The Greek sponge beds have been fished out entirely and it is only the very poor quality sponges now that are found around Kalymnos itself. If it was left entirely to Nature I do not know how long it would take for the sponges to come back. But one problem with the Mediterranean now is that it is so polluted. There is so much oil and rubbish floating around that you just wonder whether the sponges would survive anyhow.

Question:

Could the man with the Charcot's joints have had syphilis?

Dr John Hayman

There is no need to invoke syphilis to explain the man's Charcot's joints. All one needs to develop Charcot's joints is lack of pain sensation.

There was a pathologist on the island and he did do tests, but whether he was actually tested for syphilis I do not know. I do not think the joints were syphilitic. I cannot produce any evidence, but it is a fairly traditional community and they are not normal seafarers in that regard.

He had a definite sensory loss which could best be explained by spinal cord decompression sickness. He had horrible knees. As I moved them up and down they made a terrible crunching noise which you could have heard from 3 or 4 feet away. But it did not bother him at all. He certainly had loss of position sense in his foot. A lot of the disability would be due to secondary osteo-arthritis.

It really needs a team to go in and assess these people, not only a neurologist but also a radiologist. It really is a goldmine of diving related pathology.

THE BANDOS NIGHT DIVE

'Twas on the stroke of eight o'clock
In those islands of the moon
When Herwarth shouted "Tally Ho"
And not a bit too soon.

For sixty men and women bold
Each donned their BCD
Then, like a pack of lemmings
Marched, backward, through the sea.

Atop the dropoff, thumbs went down
Vent hoses were held high
When all at once rude torch lights
Pierced the evening sky.

So now the party has begun
And chaos was to reign
As drunken glowworms wandered
'Cross the undersea terrain

Like search lights in an air raid
Spotting bombers in the blue
The waters of the Bandos reef
Resembled World War II.

Corals crashed, fishes fled
Crayfish ceased to creep
Even fearless reef shark
Retreated to the deep.

No one knows what havoc
Took place beneath the foam
But sixty minutes later
The raiders left for home.

As years go by and divers
Hang up their fins and masks
They'll still remember '85
And SPUMS night diving farce.

PROVISIONAL REPORT ON DIVING-RELATED FATALITIES IN AUSTRALIAN WATERS, 1984

Douglas Walker

SUMMARY

There were four breath-hold diving fatalities identified in 1984, twelve scuba divers and one hookah diver. Two of the incidents resulted in double fatalities, though in one of these a higher toll was only averted through the skill of those involved and their avoidance of panic under extremely adverse conditions. Of particular interest is the fact that two of the victims were found to have an asthma type problem which was apparently quite unsuspected by their fellow divers, however examination of the events shows that the outcome could well have been the same even in the absence of such a factor. Cardiac problems were almost certainly critical in several cases. The occurrence of the fatal dissecting aneurism of the ascending aorta (Case SC 84/7) was an example of an undetected/undetectable fatal situation presenting during a carefully conducted dive, a tragic event occurring during a dive but almost certain to have occurred however quiet a life style he had followed. Case SC 84/11 may be usefully treated as the basis for a discussion of the responsibilities devolving on anyone who organises a dive, particularly if they hold instructor status, and the importance of buddy diving procedures, using a J-valve rather than a contents gauge, the value of buoyancy vests, and whether boats should be left empty while divers are below. These are all matters of significance when the diver runs into trouble.

CASE REPORTS

All these reports are based on depositions provided by those involved to the police investigating the incident or told to the Coroner, though sometimes other sources have been available to aid clarification of certain aspects of the events.

Breathhold divers

Case BH 84/1

Although he had trained in scuba diving his choice was breath-hold diving, which he had been doing for over 20 years. On this occasion he took a scuba diving friend with him in his 3.6m (12 foot) outboard aluminium dinghy. The dive site was off some cliffs where there was a large boulder "bommie" separated from the rock platform by a channel, a good place for crayfish but only divable in the period 3/4 to full tide, being too turbulent at other times. This day was calm though an unusual wind direction resulted in a more than usual water run off into the channel from the platform.

They were diving separately, the scuba using friend being a keen underwater photographer and the victim a breath-hold diver. The friend who was slower equalising his ears, saw the victim dive past him, which was the last time he saw him alive. When he returned to the boat he found several fish there and assumed that the victim had changed from spearfishing to hunting crayfish in the channel. The friend reported that the victim was missing but darkness prevented any search till the next day. The body was washed ashore, minus weight belt, nine days later. It is probable that the power of the water coming off the rock platform was more than he expected and held him underwater until he drowned, then washed the body away.

