South pacific underwater medicine society

Journal/*Newsletter*

C O N T E N T S

SPUMS JOURNAL/NEWSLETTER

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Editorial

We start the New Year with an abundance of interesting papers. Many of these pack a hidden message if the reader gives consideration to the largely unstated philosophical approach to diving risks that guides the thoughts of the individual writers. Readers will naturally evaluate the written words through the filter of their own private, and probably unrecognised, prejudices but the Editor does not intend to let this consideration inhibit him from certain observations concerning some of the important basic issues illuminated in the following pages. There is a polite but very real difference in the assessment of Fitness to Dive, ranging from those with criteria considerably stricter than the SAA Standards to those willing to place their (financial) heads on the block by undertaking to train "exceptional" students to dive. There is the question as to whether a central collection of personal information concerning divers should be initiated, and if so there will be the question as to who pays for and who controls the information. This matter is a veritable Pandora's Box with unpredictable spin-offs for all concerned in diving. It could well reveal inconvenient facts concerning all facets of present practices, not least the lack of any adequate data on morbidity. Ignorance is neither always recognised nor always inconvenient! Even the question of who an injured offshore diver can sue for compensation is apparently a Legal jungle that may cost the diver dearly. But first we have a question relating to diving safety that was raised at the Truk meeting. And like the dog in the night, to which Sherlock Holmes once drew the attention of Dr Watson, there is too much silence.

Our correspondents have differing views on the Octopus Rig as a necessary piece of equipment, as is only natural. It now appears that the decision taken at Truk was a more moderate one than was initially notified to members and was intended to apply only to diving Instructors and their pupils rather than to SPUMS members. Leaving aside the possible assumption that SPUMS members are all expert divers, and omitting comment on the serious discrepancy between the actual Resolution and the Official Record, the failure to provide case documentation prevents any useful discussion of the relevance of the proposed remedy to the incidents that occurred at Truk. As the NAUI survey now in progress relates to the use of the Octopus rig rather than to the occasions for its being used it is hoped that SPUMS members will document their diving experiences and comment on safety factors they consider most appropriate. Let your New Year Resolution, to notify an incident, be acted upon today!

It is with special pleasure that we print a patient's view of his "bends" incident. For far too long the victim has been a Case, usually assumed to be both careless and ignorant if a civilian, with neatly presenting signs and symptoms but no feelings. Dr Frankel has noted (*Paraplegia* 1977; 14: 306-311) an apparent difference between the response of the Professional as contrasted with Amateur or semi-professional divers who reach him at Stoke Mandeville Hospital with residual Spinal Bends problems. The small number of cases known to him may itself be a matter worthy of comment as it may indicate a pool of diver morbidity following treatment of Spinal Bends is being overlooked: it is unlikely that treatment of such a condition has total success in all save a minute percent of cases. The word "cure" is an elastic term on occasion, as can be deduced from many medical papers, and suphoric personalities as postulated to be common in non-professional victims will mislead their medical advisors. Another argument for followup of patients?

Dr Elliott's thoughtful and authoritative opinion concerning Fitness To Dive after

suffering a Spinal Bend is most welcome. It is based on his many years of experience plus .... private discussions with many of the international experts in diving medicine. He has elected to decide fitness on an individual case basis rather than to take refuge in a play-it-safe-by-the-books. A necessary condition of such an approach is the ongoing monitoring of such divers to confirm, or otherwise, the correctness of the decision. While he might well applaud .... Arnst's somewhat similar approach to a "fitness" decision it is less certain that he would entirely like to "pass" the post-trauma paraplegics that Flemming and Melamad taught (*SPUMS Journal*, Jan-Mar 1977) even though no cases of further spinal damage have been known to occur in such divers. The exceptionally friendly and understanding Insurance Company seems to be an essential factor before mere common medicos certify fitness outside the SAA of text book guidelines. Conventional Standards are, however, heavily influenced by Naval requirements that their divers be ready for instant action in adverse sea conditions, added to which is their experience of treating the serious misadventures of non-naval divers. Perhaps if graded certification of divers could be introduced there could be graded fitness standards also. To accede to the views presented by Dr Beaumont, with a necessary and logical addition of psychological assessment, is to demand perfection. Should he be proved right we would one day read in the memoirs of a famous man "It was my failure to pass the diving medical tests that led to my entering the Astronaut team".

Safety starts with an assessment of the risks and a decision as to the most practical method for reducing or avoiding the hazards, with as wide a margin as possible for unforseen contingencies. Bases on the available and admittedly minimal information, the new US Navy "Fly away mixed gas system" is a risky procedure. Presumably some Master Diver is at present planning how to treat his working diver for hypothermia or decompression sickness after, or during, a 300 foot work dive on HEOX in open sea conditions with only an open bell as a recompression mode. He may be 5,000 miles from his base facilities. With knowledge that the North Sea Rigs are only now facing the problems of evacuation-under-pressure we can only hope that there is a high power lucky rabbit foot in the kit ... or a lot more to the system than has been revealed. Anyone who disbelieves in Murphy's Law should read up the story of Sealab III. One day it may be required that before significant changes in diving equipment of schedules are permitted an Environmental Impact Statement be prepared. This would recognise the DIVER as the environment.

Risk appreciation depends on an adequate supply of accurate information. Such information regarding professional divers in the Australian area is unlikely to become available in the immediate future, judging from the recent Arbitration Court hearings before Commissioner Mansini. There is world wide awareness of this problem, the nearest to a partial solution being the UK Decompression Sickness Panel work on bone surveys of persons who work under hyperbaric conditions. In the early stages of recent diving progress the Naval Diving groups played an important part. Though never noted to be blabbermouths, they allowed publication of much information, including case reports. The practice of the present leaders in diving progress has been rather more secretive, probably a result of good commercial considerations and a caution born from experience of legal action for damages by employees. Knowledge therefore diffuses slowly concerning modifications in the basis for calculating Dive Tables and the morbidity that is occurring. It is hoped that it is not idle talk to hope for the improved discussion of experiences and new approaches to diving problems. Ultimately all stand to benefit from greater safety.

Despite a seeming concentration on the less prosaic aspects of diving medicine we must never loose sight of the fact that every diver, however shallow his descent, encounters the zone of most rapid pressure change. To most common mortals this means "will my ears clear easily?" It is useful to read Dr Roydhouse's paper to remind us of the mechanism of the Eustachian Tube, that portion of our bodies that most divers would vote in favour of redesigning, and other Ear problems.

All contributors are thanked for making their work available, as also *Barologia* (South Africa), *NAUI* (USA), and the New Zealand *Journal of Sport Medicine* for permitting reprinting of articles from their pages. But one further ingredient is required for the success of our Society and that is your interest and involvement. Safe and Interesting Diving to you all!

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CORRESPONDENCE:

The Secretary has received a number of letters concerning the proposal that "Octopus" rigs be made compulsory during SPUMS controlled diving. The following are printed to initiate discussion of this important matter.

Dear Sir,

Regarding the comment in your report about the use of octopus rigs: I am not in favour of these. I agree that while the use of tank contents gauges should prevent incidence of running out of air under water, their use in conjunction with a J valve makes running out of air very unlikely. As you are probably aware, we, in less temperate climes, have an additional problem. Much of the water in which we dive is cold, being below five degrees centigrade. There is every reason to believe that two second stage regulators operating from a single first stage may produce a sufficiently large drop in temperature to cause freezing of the first stage and a massive free flow which may then lead to freezing in the second stage. While I recognize that you are unlikely to encounter this problem on a regular basis, it is of sufficient importance to divers in colder waters that we feel that training in alternate methods must be used.

While I fully accept that the use of an octopus rig may be practical in warm water, I do not think that elementary training should require its use nor do I feel that its use should ever be mandatory.

Yours sincerely
Angus Munn

PS As a realistic, if somewhat more expensive, alternative, I prefer a "pony bottle" set up with its own regulator. Although I have never had a first fail except to "fail safe" the use of a pony rig covers that contingency as well. AM

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EDITOR: NAUI (USA) are at present conducting a survey of their members to find out how the diving public has set up its technique for the use of the octopus or secondary 2nd stage regulator. In the covering letter to this survey, the following statement is made which deserves consideration:

> "The octopus has "silently" developed as an important alternative in any out-of-air emergency. However, to date, there are no standards by any of the instructional organisations for how the octopus is to be most effectively worn and used in open water. Coupled with this is the fact that each regulator has a somewhat different first stage configuration resulting in numerous choices of how the secondary second stage is worn. Another area of particular interest is how the octopus is affixed to your person for easy access. Feel free to comment as to the efficiency of your particular technique."

A few of these forms have been distributed among FAUI Instructors in NSW. There is said to be an increasing use of the Octopus Rig among diving instructors in a bid to further increase safety of trainees.

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Dear John,

Many thanks for forwarding recently the copy of "The Secretary's Report", regarding the recent Annual General Meeting of SPUMS in Melbourne and concerning the later scientific meeting in Truk, and I also enjoyed reading Bill Rehfisch's report on the Truk scientific programme.

The Truk conference of course passed a resolution requesting the SPUMS committee make possession of an octopus rig mandatory for the next scientific conference, and as I guess I feel this is a reasonable requirement, and at your request in your report, I shall briefly give my view.

The use of the octopus rig I felt was dealt with extremely well by the American "Skin Diver" magazine of December 1976, and then again in the magazine's Editorial of May 1977. I have myself owned an octopus rig for some time, and am firmly convinced that it offers a much safer and more dependable route to the surface, in any emergency out of air situation, and certainly the extra cost involved is not very significant I feel.

As you are aware, there is still presumably international controversy as to its configuration and position, etc, although the article in the "Skin Diver" of December 1976 came out in favour of having the second regulator attached to the chest, for easy access, and to give the air donor more control of his buddy, etc.

As a result of my admittedly limited experiences with essentially planned buddy breathing from an octopus rig, certainly makes me feel that the second regulator should be in a pre-determined position, as under water the gear certainly looks like an octopus, with regulators and pressure gauges floating everywhere!

Numerous people in the various skin diving magazines have commented that attachment of the second regulator to the scuba tank is not ideal, because a victim's approach may be sudden, with a resulting tug on the tank, and the unknowing donor may through movement tear out the regulator from the victim's mouth.

I thought one slightly novel approach to this problem given by one of the Truk Lagoon dive leaders, Annette, was to fix the spare regulator on the back of her scuba tank, held there by four of five rubber bands, which either broke or rapidly slid up the tank as a potential victim grabbed for the regulator.

No doubt, if divers and we in particular at SPUMS, start using the octopus rig, we will I feel definitely have to decide on the best position for the spare regulator, particularly for the emergency situation, and I simply put forward Annette's simple suggestion for consideration and comment.

With kind regards
Yours sincerely,
John D. McKee.

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Extract from a letter from Dr Barnes:

I would like to comment on the phrase "The Conference passed a resolution requesting the committee to make possession of an octopus rig mandatory for the next Scientific Conference". My memory of the resolution was along the lines of "the Conference passed a resolution requesting the Committee to consider recommending to all diving instructors that students be taught the use of the octopus rig, and that instructors should use them." It is hoped that octopus rigs will not be mandatory for the next Scientific meeting as I wish to continue diving with SPUMS.

(Dr John Knight replies: Dr Barnes is quite correct in his recollection of the discussion and the circulated report was in error in this matter.)

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COMMENT ON DR BRAND'S REPORT - SPUMS JOURNAL, JULY 1977

Dr John Archdeacon (Cairns) offers the following comment on Dr Victor Brand's report:

On considering the awful experience which you bravely laid bare in July's Newsletter, I feel that I can supply a probable solution.

I believe that the first stage valve of your borrowed regulator jammed or became blocked with particulate matter as you tried to inhale. Your inspiratory efforts would have reduced the pressure in the connecting hose to ambient (or lower!) and the second stage valve would have been opened. There would almost certainly have been a small amount of saliva or seawater in your mouth or mouthpiece.

As the ambient pressure decreased during your free ascent from 3 ATA at 60 feet to 1.6 ATA at 20 feet, the corresponding movement of the first stage diaphragm relieved the blockage - allowing the full blast of air at over 100 lbs/in^2 into the open and unsuspecting second stage valve and oropharynx -blowing some irritant seawater or saliva onto the vocal cords and blasting the regulator out of your mouth before the second stage valve had time to react.

A moderate degree of laryngospasm would account for the symptoms of respiratory difficulty you described, especially when compounded by the effort of supporting the weight of scuba and photographic equipment whilst having the thorax immersed. Once on shore, with the weight and pressure on the chest relieved, a good cough cleared the larynx and cured the distress.

