

TABLE 3
BREATHING APPARATUS AND MAXIMUM DEPTH OF DIVE

MAX DIVE DEPTH	<=10m	<=15m	<=20m	<=30m	<=40m	>40m
SCUBA	-	4	2	3	-	1
HOSE SUPPLY	-	3	1	1	3	1

and tolerated which was the factor which decided several of these divers to seek treatment is unknown but it cannot be assumed without further investigation that the true incidence of decompression sickness has changed. It can be assumed, however, that the incidence is greater than present figures indicate. If the improved facilities for treatment have in any way increased the willingness of divers to attend for treatment of decompression sickness it would be unwise to discourage their attendance by interposing a fee for treatment. While this would effectively reduce the number attending for treatment it would in no way effect the incidence of decompression sickness. Prevention depends on the identification of a problem and then applying the appropriate management of such factors. The failure of Government agencies to regulate Pearl Diving activities in either Queensland or Western Australia is reprehensible. Had the diving community in Western Australia supported the collection of reports of diving incidents, the Stickybeak Project, the severity of the Decompression Sickness problem would have been identified far earlier and there would have been no need for a Task Force to be set up by the WA Government to collect information and threaten legislation.

Another point of interest is the fact that several cases appear to have occurred following "safe dives". Readers may like to check the dive profiles declared in cases 1, 2, 4, 9, 17, 18, and 20 against the Swiss Tables or any other tables. It is a matter for investigation as to whether the problem lies in the inaccuracy of the divers in measuring dive depths and duration, their previous diving history, their physiological oddity compared with the Tables, or the Tables themselves. Diver error appears the most likely factor, and it is noteworthy that the majority of cases followed repeat dives. It is possible to calculate the residual gas BUT it is often forgotten that the diver's physiology has been altered by the first dive so presents a different substrate for the second and subsequent dive changes. In several cases the presence of previous pathology may have been significant.

It is regrettable that divers have not accepted the knowledge that in-water air recompression is a poor option although it may appear to produce cure, and the misuse of oxygen treatment in case 19 must be deplored. There appears to be a belief that recompression CURES decompression sickness. This is not necessarily so. Such treatment seeks to halt and reverse the sequence of damaging changes which have caused the presenting symptoms, but such symptoms indicate that damage has already occurred. In particular it is now believed that resolution of symptoms of Spinal Cord Bends does not indicate the complete resolution of the damage to the spinal tracts. Such damage is permanent.

The single case of CAGE in this series is another warning that the ascent phase of the dive is critically important. There is now an increasing awareness that this tragic misadventure DOES occur with apparently normal ascents.

The answer to this "Bends" problem will only be found by examination of case histories which are as full and accurate as possible. This requires the co-operation of the divers as well as of those whose task it is to treat them. Better understanding by divers of the factors influencing the development of decompression sickness, the limitations of The Tables, the importance of early treatment, and the limitations of treatment are all factors requiring attention.

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THE DIVING CHAMBER AT BROOME AUSTRALIA'S FIRST AND AUSTRALIA'S OLDEST ?

John Hayman

Diving for pearls and pearl oyster shell off Australia's north-west coast has a long history, which stretches back to the time of first European settlement of Western Australia's inland regions. Dampier visited the coast in September 1700 and recorded the



FIGURE 1. The Decompression Chamber as it now stands in Bedford Park, Broome. The chamber door has been broken off, and lies on the ground, innerface down.

presence of pearl shell. In 1854 Lieutenant Helpman, commander of the colonial schooner *Champion* found and surveyed commercial pearl beds near Shark Bay. From 1860 to the 1880s pearl shell was gathered by skin divers, usually Aboriginal or Malays recruited or coerced by Europeans. Hundreds of these divers died: attacked by shark or crocodile, drowned while diving or being lost together with their lugger, the master, and their collected shell when the vessel was struck by cyclone.

Diving helmets were introduced about 1835 and thereafter divers were able to reach much greater depths and the mortality rose proportionally. Aborigines were unable to use this equipment and they disappeared from the pearling industry. The Japanese became very proficient with the new equipment, and hundreds of these divers entered the trade. Decompression illness was not understood before the work of Haldane and Hill, and staging an ascent was never practised. Diving all day and every day to depths of more than 30 m, these divers suffered nightly from "divers rheumatism" and paralysis, and few divers were not crippled or dead after four or five seasons. Between 1910 and 1917, 145 divers in the Broome fleet died; in 1914 alone there were 33 deaths. The Japanese cemetery in Broome contains more than 600 bodies, mostly young men and mostly divers and it has also a memorial to pearling fleet crew members who were lost in cyclones.