EXPERIENCED BREATH-HOLD DIVER. UNRECOGNISED SIGNIFICANT EXTRA WATER FLOW OFF ROCKS INTO CHANNEL. SPEARFISHING/CRAY FISHING. NO BUOYANCY VEST. SEPARATION/SOLO.

Case BH 84/2

Like most visitors to the Barrier Reef, the victim joined a day trip to a Reef cay. The boat anchored near the beach and passengers were offered the loan of fins, mask and snorkel for swimming ashore, or ferrying in a dinghy. The victim looked rather elderly and was pressed to accept the dinghy ride, but declined. He was urged to wear a life jacket and refused this offer too. They all swam independently in the calm water towards the beach and no signal or sign of distress was noticed by those on the boat until the man in the dinghy realised the victim was too stationary and not just watching the underwater scenery. He quickly motored over and jumped into the water to offer assistance. It was possible for him to stand on the bottom there. He commenced EAR and towed the victim ashore where others with knowledge of resuscitation gave assistance. Some response was obtained but not sustained. His previous health and snorkel swimming experience is unknown but the observation that he was dog paddling rather than finning suggests total inexperience. Autopsy revealed evidence of acute coronary insufficiency (a cardiac death).

INEXPERIENCED SNORKEL USER. ELDERLY. CALM SHALLOW WATER. ON THE SURFACE. NO INDICATION OF DISTRESS. REFUSED BUOYANCY AID. SOLO. RAPID EFFICIENT ASSISTANCE ONCE THE PROBLEM WAS SUSPECTED. HEART ATTACK.

Case BH 84/3

Three employees at an island resort decided to go spearfishing to obtain fish for the 21st birthday party being prepared for another employee. They used one of the resort's small aluminium dinghies to reach the dive area, anchoring 18m (60 feet) off the rocky shore. The fourth member of the party, a non diver, remained in the boat as they dived. All returned to the boat to rest about 1 hour, the victim well pleased with his successful hunting. He entered the water again after 10 minutes, followed in a couple of minutes by one of the others. They were diving independently about 100 feet apart. When the buddy saw a large Queen Fish swim past towing the victim's gun he retrieved gun and fish (which had been hit in the abdomen so been able to swim strongly to seek to escape) and placed them in the boat then started to search for his friend. The visibility was 15 feet and the current slight but a surface chop reduced ability to see anything at the surface. When his search proved to be unsuccessful, other divers were summoned and an air search was made. The body was not found until next morning when a search was organized using a grid pattern.

When found, in 15-17m (50-55 feet) deep water, his mask was in position, snorkel in his mouth, and weight belt on. The circumstances point to this being a post-hyperventilation blackout drowning incident, his known ability to dive to 12m (40 feet) and the evidence of the fleeing fish being supportive of this diagnosis. It was difficult to drop his belt to assist recovery of the body because the weight belt's end had been tucked in, making quick release impossible.

EXPERIENCED BREATH-HOLD DIVER. FISH SPEARED NON-FATALLY AND ESCAPED TOWING GUN. WEIGHT BELT NOT CAPABLE OF QUICK RELEASE. SEPARATION/SOLO. POSSIBLY POST-HYPERVENTILATION BLACKOUT.

Case BH 84/4

During an interclub spearfishing competition the victim and three others were diving from a boat moored in calm water 20 feet deep. After about 45 minutes one of the group happened to notice that the victim's line was hanging down from the boat and swam over expecting to find him in the

boat. He found 3 or 4 fish on the catch line and the float line hitched over the outboard motor, the spear gun hanging below. The victim's snorkel was later found in the boat. When the second diver looked down she saw the victim floating below her just above the sea floor. At her second attempt she managed to reach and release his weight belt and bring him to the surface, and her cry for help brought the other two divers to assist her. They got him into the boat and commenced EAR and ECC and sent a call for help via a nearby boat's radio. Police and helicopter rescue services soon arrived but resuscitation attempts were unsuccessful.

Autopsy showed the cause of death to be drowning. There was also some fibrous replacement in the interventricular septum. Although the coronary arteries and aorta showed relatively little atheroma the circumstances of the incident suggest a sudden incapacity, and the hitching of the spearfishing equipment on the boat indicates a probable awareness of illness, so a cardiac problem, possibly angina, is a highly likely critical factor. He had a reputation as being one who did NOT practice hyperventilation. No details of his previous health are available. A buoyancy vest would have made it possible for him to avoid drowning even though incapacitated by illness.