Proof of this hypothesis would depend on two factors which might have been noted when the equipment was checked after the incident, namely the presence of air in the tank and the state of the first stage valve when it was dismantled; unfortunately neither was mentioned in your account. That there was air is almost certain - it is unlikely that an experienced diver, even one being intermittently swamped and electrocuted, would fail to notice the tightening of his set which would occur for several breaths (at a depth of 60 feet) before the tank became fully empty; and something must have exploded the regulator out of your mouth.

The lessons we could learn from your experience would be

a) borrow ... equipment only from your more cautious friends, who are likely to keep it regularly serviced and are usually reluctant to lend; and

b) always have all equipment fully checked after any untoward incident - because if this valve is at fault and jams again in circumstances where buddy breathing/ free ascent is not possible, an avoidable fatality may well occur.

I cannot resist adding that this is another practical situation in which the much vaunted Octopus rig would not have helped - both second stage valves on your own set being equally affected by the first stage failure, and your buddy's being, as is too often the case with all of us, "close by but outside his reach and not looking at him".

The case could perhaps be classified as Psychotrauma secondary to Equipment Failure.

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COMPO IN THE DEEP BLUE SEA

The search for offshore oil is threatened with severe disruption because of legal advice that workers injured on rigs outside State boundaries are not entitled to compensation.

The legal advice, from the West Australian Crown Law Office, follows serious injury to an oil rig worker 64 km off the WA coast on Barrow Island.

The State Government Insurance Office has rejected the claim for compensation, saying the accident occurred outside the State boundaries and is therefore outside the jurisdiction of the Workers' Compensation Act.

But the decision has brought an angry reaction from Australian Workers Union industrial officer Mr Joe Isherwood. He warned that all rigs around Australia could be stopped.

"If this is not sorted out in the next few days we are going to pull all these rigs out. The whole industry could be halted," he said.

Mr Isherwood said companies had been paying workers' compensation premiums for up to 11 years and insurance companies had not hesitated to pay out in the past.

"Our reaction to this is one of horror," he said.

Oil companies employ about 240 men on rigs off Australia's coast. By early next year the workforce is expected to reach 500.

Mr Isherwood is seeking urgent talks with the WA Minister for Labor and Industry, Mr Grayden, and four companies involved in drilling.

In Perth, the case of the injured Barrow Island worker went before the Workers Compensation Board yesterday. But it was adjourned at the request of the injured man's lawyers.

The Australian, 14 December 1977

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VETS GO FISHY

Training of specialists in aquatic vetinary medicine will be launched in a co-operative program of five universities and research laboratories in three states in the USA. Helped by a grant of $59,800 from the Office of Sea Grant and $45,000 matching contributions from the participants, Project Aquavet will be adminstered by the New York Sea Grant Institute of the State University. Both schools will work closely with three research facilities at Woods Hole, Massachussets: the Marine Biological Laboratory, Woods Hole Oceanographic Institution and the Northeast Fisheries Centre of NOAA's National Marine Fisheries Service. The purpose of Project Aquavet is to develop graduate level courses and provide a unique research experience in the marine and aquatic fields for vetinary students, leading them to a speciality in aquatic medicine.

Sea Technology, May 1977

OCEANS 77 - MELBOURNE, 11-12 June

The experiment of holding the SPUMS AGM in conjunction with this deservedly famous annual diving Congress appears to have been appreciated by the numerous divers who attended. Unfortunately few of our members who were not involved in the program seem to have felt any irresistible urge to support the function or to attend the AGM. Though the loss was theirs, their absence was regretted. The first morning was devoted to Diving Medicine, the remainder of the weekend being taken up with talks and films relating to many differing aspects of the Sea and the life therein. The following somewhat brief reports on what occurred cannot retail the full impact made by the presentations. In line with the usual practice, no summaries of papers are available, a matter of regret to this Editor at least.

Those taking part included Dr Janene Mannerheim, who spoke on the problem of PANIC in diving. She advised that one should look at one's buddy for signs of anxiety, often manifest by undue checking of contents gauge or watch, by a jerky finning action, hyperventilation, or the facial expression. She remarked that most people found it difficult to let go of money, a spouse or a weight belt. Certainly they tend to retain weight belts unto death. Dr John Knight showed pictures of the SETT and convinced viewers of the rapidity of Steinke hooded ascents, obviously the start of the attempts to put man into space. Bob Cumberland also spoke on the recognition of anxiety in divers even before they entered the water by watching the manner in which they kitted up. On the theme of "keeping one's cool" he instanced the occasion on which he demonstrated water entry to a group of his pupils, realising too late that his flippers were not on his feet. He managed to demonstrate donning fins in the water without the onlookers being aware of the unplanned nature of the lesson! Other speakers included Drs Ian Unsworth, Doug Walker, Chris Lowry and Ray Leitch. It is hoped that the safety advice offered is of value to the audience in their diving.

The real star of the meeting was Dr Joe MacInnis, an excellent speaker, who has succeeded in getting his government to support his streaking round the North Pole and other more Scientific exploits. He had done "the impossible dive", a dip under the North Pole itself, and been trusted with the Prince of Wales (an excellent diver) under the Artic ice. He showed a number of his films and the audience will long remember his plea that we take active thought concerning the danger of introducing change into the fragile ecosystem of arctic areas. The risk of oil spills under the ice was shown in convincing manner, though it is to be doubted whether the "necessity of political and economic realities" will heed his voice. There will always be Experts to show that oil spills never occur with Modern Technology ....

The Project Jonah segment of the meeting was highly informative, though here again cynics might expect Government action to await the natural cessation of whaling rather than be swayed by the emotional opponents of the killing of these marvellous mammals. Nobody who listened to the recorded voices of whales singing in the sea, played to a darkened hall, can ever again think of them as fishes fit for slaughter. Well, not for a few days at least. It was said that each year the whales have a different song, a "top of the Pops" of one ten minute or so of hoots and whistles. As this may be repeated for a continuous period of 10 hours by a single whale one may admire their persistence but doubt their catholicity of choice.

Professor Heatwole, who descends from his mountain lair to join sea snakes on the Barrier Reef so frequently that he is now a world authority on their habits, gave a talk on the ability they have to spend half an hour at the surface without breathing. They are able to dive to 300 feet for 2 hours without fear of decompression sickness, for the cunning critters not only have lungs but utilise transcutaneous gas exchange.

He has very kindly prepared an article on their ways of avoiding having any Diving Medicine and it appeared in July-Dec 1977 issue of the SPUMS Journal. He included one piece of cheering news: there is no need to immediately panic or do anything drastic after being bitten by one of these snakes. You can wait until your eyelids start to droop or you pass red urine (don't worry, it only means that muscle pigment has been set free), before having therapy. After all, it may have had no poison left to inject into you and the symptoms are .... interesting!

New Zealand provided a number of speakers. Dr Tony Auling indicated the interest added to a dive when one observes the fishes as individuals. They obviously have the ability to learn to recognise predators and to learn their home territory. They recognise the colour codes of their fellows, have their different characters (some cleaner fish being willing to service only particular species, and some refuse to do this job at all, and in general live a quiet life except for predators like the John Dory. This chap is on the go the whole time, quite unable to understand his lack of popularity with the other fishes. This fish even swims on its side to make it appear to be going that-a-way, when it is really coming this-a-way. Another New Zealander was Kerry Tarlton, described as a mountaineer who changed. He gave an account of the difficulties encountered in recovering some treasure. The audience gave rapt attention in the hope of getting some hints!

The US of A was represented by Al Giddings talking about making "The Deep" and other matters, Dr Sylvia Earle about whales and unisex Hydrolab, and other experts from the photographic side. No-one could equal for sheer good natured entertainment, however, Bob Reeves. He has been one of Australia's Men of the Antarctic, graduating to photographic and to diving expert status by determination. Diving and photography are still sufficiently young to have this portal of entry to the ranks of the illustrious.

Naturally the talk by Dr Carl Edmonds was both entertaining and informative on the in-water Oxygen treatment of decompression sickness in far away places. Australia's complement of Decompression Chambers is such that a good few places are "far away', so his addition to the therapeutic armamentarium of divers is greatly appreciated.

As it is expected that Cousteau will be attending the Oceans '78, it is probable that SPUMS members will attend in greater numbers this year, which will be welcome as the speakers like to feel that their colleagues support them. And as a last thought after seeing one of the films, if SPUMS ever wants a really original conference location, please don't forget that Hawaii offers diving unsurpassed anywhere else in the world, for only the most select few have dived on an active underwater lava flow and it sounds even more thrilling than waiting for the snake venom to act!

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IN THE FOOTSTEPS OF A FINE TRADITION

A 33-year old former clerk in the Indian Government began walking around in circles yesterday (28 December 1977) and intends to continue for three days.

By then, he believes, he will have done his bit for international friendship. He is walking on a 8 metre track of carpets laid out under a shed at a Sikh Association compound in Singapore. Despite profuse invitations to join him, Singaporeans have resisted his offer. Some observers think that Mr Singh's Civil Service background

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Report of the SPUMS Meeting held at Flinders Medical Centre at 2 pm on Saturday October 15th 1977

The Chairman was Dr Tony Swain and in all 12 members were present.

The first presentation was by Dr Tony Trewartha who spoke on the problems of starting, and running, a diving medical centre. Sports divers and professional divers have different requirements in that the professional has to pass an annual medical to keep his job. The routine work is mostly examinations for fitness and this has increased with the recent insistence of FAUI instructors on a medical certificate before the learner qualifies for his C card. The provision of an emergency service for divers is need which was covered by having a telephone answering machine on the centre's number and taking calls from that at intervals. Both groups need educational facilities so that they may learn of the medical hazards and limitations. A film library has been started for this purpose. Clubs and dive shops need advice on basic resuscitation and equipment.

One major problem was notifying the diving public of the centre's existence. The dive shops, government departments and abalone divers were contacted. As yet abalone divers are very reluctant to appear for medicals, although they come to Adelaide for their medicals. They are thought to have an "easy" doctor somewhere.

The Diving Medical Centre consists of a suite of consulting rooms at a fairly central site with good parking facilities. There are two consulting rooms, a waiting room with videotape display, and ECG room and an audiometer room, which also houses the vitalograph. The telephone answerer and the partners' anaesthetic practice provides a 24 hour cover. The costs of the centre are in part offset by leasing the front half of the building as a shop to outside interests. The library should contain the following journals: *Australian Journal of Sports Medicine*, *Aviation Space and Environmental Medicine*, *Triton*, *Skindiver*, *Undersea Biomedical Research*, *Underwater Physiology Abstracts* and *Underwater Technical Abstracts*, both from the Undersea Medical Society. Also various Diving instructional films from both the Royal Navy and the US Navy.

Some problems with payments were originally encountered but these have been overcome by a cash-at-the-time system. There are three doctors involved and they hold one session a week, from 4-8 pm on Fridays. There were problems assessing the demand for the service, providing cover for holidays, seeing patients on emergencies, back up with specialist advice, and with raising the standard of the diving doctors' own knowledge. The RAN courses were of a high standard and very useful..

The second presentations was by Dr Bruce Arthur of Murray Bridge where the new bridge piers were sunk by caissons. He discussed three cases of decompression sickness which he had had to supervise. Two responded quickly to treatment but the third needed three consecutive treatments, one for the original presentation and for two recurrences. This man was where he worked for 4 hours at 34 psi (3.3 ATA or 76 fsw). He then retired from compressed air work. The caissons had to be sunk through a granite filled subsoil to the granite base below. This was some ninety feet from the surface. The watertable was lowered by pumping from a nearby well so reducing the amount of compressed air work needed. The piers at each end of the bridge were completed and now work is going on on the piers in the water. The resident engineer is at present laid off diving because he has ruptured both eardrums.

Dr John Knight then showed a film on decompression sickness made by the Royal Navy and after the film spoke on the patho-physiology of decompression sickness. The

thermodynamic theory of Hills was compared and contrasted with the supersaturation theory used by most decompression tables. It seems likely that some bubbles are formed after any dive and the problem is how many bubbles that have formed in the first, long, ascent. The part played by venous bubbles in producing spinal decompression sickness was covered as was isobaric counter diffusion bubbles. The difference between the uptake and output of an inert gas was emphasised.

