• **More modern antitank mines** have been designed with a view to striking the armoured vehicle in its vital parts, including the crew-habitacle.
• With the development of «influence sensors» (acoustic, seismic or infra-red), which are particularly well-adapted to antitank warfare, this variety of set-up, unsuitable as it is for mass sowing, has been consecrated to anti-mine-clearance operations against clearance vehicles equipped with forward anti-mine rollers, for example

ANTIPERSONNEL MINES AND ANTITANK MINES

Antitank mines are generally protected by antipersonnel mines which are intended to get in the way of mine clearance operations. The number of active antitank mines is therefore necessarily less than that of antipersonnel mines. Antitank mines are obviously not well-suited to low-intensity conflicts in which tanks are a rarity and in which the deployment will be almost exclusively of antipersonnel devices. Antitank mines are also very rarely found on terrain which is unsuitable for the deployment of tanks. e.g., forests, paddy-fields, etc.. Thus, in Afghanistan, for one antitank mine cleared a hundred antipersonnel mines are cleared and, in Cambodia, the figure is of 200 antipersonnel mines. **(See appendix 3, page 71, «General Development of Mines»).**

INDUSTRIAL PRODUCTION OF MINES

Each year, between 50 and 100 million antipersonnel mines are manufactured by a hundred or so firms. 55 countries have produced between them 362 models of mine (number per country given in brackets); 36 of them have exported mines

Argentina	(3)	Austria	(16)
Belgium	(8)	Belarus	
Bosnia	(16)	Brazil	(2)
Canada	(1)	Chile	(5)
China	(21)	Cuba	(1)
Cyprus	(1)	Czech	(6)
Denmark	(4)	Egypt	(5)
Finland	(1)	France	(14)
Germany	(18)	Greece	(2)
Hungary	(7)	India	(2)
Iran	(1)	Iraq	(5)
Israel	(5)	Italy	(36)
Japan	(2)	Mexico	(1)
Myanmar	(1)	Netherlands	(3)
Nicaragua	(1)	N Korea	(4)
Norway	(1)	Pakistan	
Peru	(1)	Philippines	(1)
Poland	(1)	Portugal	(8)
Rumania	(3)	Russia	(31)
Serbia		Singapore	(3)
S Africa	(5)	S Korea	(3)
Spain	(8)	Sweden	(21)
Switzerland	(5)	Taiwan	(4)
Thailand	(2)	Turkey	(1)
U.K	(9)	Ukraine	
USA	(37)	Venezuela	(1)
Vietnam	(18)	Zimbabwe	(3)

Note: Russia has inherited most of the ex-Soviet plants. Bosnia most of those of the former Yugoslavia, and the Czech Republic all of those of the former Czechoslovakia, the Czech Republic has, since the break-up of Czechoslovakia, officially ceased all exporting of antipersonnel mines

DISTRIBUTION OF CATEGORIES OF MINES

By known model

Production area:	NATO	Eastern Bloc*	Other countries
Antipersonnel	44%	45%	63%
Antitank:	44%	39%	27%
Other types:	12%	16%	10%

** in virtue of similarities in production, what is meant by «Eastern bloc» is both the former members of the Warsaw Pact and countries from ex-Yugoslavia*

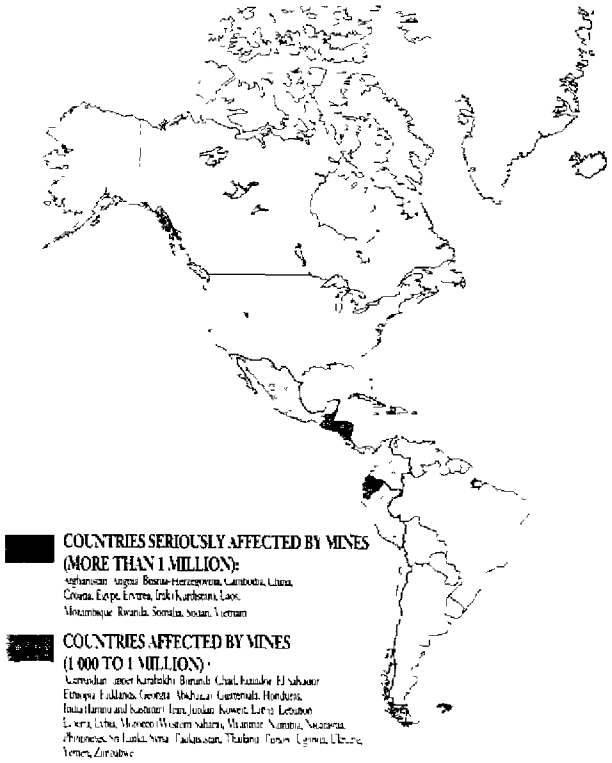
Polluted countries :