EXPERIENCED BREATH-HOLD DIVER. SPEARFISHING COMPETITION. NO BUOYANCY VEST. WEIGHTS ON, NO SURFACE COVER. SEPARATION/ SOLO. SUDDEN INCAPACITY AFTER BEING FIT ENOUGH TO SPEAR SEVERAL FISH. PROBABLE INTIMATION OF ILLNESS. RESCUE AND RESUSCITATION ATTEMPTS EFFICIENT. EVIDENCE OF PREVIOUS MYOCARDIAL DAMAGE.

Scuba divers

Case SC 84/1

Two friends of many years decided to go recreational scuba diving together. The victim was a large, strong man involved in a number of active sports who claimed to have acquired scuba diving experience over the past year and had his own equipment. His friend, who had been diving for about 20 years, was using borrowed equipment. Neither had received formal instruction, which was the reason for the buddy being unable to hire scuba. Nevertheless they were able to obtain air fills. During this dive, their 2nd or 3rd together, the victim indicated that his reserve lever had become displaced and the buddy pulled it for him before they started their return swim underwater. Separation soon occurred and when the buddy came to the surface he saw the victim apparently standing on the rocks in waist deep water, then both were hit by a wave. The buddy managed to stagger ashore, fatigued, after ditching his weight belt, then he took off his backpack lest he be washed back into the water from the rocks. There were other divers and some children nearby and he expected that they would assist his friend ashore. Apparently a little later the victim was seen floating unconscious, moved by the surge of the water, by a more distant diver while those nearby appeared oblivious to these events. The weight belt was still on, though witnesses stated the contrary (demonstrating the fact that eye witnesses may be fallible). He did not respond to efforts to resuscitate him. Witnesses also differ concerning whether he wore a (deflated) buoyancy vest.

His medical history revealed an occasion a year previously of an episode of "wheezy bronchitis" but no other significant ill health, though hyperlipidaemia had been noted. He was neither regarded nor treated as having "asthma" and not prescribed ventolin. The reports which circulated after this fatality concerning finding a ventolin unit in his bag were not mentioned at the inquest and at the autopsy there was no histological evidence of asthma. A detailed examination of the heart discovered a significant degree of atheroma in the left coronary artery and histology revealed the unexpected presence of both old and recent myocardial damage. The cause of death was by drowning.

UNTRAINED. EXPERIENCE UNKNOWN. WASHED OFF ROCKS BY WATER POWER. UNCERTAINTY ABOUT BUOYANCY VEST. OWN EQUIPMENT. NO CONTENTS GAUGE ON 62 CU FT TANK. BUDDY ACTIVATED RESERVE AS VICTIM COULD NOT REACH LEVER ON RESERVE BEFORE THE PROBLEM AROSE. EVIDENCE OF HEART DISEASE. POSSIBLY LIABLE TO ANGINA WITH SEVERE EXERTION.

Case SC 84/2

The victim and a friend were diving at night to retrieve golf balls from a water hazard on a golf course. As the victim broke the surface (or possibly a little later) a shot was fired. The other diver immediately yelled out "DON'T SHOOT!" lest he be shot. The person charged claimed that he had been after ducks and had seen the surface change through his telescopic rifle sight so fired. The case has not yet been formally tried so it is neither possible nor correct to discuss the matter further.

SHOT WHILE MAKING A NIGHT DIVE FOR GOLF BALLS.

Case SC 84/3

Experienced diver with Cat 2 cave diving certification.

Case SC 84/4

Experienced diver, some cave dive experience: no CDAA test.

This double fatality illustrates the special care required by those entering sink hole waters where cold, narcosis, visibility loss, restricted space and impossibility of a frantic