Dr Dean Beaumont discussed the new draft (DR77107) of the revised CZ18-1972 from the ENT surgeon's point of view. He considered that sinus X-rays should be almost routine as much sinus disease is undetectable clinically. Vestibular dysfunction may be missed as the symptoms may not be noticed by the patient or doctor. He considered that electro-nystagmograms (ENG) with caloric tests should be done on all professionals. There are 17 ENT conditions mentioned in the draft. He disagreed with some of the recommendations. He recommended that the diver who needs a stapedectomy should be provided with a fibrous seal to the minimal footplate removal and an exact length prosthesis. Unless these precautions are taken he considers stapedectomy a contraindication to diving as some cases of rupture of the oval window in stapedectomised patients have been reported with the inflation associated with anaesthetics, and with sneezing and with autoinflation. Similarly a malleolar-vestibuloplexy is a bar to further diving. Incus repositioning may not bar further diving as the worst that can happen is the dislocation of the artificial joint and the recurrence of the hearing loss. With an open mastoid cavity with the semi-circular canals exposed, the stimulation from cold water and the likelihood of infection make further diving unwise.

Sinus surgery is often followed by loculation which would interfere with safe diving. For the frontal sinus the only procedure which would allow diving after surgery is osteoplastic obliteration. People with repaired cleft palates almost always have Eustachian tube dysfunction. Eustachian tube function is more important following a tympanoplasty than the method of repair of the drum, which is often stronger than the original. He did not consider that a deviated nasal septum should disqualify one from diving, provided Eustachian tube function was normal. Deafness is a difficult field especially with the employer's liability for compensation. He considered that the suggested level of 15 db at all frequencies was an unrealistic standard of perfection. He emphasized that the standard applied only to professional divers whose livelihoods were at stake.

The meeting closed at 5 pm and was then resumed at Dr Swain's home at 7.30 pm. The Society owes a debt of gratitude to Dr Tony Swain and his wife Helen for organising such a good meeting.

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A Note from The Editor

The next issue of SPUMS will contain a special article by Professor Brian Hills: The Fundamental Approach to the Prevention of Decompression Sickness.

There will also be articles by several authors giving their view on the place of Practise of Emergency Ascent in the training of amatuer divers.

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IDLE TALK - *"If it wasn't enthusiastic amateurs..."*

In an apparently idle aside during the discussion on the last day of the Diving Medicine meeting at DOWNUNDER 77 one of the Professional diving medicine specialists present voiced his "fear" lest "amateurs with their need for power, their Ego trips and less informed views, will take over in Diving Medicine". Leaving aside the faint possibility that in this somewhat imperfect world the occasional professional may be less than totally objective and open minded at all times, the proposition concerning the place and value of "the Amateur" is worthy of greater study. One must remember that a sufficiently successful amateur is granted professional status in most Arts and Sciences!

The history of human progress has shown the difficulty new ideas have always met before becoming the new shibboleth of the learned. Medicine has a long tradition of recourse to Authority when confronted with some challenge to its teaching, though showing an alarming tendency to embrace some ideas in an almost hysterical manner. The "Stress and Steroids" era and the unquestioning faith that Antibiotics will Cure All Ills are now as passe as belief in the flat earth theory or that Scientists are filled with an unemotional and unworldly search for Truth. For it is those who are not satisfied with the accepted dogmas who provoke change and make discoveries known: the "professionals" have reputations to protect, private kingdoms to guard against interlopers. So what sort of story do we find in the matter of Man's adventuring underwater, what is the "track record" of the diving "Establishment" to date?

In the beginning only the slave or fisherman classes dived, and deaths were accepted as natural to such people in such occupations. It was really only the need to remove the "Royal George" wreck that made respectable people accept that there was any problem, other than that of getting drowned. So "they" called in Professor Haldane and The Tables were handed down. Thenceforth it was to be understood that anyone suffering Bends had failed to stick to the rules and it was his own fault. It is only now being accepted that some divers <u>are</u> susceptible to decompression sickness at depths and times completely safe to the vast majority of others. For far too long such tales were laughed out of countenance by The Experts. It was noticed, however, that as dives became deeper the tables became less successful. Rather than re-examine the basic theory The Experts added a half-time here and there. Recently the complexity of Decompression Sickness has been accepted: the facts for this change of attitude have been around for many years And it is the outsiders like Keller who showed that there were other ways of tackling diving problems. There is even a powerful move afoot now to turn theory upside down and have the deeper portion of the ascent slow, with the faster phase as the surface is neared. And everyone knows how it was "proved" by the physiologists of the diving inevitably result in a fatal crushing of the chest. The exploits of native divers, being contrary to the possible, were totally disregarded until the deed was seen by too many people of standing to be any longer denied. The present record, held by Jacques Nayol, is 100 meters. This man only started to dive deeply at the age of 40 year. He now dives so deep that the "safety divers" are using their apparatus deeper than its safe limit. By present Medical Fitness Standards it is doubtful whether he would be allowed to take up diving without a friendly lecture on the health hazards he faced: and Dr Nic Flemming would certainly never be let loose amongst his sunken cities had he been one to take advice readily.

It seems possible that the taking-up of the SCUBA and the wet-suit by the non-naval

divers of Europe and the USA after WW2 greatly advanced the interest in diving, hitherto the exclusive reserve of burly hard-hat divers and the “frog men”. This expedited the exploration of the undersea world and led to greater awareness of the need for safety, a prerequisite for the evolution of Diving Medicine itself. It was the BS-AC, an amateur body, that first started to require effective health checks of divers outside the armed forces. And because they are nobody’s employees, the amateur diver will more readily complain of bad apparatus, cold, etc if anyone is willing to listen with an open mind.

Perhaps we all need to accept that for sheer pleasure and adventure one may find the Amateur can offer much, but for steady dependable performance to a programmed routine the Professional will always be required. One can safely say that throughout history there have always been professionals not pleased at the competition of enthusiastic amateurs.

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A “RED” MONSTER ?

Soviet Oceanographic Society member A Pechersky told a reporter of the Komsomolskaya Prava that he and his son saw a giant snake-like creature in Lak Kok-Kol in southern Kazakhstan. Water fowl fled the water in alarm as the monster reached the surface and ploughed through the water. Several sightings of a huge creature have been reported in the lake. Scottish scientific circles have refused to comment on the possibility that “Nessie” has defected.

A, 31 January 77

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THE KISS OF MILDRED’S LIFE

Mildred the goldfish is alive and kicking today .... saved by the kiss of life. She had been found floating apparently lifeless in her tank by Rodney Griffiths, 8, at his home in Stevenage, Hertfordshire, England. His uncle, Michael Reed, lifted the fish from the water and blew into its mouth. “I was amazed,” said Mr Reed, “the fish responded immediately and looks fine now”

S, 6 April 1977

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A FIN WAY TO ENSURE CLEARED WATER!

Terry Hendrickson of the La Jolla Scripps School of Oceanography has been credited with a novel way of clearing others away from where he wants to dive. He is said to have constructed a large dorsel fin and wired it for remote control. When solitude is required he comes ashore and suddenly the fin appears weaving in a sinister fashion along the top of the water. It is to be hoped that he also leaves the water if the fin fails to respond to the control instructions ...

MD, 16 February 1977

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DIVING AFTER SPINAL BENDS

Dr David Elliott, now Consultant in Undersea Activities for Shell UK Ltd, has kindly supplied the following advice and comment on this problem:

"We have just concluded a fairly vigorous discussion of the problem of fitness of divers to continue diving after suffering 'spinal bends'. This arose because an 'approved examining doctor', in accordance with UK Department of Energy Regulations, examined a diver for fitness to continue diving after an episode of numbness and tingling. The patient was referred to a consultant neurologist who confirmed that there was no detectable neurological deficit. In spite of this finding the approved doctor considered that the diver would be permanently unfit for diving. The diver appealed to the Health and Safety Executive and I was asked to give an opinion. My own view was that this diver should be allowed to continue diving but, since this was an important precedent, I sought the opinions of a number of colleagues. The replies were detailed and not without some reservations but, in summary, it may be concluded that after a suitable interval a diver who has had a 'spinal bend' may resume diving (though possibly with some temporary restriction on depth and duration), provided that a Consultant Neurologist confirms that there is no residual deficit. It can also be concluded, from this very informal canvassing, that any diver who does have a detectable residual lesion must be told that he should not dive again. Of course much depends on the circumstances of an individual case and the judgement of that individual's own doctor. It is hoped that this guidance is helpful."

We are extremely grateful for this very helpful statement of opinion.

THE HISS OF LIFE ?

When Adelaide reptile farm owner Joe Bredl transported some of his specimens in sacks in his truck he forgot that the term "peer group pressure" could be translated to mean that those at the bottom of the pile get squashed.

He was dismayed on arriving at his destination to find that his favourite taipan, the deadliest snake in Australia, had seemingly expired. Never one to fail a friend in need, Joe pushed a straw down the snake's windpipe and revived it by EAR methods. Could you successfully resuscitate a friend?

EXERCISE, LIKE SEX, SHOULD BE REGULAR, SAYS DOCTOR

Dr Harry Lander, at the University of Adelaide, has spoken up after a couple of health-seeking joggers fell dead after their exertions recently. He said that a lot of people are seen in the Adelaide Hospital who have discovered that they have pushed it too far. The most strenuous exercise most people take, he commented, is regular breathing. He added "it's the same with sexual intercourse, you've got to keep at that, otherwise you can drop dead there too". He gave his exercises as breathing and flying.

Naturally the National Heart Foundation doesn't accept this defeatist talk. Dr John McPhie, Medical vice-president, replied that "there is ample evidence that people who exercise have a lower incidence of heart attack. The sudden death of a 25-year-old can happen in front of the television just as easily as while jogging. It depends on whether there is an existing predisposition."

It is not certain whether divers let all aspects of their health become neglected, but it is best to keep the above advice in mind .....

A TREASURED INCIDENT
(Contributed)

We were diving on the remains of this wreck, using an air lift to suck the pay dirt from inside the wall. Dick was down first, followed by Tom (who got hooked up in the blower drum float on his way to the surface when the sucker pulled out of the drum). Then it was my turn to go down. I sucked along the outside of the ship's plate we had discovered until my DCP got into the first red square. Then I gave three tugs on the rope for the drum to be pulled up. It was so heavy that they thought it was caught up on something and slacked away again. I rushed to the surface to tell them to keep on winching, then went back down to 50 feet and checked that all was alright before surfacing. I was telling Tom what to do on his next dive when I suddenly felt a little bit funny. I said "Hold on, lads, I feel queer." Then I noticed my right arm was going numb and that I could not move my fingers - my arm felt like a dead log of wood. My thinking was unimpaired and I told them to hurry and get me a new tank and get me back in the water quickly, with someone to come with me also. I could not put my flippers on or mask. Finally I had all gear on. The weight belt was hard to get on. My legs seemed weak, but it could have been nervousness. Tom threw the pay dirt drum, on a rope, into the water and I fell over the side with Harry.

We sank down with the drum, Harry holding my arm. We reached bottom at 100 feet and within a minute my arm came right. It was a great relief to move my fingers and feel with them. My legs seemed OK again, too. After about 2-3 minutes we started slowly up the rope. Harry had a depth gauge. We ascended to 60 feet and spent about 2 minutes there, then I asked him to get a watch. He went to the surface and I started slowly working my way to the surface up the rope, taking 5 minutes to reach 30 feet. I spent 5 minutes at 30 feet, 10 at 25 feet, 20 at 20 feet, 20 at 15 feet, 20 at 10 feet, 10 at 5 feet and then surfaced OK. Total time of dive treatment had been 1 hour 35 minutes.

It is hard to say just what went through my mind. For a start I was worried, for I remembered other bends cases I'd heard about, and I was worried about what my wife would think. Then when I reached the bottom it all seemed unreal, I felt so fine. But I knew that if I went straight up to the surface I would be worse than ever, and even going slowly I might get it again at say 30 feet. It was miserably cold when I was by myself but when someone else was with me time passed more quickly. Harry arrived with a watch: till then I kept thinking of all the bad things that may happen and kept wondering if my hand was tingling with cold or was it bends coming on again. For a start the time at 30 feet to 20 feet passed very slowly, every minute seemed like an hour. But after a while it seemed to speed up. I was quite cold though not shivering, and the water was opaque like green soup. Dick and Harry swapped duties as "nurse" and gave me a new tank, which I held between my legs. Just having something like a tank to look at helped pass the time.

After I finally surfaced I took my gear off except for the wetsuit, and waited for any symptoms to return. The others wanted to go but I decided we would make the most of a bad day by pulling up the metal plate with the portholes. We nearly tipped the boat over with a double purchase on the davits. Eventually we got it slung beneath the boat from both sides and slowly steamed ashore, arriving just in time to winch the boat out and pull the plate to land. Then home, showered, lunch and back to the ramp to remove the portholes from the plate, afterwards working on garden pump and boat bilge pump.

During decompression treatment Dick came down with a good 3-diamond ring from my pay

dirt bucket to cheer me up ... it did give me a burst, too.