Distribution by number of active mines

Afghanistan	12 millions	Zimbabwe	2-3 millions
Angola	12 millions	Chad	< 1 million
Iraq	12 millions	Ruanda	< 2 millions
Cambodia	9 millions	Sudan	> 1 million
Kuwait	5 millions	Ethiopia	< 1 million
Mozambique	2 millions	Erythrea	< 1 million
Vietnam	2-3 millions	Liberia	?
Croatia	3 millions	Salvador	< 100,000
Bosnia-Herz.	3 millions	Nicaragua	135,000
Sahara	1 million		
Somalia	1 million		

Note: Given the secrecy surrounding the production, circulation and particularly scattering of mines, the figures related to their use are only estimates

MAP OF MINE AFFECTED COUNTRIES



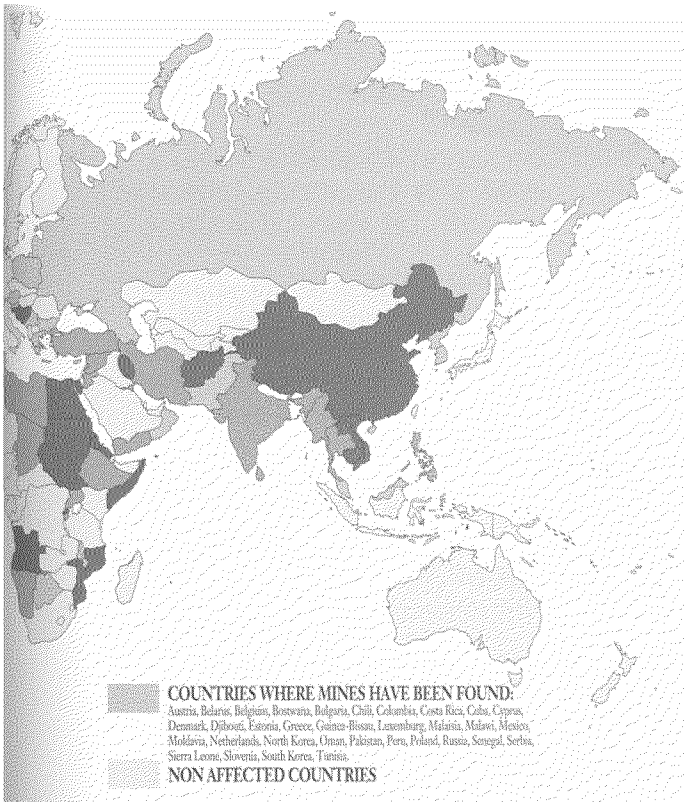
Source : Handicap International.

MINE EXPORTATION OVER THE LAST TWENTY YEARS

85% of mines neutralized in 1993 and 1994 had been manufactured in a foreign country. Thus producers and exporters bear a heavy responsibility in the problem of such mines. During the last 20 years, the principal mine-exporting countries have most certainly been China, Italy and the (ex-)U.S.S.R.. The former Czechoslovakia and the former Yugoslavia have also played an active part in the proliferation of mines. The U.S.A., the U.K. and Belgium have in the past been serious competitors for these countries; their export-activity, however, sharply dropped off during the 1980s and has now officially ceased altogether. In the late '80s, South Africa, Germany (both Federal and East), Bulgaria, Egypt, France, Hungary and Pakistan were to be counted among the mine-exporting nations.