AUSTRALIAN DIVING RELATED FATALITIES 1984

CASE	AGE	DIVE SKILL		DIVE			WATER DEPTH M (FEET)	DEPTH INCIDENT M (FEET)
		VICTIM	BUDDY	GROUP	BASE	PURPOSE		
BH 84/1	44	Experienced	Experienced (Scuba)	2 Separation	Boat	Crayfish	N.S	N.S
BH 84/2	68	Inexperienced	N/A	Group solo	Boat	Recreation	1.5 (5)	Surface
BH 84/3	19	Experienced	Experienced	3 Separation	Boat	Spearfishing	15 (50)	N.S
BH 84/4	62	Experienced	Experienced	4 Separation	Boat	Spearfishing	6 (20)	N.S
SC 84/1	41	Inexperienced Just Trained	Experienced Not Trained	2 Separation	Rock	Recreation	6 (20)	Surface
SC 84/2	25	N.S	N.S	2	Land	Golf balls	?	Surface
SC 84/3	28	Experienced CD2	Experienced CDX	2	Land	Recreation	70 (230)	60 (200)
SC 84/4	30	Experienced CDX	Experienced CD2	2	Land	Recreation	70 (230)	60 (200)
SC 84/5	31	Inexperienced Not Trained	N/A	1	Rock	Crayfish	N.S	Surface
SC 84/6	25	Experenced Trained	Experienced Trained	3	Boat	Recreation	18 (60)	Ascent
SC 84/7	20	Experienced Trained CD2	Experienced Trained CD2	2	Land	Recreation	42 (140)	42 (140)
SC 84/8	33	Experienced Trained	Experienced Trained	4 (9)	Boat	Recreation	21 (70)	12 (40)
SC 84/9	22	Experienced Trained	Experienced Trained	4 (9)	Boat	Recreation	21 (70)	12 (40)
SC 84/10	21	Inexperienced Trained	N/A	1	Dock	Work	10 (33)	10 (33)
SC 84/11	26	Inexperienced Trained	Inexperienced Trained	2 (14) Separation	Boat	Recreation	24 (80)	N.S
SC 84/12	30	Experienced	Experienced	3 Separation	Boat	Recreation	48 (160)	48 (160)
H 84/1	27	Experienced Not Trained	Experienced Not Trained	3 Separation	Boat	Work	16 (54)	Ascent

KEY

CD2 = Qualified as category 2 Cave Diver
CDX = Unqualified but with some cave diving experience
Trained = Had completed a course of instruction
Just Trained = Had just completed a course of instruction
N.S = Not Stated
N/A = Not Applicable

AUSTRALIAN DIVING RELATED FATALITIES 1984

WEIGHT BELT KG (LB)	WEIGHT BELT POSITION	CONTENTS GAUGE	BUOYANCY VEST	REMAINING AIR	EQUIPMENT TESTED	EQUIPMENT SUPPLIER	WET SUIT	SIGNIFICANT FACTORS
N.S	N.S	N/A	No	N/A	N/A	Own	Yes	Water power in narrow channel. Separation/solo; more than usual runoff water.
None	None	N/A	No	N/A	N/A	Loaned	No	Tourist. Swim to sand cay, calm shallow water. Refused offer of vest. Heart attack.
5.5 (12)	On	N/A	No	N/A	N/A	Own	Yes	Spearfishing, hit fish in belly and it fought hard. Blackout.
N.S	On	N/A	No	N/A	N/A	Own	Yes	Solo return, placed equipment in boat. Presumed to have had a heart attack. No buoyancy vest so drowned.
7.5 (16)	On	Yes	No	Nil	Yes	Own	Yes	62 cu ft tank. Separation expected. At surface hit by wave. Possibly asthmatic. Heart disease fatality.
?	?	?	?	?	?	?	?	Searching for golf balls in a dam. Shot by duck shooter at night.
7 (15)	On	Yes	Yes	Nil	Yes	Own	Yes	Little sleep with an early start to avoid the ranger. No permit. Excessive depth and weights.
7 (15)	On	Yes	Yes	Nil	Yes	Own	Yes	Danger grade dive. Nitrogen narcosis. Cold. Dark. Excessive loose line. Return wrong side rock. Entangled.
N.S	N.S	N.S	No	Low	Yes	Own	Yes	Buddy leaky hose, no dive. Swell and breakers sea dangerous.
9.5 (21)	On	Yes	Yes	Low	Yes	Own	Yes	10 divers. "64" tank so planned solo ascent. Inflated vest ascent. CAGE. Delayed death. Asthmatic.
N.S	On	N.S	N.S	N.S	No	Own	Yes	Careful diver. Pre-dive feeling of chest tightness. Pain at depth. Taken to hospital. Delayed recognition serious illness. Aortic rupture.
13 (29)	On	Yes	Yes	N/A	Yes	Own	Yes	Two Groups (4+5) in sea cave. Wrong cave. Hit by swell. 2 died trauma.
10 (22)	On	Yes	Yes	N/A	Yes	Own	Yes	Damaged tanks vented air. Successful rescue of 2 others.
9.5 (21)	On	No	No	Nil	Yes	Employer	Yes	Used small "get-home" ungauged tank to dive narrow dark area. Poor air supply from tank. Solo. Inexperienced.
7 (15)	On	No	No	Low	Yes	Hired	Yes	End of course dive; instructor took no responsibility. Not in favour of strict buddy discipline, nor vests, nor contents gauges, nor surface cover. Separation. Solo. Speared cuttlefish. Out of air.
8 (17)	On	Yes	Yes Faulty	Ample	Yes	Own	Yes	Had previously dived this wreck. Separation on wreck. Twin tanks. Plenty of air. Buoyancy vest had defects. Nitrogen narcosis? Boat well prepared for diving, but no radio.
N.S	On	N/A	No	N/A	No	Employer	N.S	Pearlshell collecting. Suddenly pulled himself up line to surface. CAGE. Old and recent pleurisy noted.