Perhaps the worst parts were the initial feeling of impending disaster as my arm went numb and the thought that symptoms could come back as I ascended after coming OK at 100 feet. My thoughts? I could see the boat above but was unable to go there, it was Taboo Country.

(The writer of this account kindly gave permission for it to be published. Names have been changed, the facts are as related. It may be of both interest and help for diving doctors to hear the patient's story. This tale can be interpreted to show many lessons and at least two diagnoses. The victim of this tale has heard Dr Carl Edmonds talk on the in-water treatment by oxygen, but only since the incident occurred.)

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AVIATION SAFETY, WINGED AESCULAPIUS

It isn't every day that an invitation comes to join a class of pilots on an air medicine course. I arrived just in time to enter the compression chamber and "go up" to 24,000 feet before taking off the oxygen mask to learn the feel of oxygen lack, to be recorded by pencil on a pad ..... nearly illegible before oxygen was resumed.

Everyone talks flying all the time. We saw a lot of films ... how to survive on a tropical island; when and how to use a variety of ejector seats (they never practice using them, as crush fractures of lumbar vertebrae are a real hazard).

The old pilots (in their thirties) speak critically of the younger generation. "We worked hard to ensure success. Now they don't care if they're scrubbed; they go and do something else. And it's no use threatening young student pilots that they'll get killed if they do the wrong thing. In these days of disposables and inbuilt obsolescence they don't fear death ... so they are taught it will hurt before they die; then they pay attention."

We learned of noise hazards, about spacial disorientation and about night vision. Good pilots are encouraged to lead almost monastic lives. Wine, women and song are all bad news before flying.

(Extracted from an essay by "Hypophysis" in AMA Gazette, 4 August 1977)

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MARINE RESEARCH

A major expansion of research on the Great Barrier Reef will begin in 1978 with the commissioning of a new $1.2 million ocean-going research vessel for the Australian Institute of Marine Science.

Funds for research in Australia's Antarctic Territory have been increased from $6.5 million to $8.7 million, with the emphasis on marine research.

The Bureau of Meteorology will also be upgraded and intends to deploy drifting buoys in oceans to the south and west of Australia to measure sea surface temperatures and atmospheric pressure.

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Establishment of a Medical Registry for Professional Divers
AUSTRALIAN CONCILIATION AND ARBITRATION COMMISSION DECISION
MIS 102/77 SD PRINT D2841 (C NO 2580 OF 1976)
Mr Commissioner Mansini Wednesday 20 April 1977

In this matter, which was heard at Sydney on 23 and 24 November 1976 and at Melbourne on 20 December 1976 and 3, 24 and 25 February 1977, the Professional Divers' Association of Australasia ("the PDAA") seeks by award prescription the establishment of a central medical registry for the purpose of filing and reviewing all professional divers' X-ray films, medical histories of compression and decompression and results of six monthly medical examinations.

The PDAA seeks to have such a registry established at The Prince Henry Hospital, Sydney, where on 23 November 1976, during an inspection of the hyperbaric and radiology sections, Dr I Unsworth, the Director of Hyperbaric Medicine and Professor HBL Williams, Director of Diagnostic Radiology at the hospital, indicated a willingness to co-operate and assist in such project, subject, of course, to authorisation by the proper authority. I am indebted to both Dr Unsworth and Professor Williams and to Dr CG MacFarlane of Bairnsdale, Victoria, who later gave evidence in Melbourne in relation to his experience of examination and treatment of divers generally and the question of establishment of a registry for the purpose sought by the PDAA, for the time they gave and the expert evidence presented to the Commission.

Employers opposed the application on three principal grounds:

(a) that it was not an industrial matter within the meaning of the Conciliation and Arbitration Act,
(b) that it was neither practicable nor desirable for the Commission to prescribe by award, terms and conditions relating to health and safety of divers, and
(c) it was not possible for the Commission to require a hospital not bound by the award to observe certain terms and conditions of that award.

They suggested that what the PDAA was seeking was a matter for appropriate government legislation. Some States already had certain legislation on some of the subject matter of the application and the PDAA should seek to have this updated and similar legislation introduced into other States where professional divers operate.

The PDAA submitted that on matters so vital to the health and safety of its members engaged in diving work around Australia and in an industry where employees moved to and from places as far apart as Mackay in North Queensland to the north-west shelf off the Western Australian coast, it was essential to have common and uniform safety regulation and the only practicable way it could see to effect that was by provision in the award which covered most employers in the industry. The establishment of a central medical registry would form an integral part of such regulation. Mr B O'Brien, Assistant Federal Secretary of the PDAA, told the Commission that his enquiries had revealed there were "real jurisdictional problems" in having Federal legislation covering Part II employees; other States, according to Mr O'Brien either had outdated legislation or none at all (ref. transcript at pages 178, 179).

Firstly, I consider this is an industrial matter within the meaning of the Act. It relates directly to the work of divers in the employ of employers covered by an award of the Commission. There is, of course, already some provision relating to safety

in the current Professional Divers Award. However, the Prince Henry Hospital is not a party to the dispute, it cannot be made a respondent to an award made in settlement of the dispute and therefore the Commission is unable, by award prescription, to have the Prince Henry Hospital establish and maintain a medical registry in the manner sought by the PDAA.

At the same time the material presented to the Commission in these proceedings has established that there is considerable merit in the proposal of the PDAA. Professor Williams and Dr Unsworth favour the establishment of a central medical registry for X-rays and medical records of divers as a means of detecting the disease known as aseptic bone necrosis and prevention of the disease in divers. They indicated that proper facilities were available at Prince Henry for keeping such a register. Dr MacFarlane agreed to the extent of keeping a register or record of long bone X-rays, but was not so enthusiastic about the practicability of keeping other medical records of divers in a central registry. They all agreed it was most important that the quality of long bone X-rays be of a high standard and that it was possible to miss early detection of aseptic bone necrosis unless a high standard of X-ray was maintained. Professor Williams suggested it was desirable for all radiology clinics taking X-rays of the long bone to adopt standard techniques and preferably those recommended by the British Medical Research Council which are used at Prince Henry Hospital.

During these proceedings Mr T Taylor, appearing for a number of respondent employers, said:

> "I submit that an award is not the document or the legislation or the law that should cover these aspects. I suggest that if there is to be control, then it should be done through appropriate legislation made by the government of the day" (ref. transcript at page 153), and later Mr R Taylor, appearing for other respondent employers, said:
>
> "We do therefore ask that you dismiss the application by the union which seeks the formation of a central medical registry in the ageas of the award but to give consideration to using the influence of the Commission wherever possible to assist in the formation such a body under the appropriate government authority." (ref. transcript at page 176).

In my view the matters raised in this application are of such importance to both employers and employees engaged in the professional diving industry that they should be pursued at an industry level and not only by one or other of the parties. The parties are already agreed on the necessity to have a central registry for X-rays of divers and if it be found to be practicable, I would suggest consideration should also be given to keeping their medical histories in the same manner, or at least, other alternative and effective means should be investigated. With this in mind I propose to arrange as early as possible for industry representatives (ie. from both the PDAA and employers) to discuss the matter with appropriate federal government officers so that the PDAA proposals can be considered and investigated by the proper authorities. The parties will be notified when such arrangements have been made.

The PDAA also sought an order in respect of additional safety standards, divers log books, etc. (proposed clause 4), but as there is insufficient material before the Commission on which to reach a conclusion at this point in time, leave is reserved to the PDAA to present argument on those matters when other outstanding issues in the log of claims are being considered.

DIVING EXPLORATION OF EXTENSIONS TO LIMESTONE CAVE SYSTEMS

CD Maxwell

This paper was presented at the 1977 Symposium for the SA Society for Underwater Science.

ABSTRACT

For many years members of the South African Spelaeological Association (SASA) have had to end their exploration of a cave system at a place where the cave passage ended in a pool of still or flowing water. Besides a few dangerous and usually futile attempts at free-diving these underwater passages, diving in this type of situation has been very limited in South Africa until a few years ago.

Most of the SCUBA diving done in fresh water caves has previously been done in large underground lakes or crater lakes such as Sinoia Cave (Rhodesia), Otjikoto Lake (SWA) and Wondergat (OFS) which require little, if any, experience in caving or cave diving techniques.

This paper describes a few caves which have been explored more fully by SCUBA DIVERS FROM SASA in the limestone belt of the Cango Valley near Oudtshoorn. Reference is made to specialised techniques and equipment used as well as the dangers, aims and Scientific Research possibilities associated with cave diving of this nature.

1. INTRODUCTION

Fresh water cave diving is a subject with many variations because there are not only many reasons for diving in a cave but also many types of cave to dive in. As a result the diving conditions vary from short, tight stream passages with zero visibility, only a few metres deep to huge underground lakes over 100 metres deep with visibility of 50 metres or more. This paper deals with the former type of diving condition, with special reference to three limestone caves in the Cango Valley, near Oudtshoorn namely Cango Cave, Efflux Cave and Conflux Cave.

Cave diving in South Africa is a fairly new branch of SCUBA diving and in the past most people who have dived in caves have been trained either as SCUBA divers or as spelaeologists, but not as both. In June, 1973 a party of divers from The Atlantic Underwater Club were invited to join The South African Speleological Association (SASA) in a trip to the Cango Valley to dive in Emerald Lake and in a water trap in the stream passage at the furthest explored extremity of Cango II or “The Wonder Cave”. Since that most successful weekend there has been an increased interest in cave diving as an integral part of spelaeology and close co-operation between SASA and The Atlantic Underwater Club has resulted in a number of people now being members of both organisations simultaneously. By November 1974 the position of Cave Diving Officer has been made in the SASA committee and to date a large number of caves have been dived in by SASA, not only in South Africa but also in SWA and Rhodesia. In addition, a set of Guidelines for Cave Diving and a Cave Diving Handbook have been drawn up by SASA. The union of spelaeology and SCUBA diving can be seen when a cave diver is diving a short underwater passage, kitted up in mining helmet and lamp, overalls, boots, SCUBA tank and mask.

The reason for SCUBA diving in water filled passages such as those found in some caves in the Cango Valley would firstly be to ascertain whether further ** “dry” cave existed

** NOTE: "dry" cave means the part of a cave system not requiring diving even if the floor has water over it.

further on. The passage can then be surveyed by SCUBA divers, the results of which being included in the map of the rest of the cave. Once the exploration is completed SCUBA diving can, either directly or indirectly, be used for research into the archaeology, geology, biology or hydrology of the cave.

2. LIMESTONE CAVE FORMATION

If a fault occurs in a sedimentary rock such as limestone (ie. calcium carbonate), rain water combining with carbon dioxide from decaying organic matter to form a weak solution of carbonic acid, finds its way into the fault and reacts with the calcium carbonate to form soluble calcium bicarbonate.

$$CaCO_3 + CO_2 + H_2O = Ca(HCO_3)_2$$

This reaction is reversible and, when the calcium bicarbonate solution comes into contact with an atmosphere less rich in carbon dioxide, calcium carbonate is deposited in the form of calcite formation. In this way a solution cave is formed, often with a stream passage at the bottom, although a number of upper systems may exist.

For this reason, when exploring a cave system that appears to have reached an end on an upper level, the stream passage should be located and explored in the hope of breaking through again further on into the main upper system, possibly on the far side of a rocky collapse. It often happens that the stream passage reaches a water trap or totally submerged underwater passage and the only way to attempt further exploration lies in diving. As free diving in caves is expressly dangerous except for short and well explored passages, SCUBA diving equipment and techniques, specially modified for cave diving in confined spaces, should be used by specially trained cave divers.

3. EQUIPMENT REQUIRED FOR DIVING IN RESTRICTED CAVE PASSAGES

When selecting equipment to dive a waterfilled passage in a cave, the minimum of equipment should be used that will still allow a good safety factor, as the site for the cave dive may be over 1,000 metres from the cave entrance and it is a considerable task to transport diving equipment, ropes, caving equipment and emergency equipment through a cave which may require crawling or climbing over slippery rocks or mud.

It has been found that a high pressure 4 litre tank with carrying handle and screw-in type demand valve is an ideal combination for short water traps. The tank is usually hand-held while diving to prevent it catching on the roof of the passage. Although only one diver usually dives at a time, there must be a standby diver and a rope tender present. The life line can either be made of polyethylene which floats or braided nylon which sinks, although nylon is the stronger of the two. The lifeline must be brightly coloured and be at least 4 millimetres in diameter. A mask without a snorkel, a neoprene vest, an underwater torch, compass and watch complete the basic diving equipment.

Flippers and weights are usually not used as the diver can push and pull himself along with his feet and hands. A spare torch, caving boots and helmet must be available to enable exploration on the far side of the water trap if necessary.

