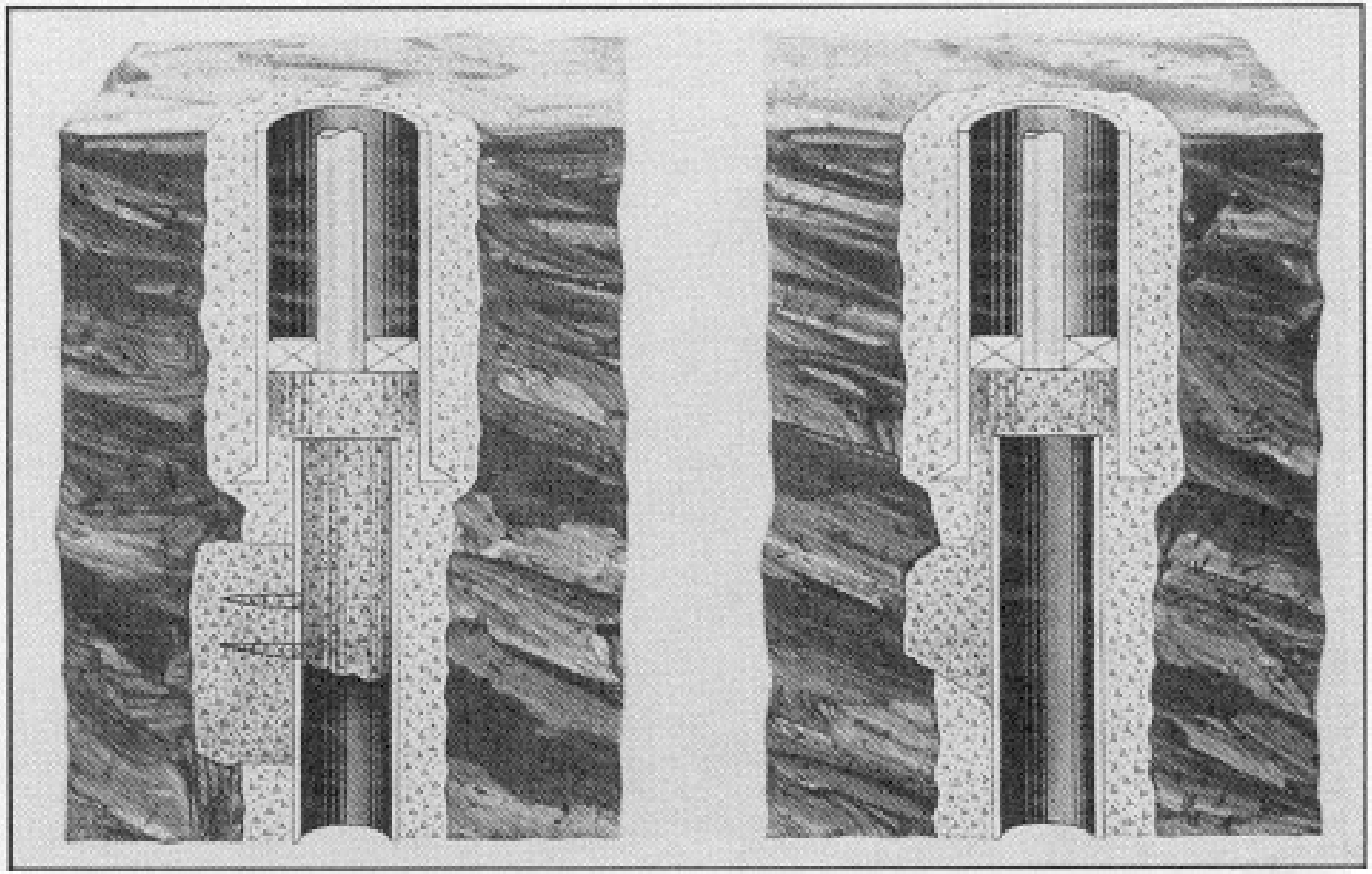
CHANNEL SQUEEZING

SQUEEZE JOB - TYPES



CASING SPLIT

SQUEEZE JOB - TYPES



LINER SQUEEZE

Summery

- Cementing is one of the most important operation in drilling & producing a well.
- Cement operation is a **“one shot”** process with no second chance, unlike mud is run as a dynamic, continuously changing process.
- The success of a cementing operation is affected by many factors.
- Everything, therefore, needs to be done to ensure that the first attempt is the very best possible job.

It is very critical to conduct a

successful primary cement jobs

to achieve well integrity

-: T H A N K S :-