MINE TRADE CIRCUITS

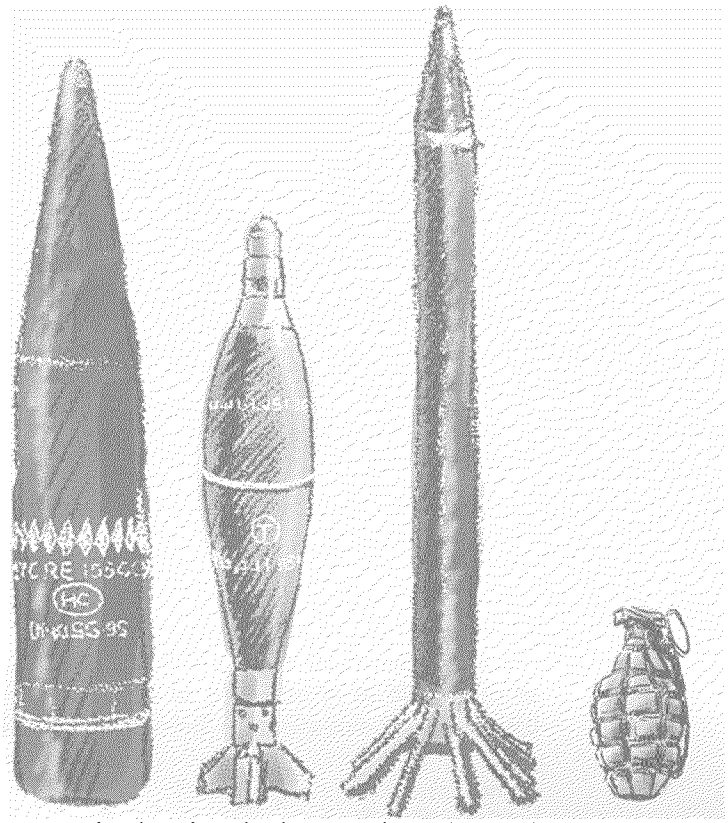
Mine clearance operations have made it possible to break down the trading circuits for antipersonnel mines: Some of these transfers were made without the control of the producer country. Thus, for example, certain French antipersonnel mines found in southern Africa had in fact been supplied to the warring faction by a third country which was a client of a French manufacturer which had previously been an exporter. Other supplies served for nothing more than the build-up of stock-piles which have never been put to use (NATO countries) and do not figure in the table in **(See appendix 4, page 73, «Mine Trade Circuits»).**



The imminence of new international restriction agreements regarding the deployment of and trade in mines has very likely increased the number of mine-related transactions- the veils of secrecy surrounding which do not, however, allow it to be known just how far they may have been taken.

UNEXPLODED PROJECTILES

Apart from mines, which are designed «to be set off by an unintentional action by the enemy», there are also other pyrotechnic devices which, when they malfunction and/or have been booby-trapped, may be equally dangerous.



ABANDONED OR DEFECTIVE PROJECTILES

Stocks of projectiles (shells, bombs, rockets, etc) which have been abandoned, often in a hurry and in conditions which may not be specified in advance, may, when they are later found, need to be treated in a way which is much the same as an actual mine-clearance operation. The simplest booby-trapping, or indeed a mere oversight in their storage, may lead to the explosion of several tons of munitions, with all that may entail.
The percentage of shells, bombs and grenades which fail to detonate when fired is by no means negligible Some of this kind of unexploded devices will remain harmless, but others may be set off by the slightest event- and, in case of uncertainty, all of them will need

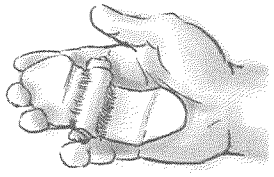
to be dealt with. Such defective munitions may (in the case, for example, of large shells or bombs) contain an explosive charge a good deal more powerful than any to be found in mines. Moreover, such charges, intended for purposes quite different from those of mines, will very often be no less different in nature.

• **Wholesale pollution:** by way of example, in Cambodia, during clearance operations in a 14.5 sq. km minefield, 33,290 antipersonnel mines, 272 anti-tank mines but also 309,329 unexploded projectiles were neutralized,

• **Long-term pollution:** It is this sort of device, mass-scattered over Eastern France and Normandy during two World Wars, that French Civil Security artificers are still busy neutralizing today, at a rate of 800 tonnes per year The field of Verdun (1916-17) had no less than 12 million shells shallowly buried in it and still ready to go off.
German mine-clearance squads are now at work on defective shells left by the Soviet artillery in firing-range containers in the former East Germany, after 50 years of use.