4. CAVE DIVING IN THE CANGO VALLEY

4a. CANGO II WATER TRAP

The Cango Cave system runs due west along the main Cango limestone belt and consists of Cango I which is the tourist section (800 metres long), Cango II or the “Wonder Cave” (400 metres long) and the newly discovered Cango III (approximately 2,000 metres long).

On the 1st June, 1973 a party of five cavers, including two divers, attempted to dive a water trap in the stream passage below the end of Cango II. A water trap is defined as any place where the roof of a cave passage dips underwater but lifts again above the water further on. The purpose of the dive was to try to ascertain the extent of the underwater passage and whether access existed to a further "dry" cave further on. An attempt had previously been made to free-dive the water trap by a senior member of SASA and a small chamber with limited air space had been found, about 6 metres in. It was therefore planned that the same person would again free dive to the first chamber to act as an intermediate rope tender for a SCUBA diver, who would continue along the underwater passage at the far side of the chamber. This memorable cave dive resulted in the discovery of a further 15 metres of underwater passage at which point the passage consisted of limestone with a floor of fine silt, which quickly stirred up the naturally clear water into zero visibility. As the water flow was towards the entrance to the trap the visibility was good in front of the diver with the result that small calcite formations were seen further on in the passage before it took a gentle turn, indicating that there had been air in that section during some previous period. A direct result of this cave dive was the purchase by the Oudtshoorn Municipality of a submersible water pump to enable the water level to be dropped so that the passage floor could be dug out, enabling cavers to get through.

On 30th March, 1975, after the stream passage had been suitably enlarged, the first two people broke through into a continuation of the upper Cango Cave system which turned out to be about 2,000 metres of the most beautiful cave in South Africa, now known as Cango III.

As Cango III is sealed off from the rest of the cave, and probably from the outside World completely, it presents a unique situation for scientific research for a number of reasons. It has not yet been ascertained where the Cango stream originates or where its final destination lies. It has been explored downstream from the Cango II water trap to under Cango I and upstream well into Cango III beneath the upper system. Both ways it is likely that further exploration will require SCUBA diving. The mean water flow of 700 litres per hour and water temperature of 18 degrees Centigrade do not differ appreciably throughout the year.

If the seal on the water trap is continuously broken by dropping the water level in the stream passage by means of a pump, then the delicate balance that exists in Cango III may be affected. This could effect the formation of the calcite deposits that decorate the cave in such abundance. The ideal way to control this would be to allow only divers through the water trap to take readings of carbon dioxide in the air, air and water temperatures, humidity, atmospheric pressure, etc. The air in Cango I is badly contaminated with carbon dioxide by the many people who visit the cave and to a lesser extent, is the air in Cango II. As the humidity in the cave is very high (nearly 100%), the high concentration of carbon dioxide combines with water vapour to form carbonic acid, causing the formations to lose their original sparkle, often to re-crystallise in a dull, powdery calcium form which attract dust deposits. For this reason an excess carbon dioxide build-up should not be allowed in Cango III.

4B. ATTEMPTED LINK UP OF EFFLUX AND CONFLUX CAVES.

About 15 kilometres to the East of Cango Cave is situated Efflux Cave, also running due West along the Cango Valley limestone belt. Here 760 metres into the cave through tight crawls and one impressively large chamber is found a water trap in the stream passage.

Here on the 16th December, 1973 another important breakthrough was made by members

of SASA when the water trap was dived by two of its members, using a four litre high pressure tank. The trap was wide but with very little roof clearance, and had a muddy floor. As it was entered with the flow of the stream going in the same direction as the diver, the opposite situation existed to that in the Cango II water trap and the visibility was zero from the start of the dive. The water trap was only about 6 metres in length and the stream passage on the far side led into a very large chamber with active calcite formations. To date the explored length of the cave has been extended by another 740 metres. A fixed guide line has been installed in the water trap by divers as well as a very simple but effective communication system, consisting of a length of hose pipe with a funnel at each end.

On plotting the line surveys of Efflux I and II it was found that the furthest point of exploration, where the stream passage becomes too restricted to progress further was only about 100 metres from an underwater passage in another cave named Conflux. This has been dived in once and about five metres in a small waterfilled chamber was found with a rubble slope at the far side which appeared to be accessible, but dangerous from a diving point of view. At present plans are being made to lower the water level to enable an attempt at breaking through into a side system of Efflux cave. The likelihood of an Efflux-Conflux link-up are good as the water temperatures are identical and during heavy rains the same volume of water that is observed running into Efflux is observed coming out of the entrance to Conflux. A fluorescein test will also help to confirm this theory and is planned for the future.

5. CONCLUSION

To conclude, cave diving has become a vital tool in the exploration of caves and has become an extension to speleaology as well as an extension to SCUBA diving. The true cave diver must be concerned basically with cave research and exploration.

The scope for cave diving is wide and varied and there are many more underwater caves awaiting exploration.

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7. ACKNOWLEDGEMENT

I would like to express my thanks to Mr J Blacquire of the SA Spelaeological Association for supplying me with some of the technical information used in this paper.

continued from page 11

has given him a unique insight into walking in circles. This is his 12th public walk of this nature. He has done it several times in India and also in Afghanistan, Iran, Kuwait, Thailand and Malaysia. His aim is eventually to give the British people a chance to watch him walk in circles, and at the same time to break the world record of 160 and a half hours non-stop for walking in circles.

Daily Telegraph, UK

(Editor: This story seems to be some sort of comment on Life, if I could but dare to draw conclusions!)

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APPENDIX A:

GUIDELINES FOR SCUBA DIVING IN CAVES UNDER THE AUSPICES OF THE SOUTH AFRICAN SPELAEOLOGICAL ASSOCIATION (CAPE SECTION).

Charles Maxwell - Cave Diving Officer - 16th March 1976

1. A dive leader must be approved by the committee prior to the meet. The dive leader should be given as much notice as possible to enable him to plan the dive. A dive leader should be a competent caver. The dive leader has the privilege of choosing his diving team and non-diving assistants with the co-operation of the meet leader. The meet leader has the final say in any decision.

2. The dive leader should use the following guidelines when choosing cave divers:

   (a) It is recommended that a 3rd Class Diving Certificate by held by all cave divers except under certain circumstances and at the discretion of the dive leader. An eventual cave diver's competence test should be devised, to be passed by all cave divers.

   (b) All members of the diving team should be able to handle themselves in the cave up to the point of the dive.

   (c) Diving in restricted caves should be done only by cavers experienced in tight dry caving and caving in stream passages.

   (d) It is the dive leader's privilege and/or responsibility to decide on the equipment required by each cave diver in the team and must prevent a diver from diving if his equipment is considered to be inadequate, unsuitable or faulty.

3. Whenever a cave dive is done involving SCUBA, then there must be suitable standby diver/s with adequate equipment to perform a rescue if necessary. At the dive leader's discretion a diving buddy can be considered as a standby diver.

4. When the dive leader is personally involved in a dive then he should, if he feels it is necessary, elect a deputy dive leader to take charge while he is underwater.

5. It is acceptable for one diver to dive at a time if the type of cave dive dictates this. In some cases it is dangerous for two divers to enter an underwater cave together.

6. When the circumstances permit the use of rope signals the following should be memorised by all members of the team prior to the dive:

1 PULL: **DIVER** - I AM OK. OR I AM GOING FORWARD. GIVE ME SLACK.
TENDER - ARE YOU OK? OR ACKNOWLEDGEMENT OF DIVER'S OK SIGNAL OR GOING FORWARD SIGNAL OR ASKING DIVER TO REPEAT ANY OF THE OTHER SIGNALS WHICH WERE NOT CLEARLY RECEIVED.

2 PULLS: **DIVER** - I AM COMING BACK, TAKE UP SLACK.
TENDER - ACKNOWLEDGEMENT OF DIVER'S SIGNAL OR TELLING DIVER TO COME BACK. (DIVER TO ACKNOWLEDGE).

3 PULLS: **DIVER** - PULL ME OUT SLOWLY.
TENDER - ACKNOWLEDGEMENT.

OVER 3 PULLS: **DIVER** - RESCUE AS PREPLANNED.
TENDER - ACKNOWLEDGEMENT.

(The last signal should be a good number of pulls by the diver so that it cannot be confused with any other signal; say about 5 or 6 pulls in quick succession).

7. The use of life lines is mandatory.

8. When a diver cannot communicate with the tender and the underwater conditions permit him to wear and read an underwater watch, then he must wear one. The rope tender should always have a watch and the duration of the dive should be pre-arranged.

9. When selecting the size of diving tank or planning the maximum depth and/or duration of a dive the one third method should be the minimum one used. (ie. 1/3 in + 1/3 out + 1/3 reserve). For exploratory dives in poor conditions a larger margin of reserve air is recommended.

10. The dive leader shall be responsible for reporting to the Cave Diving Officer or Committee any new developments in cave exploration involving cave diving, so that records can be kept to assist future cave divers.

APPENDIX B

USE AND CARE OF LIFELINES

There are basically two methods of using a life line and each has it’s advantages and disadvantages. The first is a line, attached to the diver’s waist or wrist by means of a bowline which is controlled by a rope tender. This is useful in that the diver need not worry about handling the rope and signals can be transmitted along it for long distances, provided the line does not go round corners or become snagged in a crevice. The main disadvantage with this method is that the line is moving as the diver moves, increasing the risk of it fray-through or being pulled from the central passage into a crevice. The second method is the use of a free running reel with a handle and brake which can be made up easily using perspex and aluminium strips. The reel must be attached to the diver in case he drops it. The brake should work with a pin that is spring loaded so that when released it would shoot into a hole on the side of the reel so in an emergency where the diver drops the reel, it would automatically lock.

When a passage is being explored for the first time or when a survey is being conducted, a temporary knot should be made at the point of furthest penetration or other important feature either by the rope tender (when using Method 1 or the diver when using Method 2 to be measured later for the records. Remember that any knot in a rope reduces the breaking strain dramatically. A bowline is the best knot for attaching the rope to the diver, but even this reduces the breaking strain by about 55% in water, as the rope must be kept as thin as possible for bulk and weight reasons and the knot is the weak link, a short piece of thicker rope could be used to tie on with, attached to the thinner rope by means of an eye spliced into the end of each rope and a small stainless steel snap hook or shackle (a splice weakens the rope a great deal less than a knot).

The rope should be inspected at regular intervals for signs of wear or damage as this

is one of the most important pieces of equipment in a cave dive. A fixed guideline or life line should not be used to pull the diver through the water unless in an emergency, as this will place unnecessary strain on the rope. When a polyethylene (floating) rope is used in a cave with an irregular roof, it may float up and get stuck, making the return trip, possibly in zero visibility, difficult. In such situations the diver should signal “take up slack” so that the rope tender will keep tension on the rope.

In some underwater passages which are dived often such as a water trap separating two “dry” sections of the cave, a permanent guide line is recommended. This should be fairly heavy rope such as an obsolete climbing rope or steel cable and should be well secured at either end. This does not mean that the diver may dive without a life line unless under certain circumstances, a short rope is attached to the diver and the other end is run along the guide line, using a snap hook. For short syphons fixed communications can easily be set up by means of a length of hose pipe with each end out of the water and a funnel stuck in each end, making a “voice tube” which is very effective, reliable and cheap.

When two divers use a life line together, the rope should be secured to the leading diver and the second diver should have a waist band with a snap hook that can be attached to the life line and run along it. An alternative is to use a “buddy line”, but this is not suitable for tight passages. The normal procedure would be to select a “lead diver” to who’s waist or wrist (depending on personal preference) the life line is tied, using a bowline knot. The second diver would have a length of rope attached to himself, leaving a length of about 2 metres. On the other end would be a snap hook or carabina which would be snapped onto the life line between the “lead diver” and the rope tender, ensuring that it could run freely back and forth along the line. This method is much less restrictive to both divers and using this method the signal is passed either from the tender or from the second diver both ways, so that both divers and tender are always kept informed. Also, if the “lead diver” discovered a side system to explore, the second diver can remain at the entrance (that might already be deep into the cave) and become the temporary rope tender. This is especially useful as rope signals do not transmit round corners and the lead diver might require someone at the entrance to the side system with a torch to enable him to retain his orientation, especially on a deep dive. Rope signals are of vital importance and should be standardised for all divers with possible modifications when required. They should be simple, few in number and memorised by all members of the diving team. When any involved messages are required a proper underwater communications system must be used (refer Section 12). The rope tender should keep tension on the rope at all times to receive signals and might need an assistant to help with coiling the rope when the diver is coming back to avoid tangles.