rush for the surface add to the usual problems of diving. The approach to this problem by the Cave Divers Association of Australia (CDAA) is by way of assessing and giving grades to both cave risk and the diving applicant. There are three test grades, plus caves too deep or dangerous for other than, possibly, a major dive effort by a special team. Diver A was graded as allowed to dive in this cave but NOT to enter the passage in which he and his friend were found. The friend had not applied for testing of his knowledge of cave diving so was diving "illegally", though his experience could well have been adequate for safer cave dives.

The tragedy was discovered when some divers saw a van near the entrance of the sinkhole. They waited patiently for a time as they did not wish to compromise the divers already down, then gradually realised that there were no bubbles to be seen coming up and that the time was too great for a dive in this depth of hole. A check dive was therefore made and a line found tied off at 20m, and 15m lower there was a tank evidently intended for use during the decompression stop by the missing divers. After descending to 45m they saw the glow of two torches possibly 15-20m below them. There were no bubbles to be seen. They surfaced and notified the police of what they had observed.

The police divers made an initial assessment dive and they found two bodies at about 59m depth. Nitrogen narcosis was noted during this dive so the recovery effort was postponed until it was possible for a team to dive using full-face masks, lines, and a communication link diver-to-surface. All conversations were taped. A "body line" was attached to the bodies and then it was discovered that it was not possible to raise them far because not only were they completely tied together by their line but also tethered to a rock bridge. It became apparent that their descent had been one side of this rock and ascent the other, which looped their reel line below the rock. Later measurements showed that they had permitted about 10-15m of line to float free, not reeling it back in. This formed the fatal trap. They were too closely tied together to have been able to reach their knives even had narcosis allowed them clarity of thought, and their knives were not sufficiently sharp to easily cut their line. Maximum permitted cave diving depth is 37m. They had reached about 69m before starting their ascent. The fact that they retained their 15lb weight belts during this dive was one of their additional mistakes.

The victims had little sleep the night before making this dive and started out early, possibly in order to avoid meeting the Park Ranger who would have asked to see the dive permits they did not possess.

This case received great publicity and it is probable that if the CDAA had not been in existence, and been seen as exercising real regulatory function, there would have been punitive (and most likely inappropriate) political and legal intervention to control diving in this area. A brief flurry of ruffled feathers did occur when the safety of the police divers was made the subject of some newspaper correspondence. These events highlighted the importance of diving organisations having a spokesperson who can provide the news-hungry media (and politicians) with information in a totally non-partisan manner. It was this factor which defused a situation threatening to spill over into parliamentary point-scoring.

DOUBLE FATALITY. ONE DIVER CDAA CAT 2. OTHER DIVER NOT CDAA TESTED. BOTH EXPERIENCED. SINKHOLE DIVE. WENT FAR BEYOND ADVISED/PERMITTED DEPTH AND INTO A CAVE DANGER GRADE BEYOND CATEGORY HELD. NITROGEN NARCOSIS. COLD, DARK. NARROW PASSAGE. WRONG WAY BACK ROUND OBSTRUCTION. EXCESS LINE UNREELED FREE FLOATING. TIGHT ENTANGLEMENT. KNIVES COULD NOT HAVE CUT LINE. WEIGHT BELTS ON. EXCESS WEIGHTS. OUT OF AIR. NOBODY TOPSIDE.

