Chapter 1

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HISTORY of DIVING

Historians are unable to identify the first divers. Probably the techniques they used were similar to those of the native pearl and sponge divers. They may have used a stone weight to ensure rapid descent, but it is unlikely that they could dive deeper than 30 metres, or spend longer than 2 minutes underwater. Later, diving was employed for military purposes (such as destroying ships anchoring cables, boom defences, etc.) and for salvage work. Divers took part in great naval battles between 1800 BC and 400 BC. Alexander the Great was said to have descended in a diving bell (circa 330 BC) but the details are scarce and some of the stories of the descent are fanciful.

Commercial diving evolved through the 19th and 20th centuries and encompassed salvage and shell diving, extending into exploration, deep diving, off shore oil rigs, aquaculture, ecology and most importantly for you – recreational diving.

The history of diving evolved in two directions. The first is the development of diving equipment – described in this chapter. The second is the understanding of diving physiology and medicine – described in the rest of this text.

Fig. 1.1

A Roman historian, Pliny, recorded the earliest use of surface supplied breathing air by divers in AD77, when a breathing tube connected the diver to the surface. This possibly represents an early "schnorkel". Its use was limited to very shallow dives, since man's respiratory muscles cannot draw air very far down from the surface – maximum half a metre. It was also depth limited due to the excessive volume of the breathing tube.

Leonardo da Vinci sketched several designs for diving equipment and submarines. Many diagrams of divers' hoods can be found in other historical texts from 1500 AD onwards, but much of this equipment would not have worked at depths greater than a few feet. They did, however, attest to man's desire to remain below the surface for extended periods. In 1680 Borelli, an Italian, designed a diving set which purported to be a self-contained diving apparatus. Although it was impracticable, the idea was revolutionary at that time. Despite the fact that much diving equipment was primitive and rarely functioned adequately, diving bells were used with success from the 17th century onwards.

Fig. 1.2

Diving with a helmet (the equivalent of an upturned bucket which enclosed the diver's head) gradually became an accepted method. It contained air that was pumped down from the surface following the development of efficient air pumps around 1800 AD. Bellows were used to force air down to the divers. This allowed longer and deeper dives and brought to light the many physiological problems caused by the undersea environment.

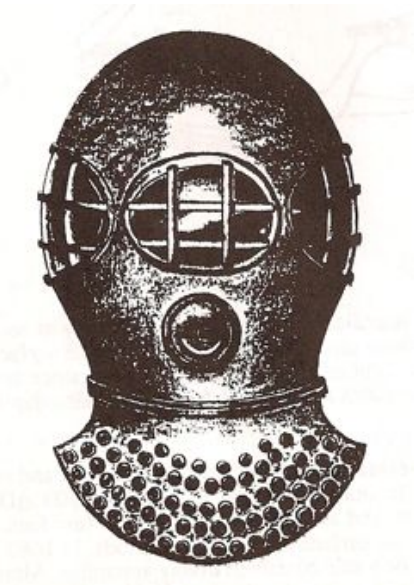

Fig. 1.3
Siebe's helmet.

In 1837 Augustus Siebe marketed the first effective standard diving dress. This incorporated an air-supply line connecting a pump or compressor on the surface to a diving helmet. The helmet was attached by an airtight seal to a flexible suit that enclosed the diver and was filled with air.

The development of **self-contained** air supplies was impeded by the lack of sufficiently powerful compressors and reservoirs. In 1863 the Frenchmen, Rouquayrol and Denayrouze, invented the first satisfactory demand regulator for self-contained underwater breathing apparatus (SCUBA), but due to lack of suitable high pressure air compressors and cylinders, it was limited to surface air supply lines.

In 1878 H. A. Fleuss made a workable self-contained (closed-circuit) oxygen breathing apparatus utilising caustic potash to remove exhaled carbon dioxide. "Closed" refers to the absence of an outlet for gas (i.e. no bubbles) and means that the exhaled gas is rebreathed. This was the forerunner of modern closed-circuit diving units.