There are a number of ways to attach the rope but the best would be around the waist or onto the wrist. The latter way is better for signals and for being pulled out in an emergency, but must be well tied as it can (and has) slipped off a diver’s wrist during a dive. A bowline with double hitch is the best knot and must be well tied and checked before the dive starts.

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The above guidelines have purposely been left open to manipulation to suit the many variations to cave diving. It is also important that one member of the non-diving team should have a good knowledge of first aid, with special emphasis on mouth to mouth resuscitation, cardiac massage and treatment of shock.

Although these guidelines were designed for one particular diving club they may be of some use to other cave diving groups, with possible modifications.

DON’T SELL THEM SHORT - Teaching the Exceptional Student

Susan O Arnest

ABSTRACT

In the course of an instructor’s career, certain exceptions to the normal student may be encountered. A few such exceptionally poor or marginal students are mentioned in the paper with two discussed in detail. Observations on the methods of instruction and the progress of these students are made and some suggestions for instructing similar students are made. The conclusions drawn are personal, general and largely subjective, but worthy of consideration by all instructors.

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Sooner or later there comes a time when you as an instructor are approached by a prospective student who seems to be a most unlikely candidate for SCUBA instruction. Assuming that you can overcome the problems, whatever they may be, should these people be taught to dive? Most could easily be rejected outright; it is unlikely that they could pass a swimming test designed to screen out a moderately incompetent water person. What is it that persuades the occasional instructor to teach an exceptional, a really exceptional, student? For the purposes of this paper, an exceptional student is one with either physical or psychological problems that seem to make successful completion of a basic SCUBA course an unlikely venture. As such I would propose the blind, the one-legged and the non-swimming candidate and also the prospective student with a debilitating fear of the ocean. People in all these categories have been taught successfully, not all by me but by instructors that I know. Let me emphasize TAUGHT, not necessarily certified.

Why don’t we turn these students away? For some instructors there is a curiosity, for others compassion, and for still others there is an opportunity to meet what appears to be the ultimate teaching challenge. Certainly the hours spent with an exceptional student often exceed all the bounds of economic good sense. To balance this the rewards can be correspondingly great. It is always a pleasure to take a healthy, well-co-ordinated, fit and water-oriented young adult and open the doors of the underwater world to him or to her but your role as instructor has really been just that, a door opener. With the exceptional student you function in a much more complex way and when your student is finally made free in your world of innerspace, you can truly feel that you have had a real part in creating something new.

Speaking personally I would not want to take on an exceptional student who was not reasonably well motivated. Trying to inspire a water-confident but unmotivated person is sufficiently frustrating. I’ve tried and have not been dramatically successful. The power positive motivation can give to people to overcome difficulties is virtually incalculable. As you build a climate of trust this further enhances the motivation. The whole procedure is going to take time and the financial rewards are not necessarily great. Your main returns will be a very real sense of satisfaction and a self-reinforcement of your position as an instructor in this sport of diving.

To further clarify I must confess to teaching in Hawaii, which is Paradise enow! My usual teaching site is a protected beach behind a small barrier reef. My classes are in the daytime and are all-ocean. It does no harm that the mean water temperature is about 73°F and the air temperature is usually in the low 80’s. I am free of many of the problems I would encounter on the Mainland. Water sports at home are a pleasure, not an exercise in endurance. Although students get chilled, they can pick up a neat sun tan at the same time.

In this paper I will discuss in particular two exceptional students from my records. One was a total non-swimmer at the start of her training, the other a poorly co-ordinated elderly diabetic, a functional non-swimmer, afraid of the water. Both were, fortunately, highly motivated and although neither could have been called a good example of physical fitness, both were mentally prepared to learn to dive.

I was never too sure of the primary motivating force for my middle-aged non-swimmer, Kay. I think it was partly peer pressure from fellow faculty members who had signed up for the basic course, partly curiosity and partly a desire to meet a challenge of her own devising. In the case of the diabetic, Ed, the reason was more obvious. His job requires that he make periodic trips to an isolated Pacific atoll (what other kind is there?) for which trips he is unaccountably charged vacation time. There, because of the one-plane-a-week transportation problem he is stranded for a week, sometimes two, with absolutely nothing to do after his work is completed. No diving for the uncertified! His diabetic condition was as yet undiagnosed. In so doing he had put himself in a state of near panic on two occasions while attempting snorkelling. Please bear in mind that both of these people wanted to learn to dive. Both came to me. How flattering.

Believe it or not as you choose, teaching a complete non-swimmer to dive poses very little problem if that difficulty is not compounded by fear. Time if you can afford it, is on your side. All you, as the instructor, have to do is to throw away the rule book and start at the end instead of the beginning. After we had established Kay's good health and that her desire to learn was quite genuine, we made steady, even rapid, progress.

Kay went immediately into full SCUBA gear for her first water session. Special care was taken in choice of fins and mask to assure the greatest possible comfort to minimize personal problems. The mask selected was the old style US Divers "Pacifica" with the big front purge. We have found the ease of clearing this mask makes it nearly ideal for many of our students. Her harness was painstakingly adjusted and she was deliberately slightly overweighted to start. She then waddled down to the beach to begin her great adventure.

What would you think the basic fears of the non-swimmer and the functional non-swimmer are? I've found it's the problems of being unable to stay afloat and the inability to breathe when you sink. It seems pretty-obvious that SCUBA is the ideal way to attack these problems! The procedure is to start the student on the surface breathing through the regulator, holding both hands and facing the student, much as you'd teach a small child to sit on the bottom to blow bubbles, (all the time TRYING to look friendly and encouraging through your own mask) very gradually you both settle to the bottom in about four feet of water. (Remember that extra weights). My non-swimmer, encouraged to sink and able to breathe, quickly relaxed and studied sand particles, my toes, discarded soda cans and anything else that happened by, entranced.

Not so my diabetic. Breathing was fine, as long as his face was dry. As Ed tried to fold his 6'3" of rigid and angular body into three feet (low tide) of water, he got the lower part of his face wet. OOPS! ALL STOPS! With Ed this one simple step took a full two hour water session. Two hours just to get him to sit on the bottom, breathing through a regulator! He was obviously unable to keep up with his class in the water. The first compromise made was to arrange that he would attend all regular sessions but add extra sessions of water work by private arrangement.

Working with Kay, the non-swimmer, comparatively was a snap. In rapid succession she breathed, went to exhalation through her nose with the mask in place, added small

increments of water to the mask herself and cleared it and finally removed and replaced the mask and cleared it all without having taken the regulator out of her mouth underwater. The next step was to have her correct her buoyancy which gave her step by step drills in regulator clearing. Adjusted to neutral buoyancy, she began to use her fins and to learn to co-ordinate her kick underwater. With nothing to unlearn it worked beautifully. We had just reversed most of our normal procedures.

After becoming acquainted with the basic method of manoeuvring underwater, she rapidly caught up with the class level on the rest of her basic skills, still largely underwater. There wasn't a hitch. By the end of her first two hour water session she was buddy breathing with me.

The next session, a week later (this class meets on Sundays only) she moved to the surface, still using SCUBA, and at first with her vest nearly full. Gradually she shifted over to snorkel use and continued to practice kicking, albeit not too well to start with. In the days between classes I am sure she practiced. At any rate, we lent her a class vest to use with her mask and fins in her apartment pool. She made rapid progress.

It was of inestimable help that she was intelligent, verbal and well motivated. The mechanics of SCUBA diving came easily to her, as they do to their first open ocean day for skin diving skills. With her fins, her kick had improved so much that she was able to manage surf entries and ledge exits with no more than the routine assistance given her classmates. This was exciting. On this day we usually have a full complement of safety divers along stationed in the ticklish places. Kay did not avail herself of their services any more than any of the other students.

Uneventfully, I might almost say it became dull, she progressed to the end of the course doing all her water work with her class. Obviously you all know how easy it can be for a poor swimmer to manage diving reasonably well. It gives everyone a false sense of security. The checkout dive day came and Kay, instructor escorted, made a delightful dive with no problems. Certificates and cards were handed out. Did Kay get hers? Of course not! This had been discussed with her beforehand; after all she still couldn't swim.

It was fortunate that at this time we were preparing candidates for instructor training which enabled Kay to join the twice a week "swimming club" at our practice area. Here her basic training finally began. By now Kay was totally confident in the water, both on the surface and under it. She vigorously tackled laps with the staff members which gave her leg exercise. Next we removed her mask, leaving the fins and a partially inflated vest. (We had long since stopped reminding her to inflate that vest, and by now she frequently forgot). Finally the fins were removed, and this time Kay rather nervously put quite a batch of air into the vest and set out in three feet of water to see if she could, in fact, swim. The inflated vest bothered her and got in the way of the arm movements so, quite calmly, she took it off and merrily went on her way, rather jerkily but SWIMMING. Lo! Our non-swimming gal had finally arrived at the point where most SCUBA students start; able to tread water, bob, float and swim her necessary distances. (Side stroke seemed to come easiest).

So she got her card and celebrated by completing the course a second time "just for fun" so that she could be with her husband, just back from Vietnam.

In Kay's case the secret was simply a matter of opening MY mind to an un-orthodox

ORDER of teaching basic skills to a person whose only handicaps were an inability to swim and inner conviction that she couldn't learn because she could not stay on the surface. Using SCUBA immediately and in the order used simply blew the problem away. I've tried it since with good results.

With Ed the problem was more complex. Working with Kay and other subsequent non-swimmers had given me methods and procedures. Ed was my toughest challenge ever. (Incidentally, I don't specialize in non-swimmers but you'll have to admit that a non-swimming SCUBA student is something of a rarity and therefore memorable). With Ed we had an elderly functional non-swimmer, one who had been poorly co-ordinated all his life. Also Ed had badly frightened himself trying, uninstructed, to use a snorkel. He had exhausted himself into a hypoglycaemic episode in his at-that-time undiagnosed diabetes. In his words, it was a bad scene.

We were extremely fortunate that Ed's physician realized the enormous importance psychologically for Ed to meet this challenge at a time when his life seemed to be heading straight for nowhere. This doctor was wise enough to realize that the general improvement in Ed's health was worth a gamble. At any rate he gave conditional approval. I was fortunate in once again having a well-motivated and intelligent student. Ed understood the limitations imposed on him by his diabetes and he understood the disease itself which is not all that usual in diabetics. In fact he had learned by trial and error to control his problem largely by diet before he changed doctors and found out what the problem actually was!

At first my problem was to convince Ed that I had all the time in the world, no hurry, and that his repeated failures even to get his face wet were not going to upset me. I believe my line was, "we'll either get you under water today or stick around and get you under water tonight". I'm not normally a very patient person but SCUBA instruction has wrought some changes. Working with Ed really convinced me of the necessity for presenting a totally calm, wholly unruffled, never-failingly encouraging face to a student. He did get over his self-reproach; he accepted the fact that a pip-squeak female eight inches shorter than he and nearly as old could do it and was prepared to teach HIM. He buckled down and really got to work.

But oh, it DID take time and patience. Between each repetition of every drill we stood up and discussed infinitesimal successes and failures. We weighed every manoeuvre in terms of Ed's sugar levels. It gradually was borne in on me that this was very much a dual learning experience and that I was learning as much on my side as Ed was on his. Fortunately I had a minimal background in diabetic metabolism and things like this fascinate me, so we had some valuable discussions on energy levels. (Ed is capable of several hours of hard physical labour under our Hawaiian sun, simply using sips of Coca-Cola™ to balance his sugar needs).

Gradually we reached toward the goal of getting him certified before his next trip to the atoll. There would be no diving there for him unless he had his card. Once I finally got him into the water the next hurdle was air supply. Ed is a large-framed man and a heavy breather. He was provided with the largest bore snorkel available and he found it just barely adequate for his surface work. You must bear in mind that his residual fear level was NOT assisting him in any surface work and we tried to stay underwater as much as possible to start with. He developed a hang up about our class regulators and so he purchased his own-for class use. The psychological boost of his own regulator and gauge was augmented for him by suggesting a regulator with an adjustable flow feature on the second stage. I am not going to discuss the pros and cons of this feature, I can only attest that certainly in this case the real

value was a feeling of some sort of control, however small. It was real! His own pack, adjusted for his tall frame, was another help as was a large BC with tank inflation. (These were not standard equipment). Here again my personal feelings had to be put aside, this student had to be equipped to his preference. Step by step and with checks and halts, in whatever order seemed to be best to arrive at the desired goal, the standards of performance for certification were met. With his extra hours and his full attendance at the basic course, Ed made it and received his card. It was a great day for both of us. He went off on his next assignment and his only complaint was that he didn't get enough diving.