THE CASE OF CARGO-PROJECTILES AND SUB-MUNITIONS

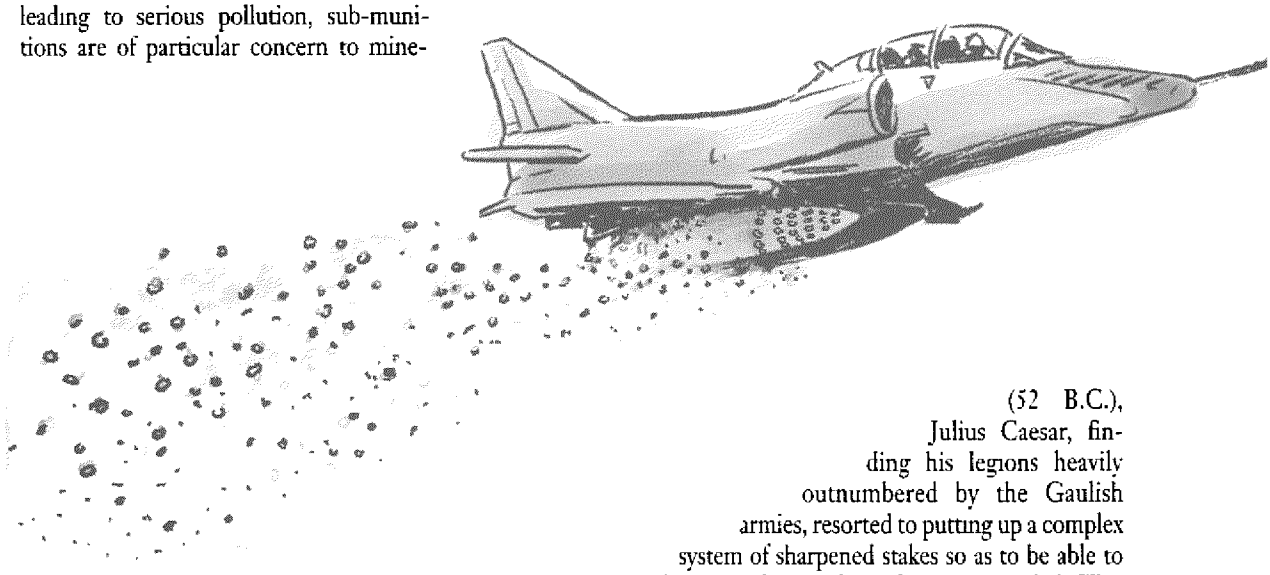
Of munitions other than mines but also leading to serious pollution, sub-munitions are of particular concern to mine-clearance operators and their superiors. The reason for this is that the threat they represent is extended in both time and space very much as is that posed by mines themselves.
Although such weapons were also to be found during the two World Wars, it was more particularly as of the 1970s that this kind of projectile was fully developed and mass-produced, taking its present form of «sub-munitions», which is to say: «any munitions, which, in order to fulfil its purpose, separates off from a primary ammunition». Such a «primary» ammunition, also known as the «cargo», may be a bomb, a shell or a rocket.
The first mass deployments of such cargo- and sub-projectiles took place in Indochina in the 1970s. During the '80s, sub-munitions were used by the Soviets in Afghanistan and by the South Africans in Angola Later on, during the course of the Gulf War (1990-91), the Allied forces scattered not less than 24 million such sub-munitions over the war-zone. Most recently, sub-ammunition rockets were fired by the Krajina Serbs against the civilian population in the centre of Zagreb in May of 1995. **(See appendix 5, page 75, «Sub munitions»)**



PFM Butterfly mine (USSR)

2. DIVERSITY OF DEPLOYMENT

It will be remembered that, during the siege of Alesia (52 B.C.), Julius Caesar, finding his legions heavily outnumbered by the Gaulish armies, resorted to putting up a complex system of sharpened stakes so as to be able to cut down on the number of sentries needed. This system of defence did indeed manage to break the Gauls' cavalry attacks and without a doubt played a part in the Roman victory.