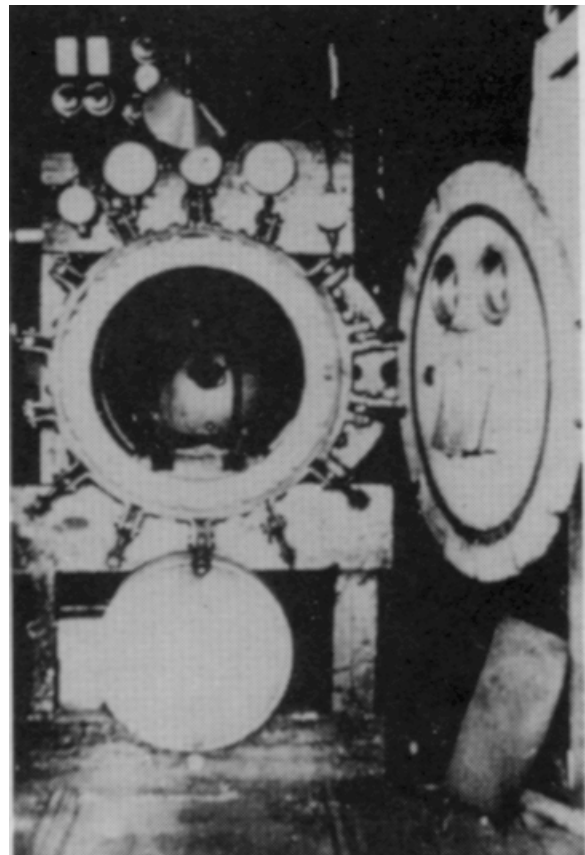


FIGURE 2. Photograph of the chamber in its operational state, installed in the old hospital.

In 1913 the London diving firm, CE Heinke & Co commissioned construction of a diving chamber for the town of Broome. This was installed in the old hospital, situated on a hill beside the now demolished pearling wharf. Installation of this chamber, together with better understanding of diving physiology and the need for "staging" led to a substantial reduction of deaths for decompression illness. In 1918 there was only one death, and although there were more deaths in later years the mortality remained relatively low. The practices then, however, still seem appalling by today's treatment protocols. The 1918 report of the Master Pearlers Association read as follows: *"this (one death) is the lowest on record and it must be ascribed solely to the education of divers by means of the decompressor the generous gift of Messrs CE Heinke and Co with the present day engine boats we are working deeper than ever before (as deep as 80 m) and partial paralysis is fairly common, but immediate decompression by returning the diver to the water has almost solved the question. In the majority of cases a few hours "staging" effects a complete cure and the diver is able to carry on his work the next day"*.

Between the wars there was a progressive decline in pearling and the chamber was no longer used. After the second World War the chamber was rescued from the local rubbish tip by Mr Alec Reid, who ran a service station and car sales business in the town. The chamber, together with its motorised compressor now stand in Bedford Park opposite the rebuilt Continental Hotel. Compared with modern chambers, it is primitive in the extreme, barely large enough to accommodate a small Japanese. A normal sized European would have been a very tight fit; there appears to have been no means of communication, no oxygen, and certainly no room for an attendant. The internal diameter is 80 cm, the internal length approximately 6.3 m. It may well have been the fear of being shut in this chamber which persuaded divers to adopt some, be it imperfect, staging procedures!

The chamber now stands in the open, partly filled with rubbish, with the cast iron door unhinged and lying on the ground beside it. Commissioned in 1913, it would seem very likely that this is the first chamber ever operated in Australia. Its present situation is very much better than the town tip, but such a relic, now 74 years old, is probably deserving of even better treatment. The town of Broome has many diving relics; anchors form garden ornaments and the wheels from hand compressors are used as garden edging. The museum, situated in the old Customs House near the now demolished wharf and hospital has a photograph of the chamber as it was in use, as well as many items belonging to divers.

SPUMS has had meetings in many different parts of the Pacific and Indian Oceans. Perhaps we would celebrate the 75th anniversary of the inauguration of Australia's first diving chamber by holding a meeting in Broome.

REFERENCES AND FURTHER READING

Edwards H. Port of pearls. A history of Broome. Perth, Adelaide: Rigby, 1983.

Photograph inscriptions and newspaper cuttings. Museum, Broome.

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SWISS DECOMPRESSION TABLES

John Lippmann

HISTORICAL BACKGROUND

The laboratory of Hyperbaric Physiology of the Medical Clinic of the University of Zurich was established in 1960. The theme of the research being carried out was that of assessing the well-being and functional ability of the human being in atmospheres of abnormal pressure and composition. The Swiss, lacking a history of decompression research, were free from the shackles of traditional approaches and could begin to introduce new ideas in this area.

The effects of both nitrogen and helium have been considered throughout their decompression research, and the tolerance to nitrogen in decreased ambient pressure has also been investigated, due to the local interest in diving in mountain lakes.

The "Swiss Decompression Theory" is only a method of calculating saturation and desaturation in a way which permits safe decompression. All of the empirical factors that are important for this method were determined experimentally in Zurich.

For decades 240 minutes was considered to be the longest half-time for nitrogen in man, but in the mid-1960s it was shown that complete saturation with nitrogen takes 3-4 days, and hence the longest half-