Drawing on my personal experiences and those of other instructors who have taught exceptional students, I can generalize a little. Teaching the exceptional student is stimulating, challenging and time consuming but in the process you learn too. You get reinforcement from THEIR enthusiasm and frequently they try harder. Your teaching techniques may get a thorough shuffling. You may find yourself reorganizing your basic course for the regulator, then mask and so on. Since my experiences with my exceptions, we now start with mask clearing as the first learned skill after breathing underwater.

Wherever possible take your cues from the student, rather than trying to stick to a rigid schedule. Flexibility is the golden word; if problems arise, you can skip a whole block of routine exercises and comeback to them later, or never. NAUI very wisely does not rigidly structure the basic course. The handbook says "the following skills must be performed during the course ..." A swimming test, per se, is not required, but a level of competence emphatically is. Thou shalt not CERTIFY thy student until he meets that level, but it does NOT have to be on the first day of class.

Because of the enormous increase of "stand around and talk story" time involved in teaching people with physical and psychological (especially the latter) hang ups, I feel I'm lucky to work in Hawaii. Although my prime teaching area looks very much like the breakwater area near Monterey, the difference is very apparent in the ambient air and water temperatures.

Now I must speak out strongly and as an individual. Two years ago Tom Mount presented a paper here in San Diego which be called The Diver's Head. I quote, "if one were to select a ratio for the ideal balance of a diver, my opinion would be 60% head and 40% physical ability. The heavier weight is in favour of the head as it governs the physical response and control of the diver." I concur. A well trained THINKING diver who maintains a reasonable physical condition can be a far safer diver than one who is physically superb yet unthinking. Which group, after all, is the high risk group for automobile insurance? Are we going to be driven by fear of legal action to insist on ever more complex and demanding physical criteria or are we going to try to become increasingly aware of the more subtle problems? To know your limitations and to have the maturity to abide by and work within, that knowledge will prolong the length and enjoyment of a diving career.

I think we do a great disservice to a large number of people by basing so many of our standards and decisions on the experiences and conditions of one major geographical region and of one large population segment. Why does a diver have to be trained as if to dive in cold, dirty water when he doesn't live in that area and in all probability will be unlikely ever to dive there? We have been so brainwashed about our sport that we're in some danger of making diving like a club for which the

entrance requirements are so stiff that the club expires for lack of members. I am sure that there are many physical handicaps. Students who, with drive on their part and with patience and innovative teaching on the instructors' side, have surmounted the challenges, have been certified and who have gone on as safe and enthusiastic divers.

Both of the two divers I have discussed in depth are currently active divers. Kay recently called me in panic with an ear problem. Her doctor, a non-diver, had given her the classic "you'll never dive again" pitch. Fortunately there are other ENT men and she was referred to one who dives. Net result - a happy diver once more doing her thing.

Ed dives with us every weekend when he's not bopping around the Pacific Basin with tanks and portable compressor. Now that he's certified he's developed his own style. He clears his own special hand signals with his buddy for each dive and limits his dive to a total consumption of an Aluminum 90 charged to 3000 lbs. He uses this air for surface swimming as well as the actual dive because this represents his approximate energy limit. A few eyebrows were raised at first because this is unorthodox behaviour, at least in Hawaii. I was able to quell this when I mentioned having seen a NAUI instructor, from the Mainland, using his regulator for a surface swim. After all I know, and Ed knows, that he CAN use that pesky snorkel.

Ed also dives with an emergency supply of hard candy in plastic film cylinders tucked into both pockets of his BC. He can comfortable eat the candy underwater should a need arise for an energy boost at depth. He complains that the taste of candy and saltwater is nauseating, but it works. Incidentally, these little cylinders are pressure proof, or at least they stay dry inside, down to 130 feet as I discovered by accident. We are at present investigating the possibility of taking Cokes underwater in playtex collapsible nursers. Except that I break up every time I think of Ed nursing away at 60 feet or so it might be an alternate solution.

Because of circulatory problems of diabetes, Ed has imposed some other limits. Following discussion with his doctor and with me, he abides by the regulation of no dives requiring stage decompression. He limits his depths. Every dive he makes is calculated as cold and arduous, that is, he uses the next greater time and depth for calculations. I emphasize that these limitations are self-imposed, are self-investigated and are scrupulously observed. Ed uses his head.

To stay in shape for diving Ed rides a bicycle and walks. His doctor is pleased with the overall health picture although still a little dubious about diving. The main point is, I think, that without the inducement of diving, Ed would be less likely to make as much effort to maintain such a good level of condition.

And so it goes. How do you balance your time and effort; against financial rewards or against job satisfaction? Are you, as a trainer of the exceptional diver releasing a hidden menace on the sport diving world or are you giving another human being a long lasting recreational activity that will enhance their enjoyment of life and improve their general health? We as diving instructors make this assessment. After all it is our names that go on those cards. I would simply like to enter a plea for the Geritol Kids and the well-motivated non-swimmers of the world who would like to join us in our world of underwater. Don't sell them short.

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THE SQUEEZE, THE EAR AND PREVENTION

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As it is only a short time since water sports have become popular, and then only on a part-time basis, the human ear is not now, nor will it ever be, suited for prolonged immersion in water. There are various ear disorders peculiar to scuba diving and they occur in each of the three parts of the ear: the outer, the middle and the inner ear. "Squeeze" is a term used by divers, being their name for barotrauma, derived from the pressure squeezing the affected part and the "Reverse Squeeze" by pressure of expanding gas.

Outer Ear Squeeze or "Reverse Ear"

Outer ear squeeze (Figure 1) is a similar condition to the squeeze of the middle ear, results in damage to the skin of the outer ear canal and requires pressure changes of 20-50 feet. The outer opening of the ear canal becomes obstructed by the pliable rubber hood, and as the air pressure in the outer ear canal does not equalise with water pressure, a negative pressure develops in relation to the surrounding pressure and to the middle ear which has been pressurised by auto-inflation. This negative pressure, when sufficiently great, results in rupture of blood vessels, haemorrhages under the skin, blood blisters and rupture of these. To prevent it, it is reasonable to cut a small hole in the hood over the ear to let in water and this does improve underwater hearing and some people claim, an improvement in their ability to clear their ears. The diagnosis is made from the history - ear pain not relieved by inflating the middle ear and bleeding from the ear. Examination shows a tattered ear canal and after cleaning no hearing loss. The early treatment is as for a ruptured ear drum - keep dry, antibiotic powder, and then cleaning in ten days to inspect for residual damage.

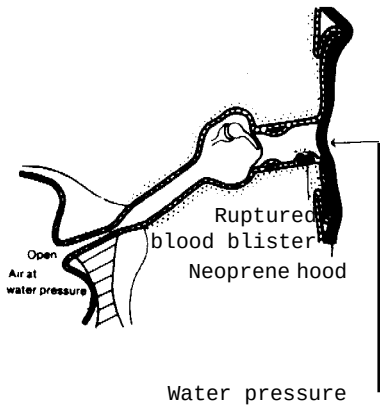

Fig. 1. "Reverse Ear" or outer Ear Squeeze. The Eustachian tbe is open but the ear canal is blocked, producing low pressure in this canal.

Middle Ear Disorders

An abscess in the middle ear is not very common, being caused by infection in the nose as a result of excessive nasal congestion due to the irritation in the nose of sea water, the entry of which is prevented by the face mask. The infection then spreads up the Eustachian tube to the middle ear. It is commoner in social surface swimmers because they allow water into the nose, but it is rare in trained swimmers because of their breathing technique.

The eardrum ruptures due to poor middle ear pressure equalisation on descent, 9 cases (Figure 2),when the rupture is inward or on ascent, 4 cases(Figure 3),due to congestion of the Eustachian tube preventing air escape from the middle ear when the drum ruptures outwards. Prevention is dependent on a healthy nose and the ability to clear the ears. In only two cases did vertigo occur as a result of the cold water gaining entrance to the middle ear.

Aural barotrauma or pressure damage to the ear of a lesser extent involving earache or pain and bleeding into the eardrum especially on the handle of the malleus where it can frequently be seen in scuba divers, illustrate the common occurrence of ear troubles all due to defective function of the Eustachian tube. The Eustachian dysfunction also plays a major part in the inner ear disorders.

Inner Ear Disorders

In the distinction between vertigo and dizziness, both of which are symptoms and not disease entities, vertigo denotes a hallucinatory state of movement, not restricted to the sensation of rotation but also when objects within the visual fields are moving rapidly from side to side or up and down.

Alternobaric vertigo which occurs when ascending is due to the expansion of the air in the middle ear (Figure 3) as the surrounding or ambient pressure decreases. Normally the Eustachian tube opens passively allowing out the excess air on ascent, but when the tube is congested there has to be a greater differential pressure to force open the semi-blocked tube. As this pressure rises the eardrum rarely ruptures, but in those cases whose eardrums remain intact, vertigo can occur.

Because some cases develop a vertical movement of the eyes up and down, such that objects seem to move up and down and it is probable that the footplate of the stapes, which is normally only 2 mm from the utricle of the balancing apparatus, stimulates this directly. It has been shown that stimulation of part of the balancing apparatus causes movement of the eyes up and down and so the diver sees objects moving up and down, the "shimmer effect". In those cases in which a rotary vertigo occurs, this is due to greater stimulation affecting other parts of the of the balancing apparatus causing a horizontal movement of the eyes resulting in a feeling of rotation or spinning. The directional response in these cases of vertigo is important in deciding whether or not the Round Window membrane is ruptured.

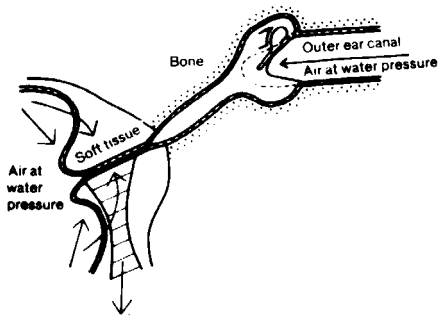

Figure 2: The Eustachian tube is locked closed, because the water pressure is greater than the muscle opening power.

Rupture of the Round Window membrane occurs through forceful and prolonged inflation of the middle ear in an attempt to overcome the relative negative middle ear pressure as a result of descent. If this inflation is delayed, greater pressure is required to overcome the pressure differential of descent.

Forceful prolonged attempts to inflate the middle ear causes high pressure inside the chest cage, preventing the blood draining down the neck from entering the chest. This causes a rise in the jugular vein and other venous pressures in the neck, then inside the head, causing decreased absorption of the cerebro-spinal fluid (CSF) which surrounds the brain and spinal cord. There is a tent-like prolongation of the subarachnoid space containing the CSF into the inferior surface of the temporal bone forming a tube of varying size, the Aqueduct of the cochlea, joining the CSF around the brain to the inner ear which is in the middle of the temporal bone. This tube's inner opening is just adjacent to the thin Round Window membrane which separates the inner ear from the middle ear.

If the CSF pressure rises high enough, there can occur a rupture forming a hole in this 3 mm Round Window membrane with loss of inner ear fluid into the middle ear and this can continue after the CSF pressure drops. Sudden deafness and variable vertigo or loss of balance develops. This membrane can be repaired by surgery and if it is carried out within 2 weeks of the incident, normal hearing results. Now that it is a recognised condition it is being diagnosed more often but many doctors and surgeons still do not bear this condition in mind when dealing with scuba divers.

It can be seen that many of the ear disorders are a direct result of malfunction of the Eustachian tube either due to faulty technique in clearing or inflating the ear, or due to a thickening or congestion of the mucous membrane lining the tube (Table 1). It is incumbent on the diver to have a healthy nose, not to lie flat as in sun bathing, and to refrain from alcoholic beverages prior to diving.

Nasal congestion is a common occurrence and undoubtedly leads to difficulty in opening the Eustachian tube. In 43 of the patients treated for ear disorders arising from scuba diving, the treatment aimed at clearing nasal congestion (Table 2) relieved their disorders.

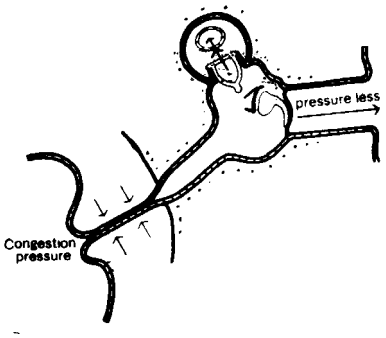

Figure 3. The "Reverse Squeeze". In ascent with the Eustachian tube blocked the expanding air pushes out the eardrum which may rupture but if not, the stapes (stirrup) bone is pushed into the middle ear where it irritates the balancing apparatus.