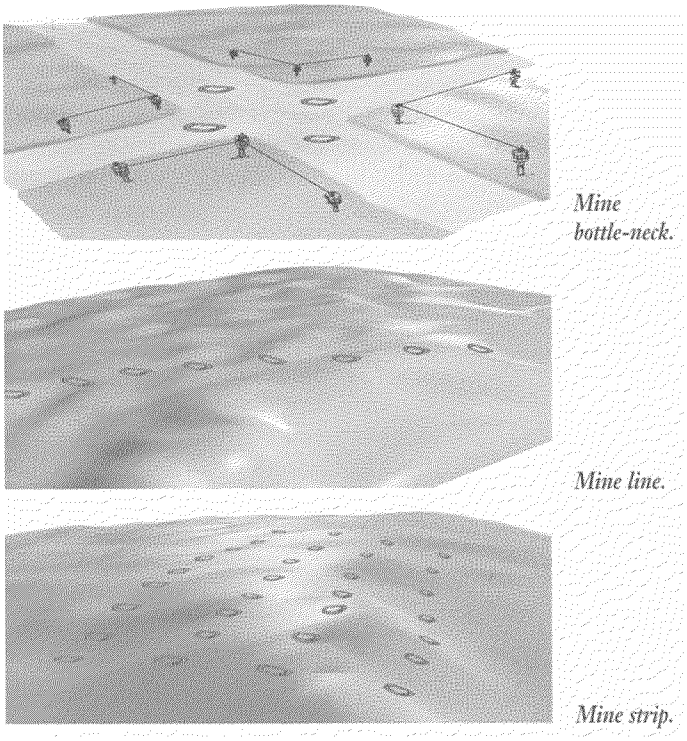


This example, drawn from well before the time of General Rains (1862) and his mines, sheds a clear light on what wartime commanders have found so interesting in mines: i.e., freeing a certain number of soldiers from certain sentry-duties to get them back into service or combat.

USE OF MINES BY REGULAR FORCES

For a modern army, equipped with powerful weapons, the use of mines is of essentially defensive interest: enemy units attempting to break through are channelled into the line of artillery fire, made all the more lethal by the fact that the assailants are being held up by the anti-mine work necessitated.

This deployment doctrine, which is very widespread, does however raise a certain number of questions, in as much as, speaking from the experience of his forces, Gen. Gray, ex-Commander in Chief of the U.S. Marine Corps, stated in 1993, «I see no operational advantage in the mass employment of mines and I am not aware of any situation during the Korean War nor during the five years which I spent in South East Asia, nor in Panama nor during Desert Shield/Desert Storm where our resorting to mine warfare really channelled the enemy destructively.»



Mine bottle-neck.

Mine line.

Mine strip.

Classification of «mined areas»

The deployment of mines amounts to «mortgaging» a more or less large area, from which the mine-layer excludes himself quite as much as he excludes the enemy. Mines are thus to be laid in a certain series of specific cases, as otherwise it will be the movement of friendly forces which is hindered, with possibly terrible consequences for them.

Once laid, mines give rise to «mined areas»: laying just one isolated mine would have no point, for a regular army, and corresponds more to a terrorist intention. According to their increasing size, «mined areas» are classified as follows:

- **«mined position»** half a dozen mines laid at a particular place (entrance to a building, well, ford, bridge, etc.);

- **«mine bottle-neck»**: up to 30 or so mines blocking an unavoidable path (road, track or river-bank);

- **«mine line»**: a row of mines shallow-blocking (less than 50 m) a given direction as such over several hundred metres,

- **«mined strip»**: up to 5 parallel mine-lines, 300 to 400 metres deep in all, constituting an obstacle sufficient to stop an assault formation and/or to hinder any further deployment;

- **«mine field»**. several strips, usually a few hundred metres apart, of a density and area such as could, if penetrated, inflict significant casualties on the assailant.

NATO Standards regarding minefields

An **international standardization agreement** (STANAG) was signed in 1987 and subsequently ratified by the Parliament of each NATO member state. Study of this document brings to light the military logic behind and certain characteristics of the mass deployment of mines.

According to the terms of the STANAG agreement, «all minefields are characterised by the fact that the laying of them must necessarily be co-ordinated with the general fire-power deployment plan and that they must be placed so as to be able to be **defended, guarded**, or at least **struck by observed friendly fire**»

The STANAG agreement sets out standards for the marking and fencing off of allied minefields, marking out of «pathways» allowing them to be crossed, and for the formulation of mine-laying reports. In the text, minefields are classified in 3 categories.

- **«manoeuvre minefields»** intended to halt or hinder the enemy by means of mass mine-laying;

- **«harassment minefields»** intended to restrict enemy activity and to wear down enemy potential by means of often irregular mine-laying in the enemy's rear or in zones delivered over to the enemy;

- **«protective minefields»** intended to reinforce the defence of a defended position or of an area where friendly forces are being deployed.

- **«fake»** minefields

Laying large minefields may run up against problems of logistics: a defensive mine-laying operation for one Army Corps requires, following Western standards, a total weight of 600 tonnes of mines.