Fig 1.4
Rouquayrol and Denayrouze, Diving suit 1863

Divers in the late 1800's were capable of reaching depths in excess of 50 metres, but the effects of decompression sickness (or bends) caused much concern and many injuries to divers. Paul Bert, a French scientist, was the first to explain that the disease was caused by the formation of nitrogen bubbles in the body and proposed the idea of a slow ascent to the surface. It was not until the early 20th century that Dr J. S. Haldane derived satisfactory mathematical decompression tables to overcome this physiological problem of deep diving. The first successful tables were based on the assumption that decompression sickness could be avoided by not exceeding a 2:1 pressure reduction between stops. It reflected a mathematical model of inert gas behaviour in a body and was to be the forerunner of current decompression tables. Later observations showed this principle to be incorrect in many cases, but these early tables and the later modified versions, prevented many divers from developing the bends.

Diving research this century has lead to a great improvement in all forms of diving equipment and since 1940 the use of such equipment has increased greatly. The design by Cousteau and Gagnan in 1943, of a proper demand-regulated air supply from compressed air cylinders worn on the back has developed into modern day **scuba**.

The scuba equipment used today, with the high-pressure regulator on the cylinder and a single hose to a demand valve in the mouth, was invented in Australia and marketed by an engineer named Ted Eldred in the early 1950s, under the *Porpoise* trademark.

Closed-circuit rebreathing apparatus using, oxygen or oxygen/nitrogen mixtures, has also been improved considerably since the early units used by Italian Naval divers in their attacks on shipping in Gibraltar in 1941. With the advent of deeper diving, gas economy has become a major problem and for this reason closed-circuit systems have achieved even greater importance.

Diving to depths in excess of 100 metres required not only the development of specialised closed or semi-closed circuit rebreathing apparatus, but also the use of other inert gas mixtures mixed with oxygen. Nitrogen, because of its narcotic effect at depth, has been replaced largely by other gases such as helium and hydrogen. These are not used without complications – as all gases cause specific physiological problems and no ideal mixture yet exists.

The advent of **saturation diving** has completely revolutionised the ability to dive and work at great depth, and for lengthy durations, and this is economically rewarding. The system is based on saturation at any depth of all the diver's tissues by the inert breathing gas. Once this is achieved the body is incapable of absorbing further amounts of gas, no matter what the duration of exposure at this depth. Hence, further exposure does not lengthen decompression times. This practice is now adopted for most diving with extended bottom times at depths in excess of 100 metres.

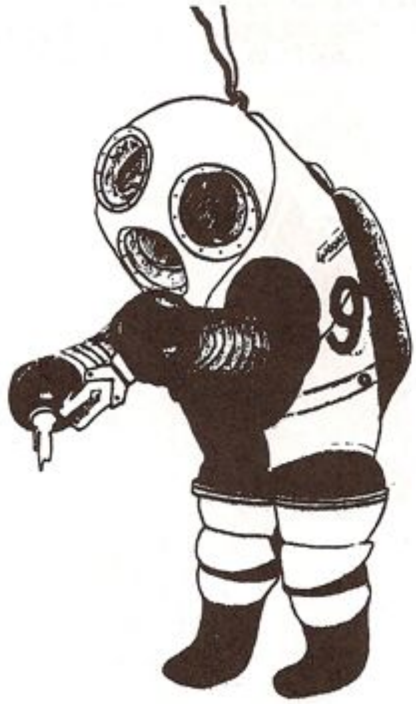

Fig. 1.5
"Jim" one-atmosphere diving suit.

In an attempt to reduce the risks in deep diving, **one-atmosphere diving suits** (ADS) have been developed out of strong lightweight alloys. These suits are fitted with articulated joints and use mechanical levers or claws for "hands". Some even have mobility and propulsion, but all require backup 'rescue' facilities. They are equipped with a self contained rebreathing apparatus and are often used at depths of 200–300 metres. Although somewhat bulky and requiring hoisting gear at the surface, divers can achieve a reasonable degree of movement at depth with the latest models. These suits are also useful for inspection-type work, although much of this is now done by non-manned **Remote Operated Vehicles** (ROV's) with video surveillance.

Fig 1.6 The Royal Australian Navy Clearance Diving Team, 1955, with oxygen breathing equipmenrt and wearing the famous “Clammy Death” suit.