Table 1
Causes of Tubal Congestion

Primary nasal congestion	Alcohol
Venous congestion of posture	Sniffing

Table 2
Causes of Nasal Congestion

The common cold	Allergic rhinitis
"Sinus" trouble	Sinusitis - with pus
Deviated nasal septum	Adenoids

Valsalva's Manoeuvre

Valsalva in 1704 published the first method of getting air up the Eustachian tube, describing it as part of treatment for the discharging ear. Hold on to the nose, mouth closed and blow hard down the nose and air may go up the Eustachian tube into the middle ear. However, this procedure, if prolonged, can have some adverse effects depending on various individual characteristics.

It is said that fainting can occur, but more importantly this is the method for rupturing the Round Window membrane as already described. That it is not as dangerous as some writers described is borne out by the fact that this method is the standard procedure for thousands of scuba divers throughout the world and very few ever cause damage to their ear.

Eustachian Tube Blockage

This in turn may be due to two factors: (a) Functional, or faulty technique and (b) increased thickness or congestion of the lining of the tube.
Technique covers the fundamental details as to how the Eustachian tube opens. That Valsalva's Manoeuvre works in the majority of divers seems against the rules anyway. From the Figure 2 it is clearly seen that as the pressure is raised it will cause increased closure of the inner end of the Eustachian tube which is mostly soft tissue, projecting up to 2 cm into the throat at the back of the nose where it can be seen with a mirror.

The valvular mechanism displayed here is therefore more complex than this diagram and is illustrated with Figure 4. Valsalva's manoeuvre will occur if the first part of the Eustachian tube is opened and the air pressure will then be able to force open the second part of the tube. Unless a person inadvertently or unknowingly or inknowingly has the inner end partly open, Valsalva's manoeuvre will fail.

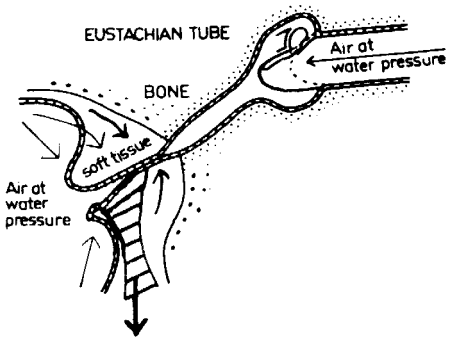

Figure 4 Before Valsalva's manoeuvre will work the inner end of the Eustachian tube must be partially opened.

How then to set this muscle going so as to clear the ears?

Frenzel Manoeuvre

This was studied by the Germans before the Second World War in their dive bomber pilots who had to inflate their ears as they descended rapidly. Herman Frenzel described in 1938 a manoeuvre to inflate the Eustachian tube without having to use the pressure effect of the lungs. With the vocal cords closed, the air in the nasopharynx is suddenly compressed by forcing the base of the tongue and the palate against the posterior wall of the nasopharynx. To perform this, one takes a light inspiration and blocks the glottis suddenly as if about to lift a heavy weight, pinch the nostrils and start to make the sound "K" which rises the base of the tongue and makes it go back against the soft palate which then forces the air into the Eustachian tube. This position is similar to the beginning of a swallow and if performed correctly one feels the pressure on the nose which is pinched, and the sensation of fullness in the ear. The mouth may be open or shut. This manoeuvre is completely independent of respiration and has no effect on the air below the glottis. There is also no effect on the return of blood causing blood pressure changes or any likelihood of Round Window rupture.

The Voluntary Tubal Opening has been described by French divers and consists of trick movements of muscles around the Eustachian tube. By obtaining a controlled contraction of the soft palate and of the upper throat muscles a force capable of overcoming the normal elasticity closing the Eustachian tube is obtained and the tube opens and a patent canal is present for equalisation of the air pressure between the back of the nose and the middle ear.

You have to be able to activate these muscles and reproduce the same feelings in the upper neck or behind the jaws as when the ears clear by other methods. To make it easier to reproduce these sensations one can look in a mirror with light from a window and view the soft palate and back of the tongue, the scuba diver is asked to try and mimic these movements himself while looking in a mirror.

In fact whether or not a person succeeds in holding the Eustachian tube open he does learn to activate the muscles which tend to open up the tube so that an increase in pressure in the nose or throat finishes off the opening and this enables clearing of the ears to be performed with less pressure from blowing. Many divers blow down the blocked nose then wriggle their jaw about until the ears clear and they are then trying out all the various muscles in that region until the correct one is activated. From what has been said if they were to find out what particular movement is the necessary one, then instead of aimlessly wriggling the jaws about they should go direct for that movement which opens the tube. The most important advice is that

all divers should inflate their ears before leaving the surface to give them a higher pressure in the middle ear to reverse the effect of the squeeze and giving them time to get stabilised under the water before inflation is required again. The diver should then be continually inflating his ears every 2 or 3 feet of descent by whatever method he has found to suit himself.

As mentioned at the beginning, the human ear is not now, nor will it ever be suited for prolonged immersion under the water. However, if the proper precautions are taken to minimise the effects of the water on the ear and the nose, it should be possible to make any person's nose and ear suitable for scuba diving.

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Whales: not Haemophilia but an adaptation for deep diving

Although cetaceans appear to have prolonged blood-clotting times this does not mean that they are haemophiliacs. In some instances it has been shown that certain blood-clotting factors are absent in the blood of whales, but this does not appear to affect the clotting in normal wounds or tissue damage. However, clotting within the blood vessels may be affected. This decrease in intravascular clotting would be advantageous to deep-diving animals such as whales for two reasons. First, disseminated intravascular coagulation is a major factor in severe cases of decompression sickness in man, so the lack of such coagulation could help prevent decompression sickness in whales. Second, acidic blood in man is hypercoaguable. After a long dive, a cetacean’s blood is more acidic due to increased carbon oxide content. Lack of coagulating factors may help keep the blood more fluid. In conclusion, whales have a highly evolved circulatory system adapted to their deep-diving way of life. They are not, however, haemophiliacs.

(Reproduced from SEA SECRETS, Vol 20, No 5, 1976
by courtesy of the International *Oceanographic Foundation.)*

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Parrot fever from Clams

A research team from the Smithsonian Institution and Maryland Department of Natural Resources has been looking at marine animal diseases by studying the gut contents of Chesapeake clams and oysters under the high magnification of an electron microscope. They find shellfish infested with a variety of phages and microbes, including some that resemble the chlamydia of psittacosis, the disease of parrots that also infects humans. Thus, they suggest, clams may transmit this disease to humans who eat raw clams.

Sea Technology, June 1977

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Are the days of deadliness of the shy blue-ringed octopus numbered? There is enough venom in the adult’s two tiny sacs to kill 10 people. But now Macquarie University reports that a five-member research team has discovered the chemical make-up of the main lethal toxin in the venom. It is identical to the known compound, tetrodotoxin, present in toad fish, some newts and frogs. Now what is needed is the antidote.

Sydney Morning Herald, 19 Nov 1977

NEDU TESTS DECOMPRESSION COMPUTER

The Navy Experimental Diving Unit, Panama City, Florida, developed mathematical programs in May and June 1977 for use with the Swimmer Life Support System (SLSS) Mk 1 closed-circuit scuba. The dive programs are tailored to the constant oxygen partial pressure gas mix supplied by the SLSS and are generated by a micro-computer that is carried on a swimmer's arm. The computer keeps track of the time spent at each depth and calculates the safe ascent depth throughout the dive. This eliminates the need to count the entire bottom time as being at the deepest depth of the dive, extending the amount of time a swimmer can spend under water safely.

The development of these multi-depth programs involved 215 test dives to a maximum depth of 175 feet. The dives, which were conducted in the 55,000 gallon wet hyperbaric chamber at NEDU, sometimes lasted longer than 6 hours. Approximately 900 man-hours were spent in the water by the test divers. Participants in the test were divers from NEDU, Explosive Ordnance Disposal (EOD) Group 2, EODFAC, Underwater Demolition Team (UDT) 11, UDT 12, UDT 21, Seal Team 1, Seal Team 2, Inshore Warfare Group 1, Inshore Warfare Group 2, and BUD/S.

These computer-generated dive tables will be used as part of the inshore warfare swimmer delivery system. They will enable a swimmer to vary his depth while approaching and departing his objective. In addition to these tables that are computed for the SLSS air-oxygen mix, the development of similar tables for air dives is anticipated.

The Micro-computer was developed by the Naval Ocean Systems Center in Kailua, Hawaii. It is battery operated and fits in a 4 x 3 x 2 inch case that can be strapped to a diver's forearm. The computer displays necessary information to the diver wearing it, including his present depth in feet and safe ascent depth in 10's of feet. In addition, the computer's display shows a coloured light to indicate whether the diver is deeper than his stop (green light) or if he is at his stop (red light). When the diver is too shallow, all the digits flash and a yellow light comes on to alert him to the imminent danger of compromised decompression.

It is planned that this device will undergo further testing and will be available to the Inshore Warfare community commencing FY79.

Extracted from FACEPLATE - SUMMER 1977

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NORTH QUEENSLAND UNDERWATER MEDICINE CONFERENCE

Dr. Dennis Pashen is organising a North Queensland Underwater Medicine Conference from 29 August 1978 to 4 September 1978 at Hinchinbrook Island. We wish him every success in this venture.

Address for correspondence:

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FLY-AWAY MIXED GAS DIVING SYSTEM DEVELOPED BY US NAVY

Timothy B Stark Lt JG US Navy, Diving and Salvage Officer
Harbour Clearance Unit One, Pearl Harbour, Hawaii
Sea Technology, September 1977

Harbour Clearance Unit One has designed, constructed and tested a portable mixed gas system called “Fly-Away Mixed Gas System”. The purpose of the system was to establish a portable mixed gas diving capability at the unit and in the Pacific Fleet. The basic components of the system are: mixed gas stowage containers, oxygen stowage containers, an air stowage container as gas distribution console, a two man open diving bell and the US Navy Mark-1 Diving Outfit.

The system operates from any platform of opportunity equipped with a boom or crane with a minimum lift rating of four tons. The system is not dependent upon the host platform for services, except space for the system.

The system is capable of supporting 18 dives of 300 feet for a maximum bottom time of 30 minutes without gas resupply. Gas resupply in the field can be accomplished with either pre-mix gas or raw gases mixed on the site. The system is configured such that two independent HEOX mixes, oxygen and air are available to the console operator for supply to the divers.

The system has been operationally deployed from Hawaii to a host platform 5000 miles away and set up to conduct helium-oxygen dives to 195 feet. Planned mobilisation time for deployment of the system is 24 hours, and set up time on the host platform is 12 hours.

(Editor: *This remarkable advance in diving capability could result in a very difficult medical situation should decompression sickness occur, after, say, a 200 foot dive as adequate recompression facilities would almost certainly be lacking on the host platform. Careful “disaster” planning would appear to be mandatory.*)

CARCINOGEN ACCUMULATION

Benz (a) pyrene is a compound with high carcinogenic activity widely distributed in the environment as a result of the transportation and combustion of petroleum products. A team of investigators headed by NA Zobova of the Georgian branch of the All-Union Institute of Marine Fisheries and Oceanography recently reported measurements of the uptake and retention of benz (a) pyrene by three common Black Sea organisms. They found that mussels concentrated the compound whereas two species of fish showed no accumulation. They attribute these results to the fact that vertebrates can metabolise petroleum derivatives whereas invertebrates lack this ability. Thus it may be safer to eat fin fish than to eat shellfish under certain conditions of ocean pollution.

Sea Technology, June 1977

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“DIPPY”

I was discussing future plans with a young Mere Male who said he wanted to be a deep sea diver. When I said the equipment might be rather expensive, he denied it vigorously. “We’ve got lots of stuff lying around at home,” he said. “Just some wool to stuff your ears, a peg for your nose and a heavy rock to tie on so you’ll get to the bottom quickly.”

Letter in *New Idea*, 31 December 1977

SUBSCRIPTIONS

Members pay $15.00 yearly. Associate membership for those neither medically qualified nor engaged in hyperbaric nor underwater related research is available for $10.00. The journal is sent up to four issues yearly to both full and associate members. Those resident outside the immediate Australasian area should write for the special terms available.

Treasurer: Dr W Rehfisch, 5 Allawah Avenue, Frankston VIC 3199

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Please type all correspondence and be certain to give your name and address even though they may not be for publication. Authors are requested to be considerate of the limited facilities for the redrawing of tables, graphs or illustrations and should provide same in a presentation suitable for photo-reproduction direct. Books, journals, notices of Symposia, etc will be given consideration for notice in this journal.

Address correspondence to:

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