Case SC 84/5

It was arranged that the victim was to dive with a recent acquaintance, an experienced diver who claimed to be highly safety conscious. The victim was untrained but had made several scuba dives over the previous year, receiving advice from this man and other divers he met. He was described as "a strong swimmer but no good at reading the sea conditions". Before entering the water the experienced diver noticed that his air hose had developed a leak and decided not to dive, but apparently did not seek to dissuade his companion from entering the water unaccompanied to search for crayfish. The entry was from the rocks, the non-buddy agreeing to return to the spot in an hour to meet the diver on his return. It was high tide when he returned and he saw the victim surface in an area 500-600m away in an area where the swell was breaking over rocks. The diver was seen to submerge after breakers reached him, then seen floating at the surface, face down. His friend bravely immediately entered the water wearing only his wet suit pants and brought the victim back onto the rocks. EAR was unsuccessful. The police did not make any recorded check of the equipment but the "buddy" reported that the victim, who lost his mask after being hit by the breakers, had worn a buoyancy vest of unstated type, apparently not inflated by buddy or victim, and must undoubtedly have been low on air after an hour underwater. It was not noted whether the weight belt was still on or what weights were worn. He was said to be short sighted, though currents or the dive pattern rather than this factor probably led to his presence in an area so dangerously unsuitable for exiting.

UNTRAINED. SOME EXPERIENCE. SOLO DIVE BECAUSE INTENDED BUDDY EQUIPMENT PROBLEMS. SURFACED IN ROUGH WATER AREA THEN HIT BY SEVERAL BREAKERS. LOW AIR. BUOYANCY VEST UNINFLATED. RAPID DEATH. "BUDDY" MADE VALIANT RESCUE EFFORT. COLD. EXPERIENCED BUDDY SANCTIONED SOLO DIVE. SURFACE NO POLICE EXAMINATION OF EQUIPMENT.

Case SC 84/6

A charter boat dive was arranged for 10 divers but strong winds forced a change of dive location from the intended one to a more sheltered area off the chosen islet. The divers were paired, though the victim was in a group of three as one of the party did not choose to dive. Both the boat's captain, a diving instructor, and his wife, an experienced diver, remained in the boat and maintained position a short distance from the dive area. The victim was seen to surface alone, with his mask off, buoyancy vest inflated and his regulator out of his mouth, about 20m from the boat. He appeared to be helpless. The boat was brought to him and he was pulled aboard quickly. It was noted that there was no blood or frothy saliva in his mouth, but he was incoherent. So he was placed on his left side and given oxygen, which produced a rapid improvement. A radio call was made for the helicopter rescue service, which evacuated him to the nearest RAN recompression unit. Although he appeared to be making a satisfactory response to treatment his condition deteriorated and he rapidly died during the decompression stage, a clinical failure ascribed to the severity of the pulmonary damage (plus consequent cerebral anoxic damage) rather than the direct effects of cerebral arterial gas embolism (CAGE).

His buddies and the other divers surfaced and came aboard soon after his resuscitation had been initiated and all agreed that he had suffered an air embolism (CAGE). A "Ventolin" inhaler was found in his belongings, though nobody could recall seeing him using it. His buddies reported that they had remained together as a group and turned back together to avoid getting too dangerously near an underwater gully at 18m (60 feet) depth. When the victim showed them that his contents gauge showed only 500 psi they indicated to him they would continue diving as they had more remaining air (he had only a 64 cu ft tank, while theirs were of larger capacity), while he was to ascend alone. He showed no signs of panic or concern and this separation seemed a safe decision to them. It was suggested later that he had carried excessive weights (20-25 lbs) and accidentally over inflated his vest to assist his ascent, unfortunately failing to vent it successfully. The contents gauge was read after he was brought onto the boat and then showed 250 psi, indicative of having used air freely for vest inflation. The vest had no crutch strap so would have ridden up and pushed the regulator out of his mouth during his rapid ascent, a factor very likely to distract him from following correct ascent procedures.

He was described as a "mild smoker" but likely on occasion to smoke heavily. A visit to his unit revealed 4 empty "Ventolin" inhalers but his sister and mother vigorously denied he suffered from "asthma", though admitted "he did until he was 8 years old". Both he and his sister self medicated with "Ventolin", which can be purchased without prescription, but vigorously rejected the label of "asthma".

This apparently "Polaris" type of ascent could have caused CAGE even in an experienced diver who inflated his vest and found it suddenly rise up and push the regulator out of his mouth, so an inexperienced one could be excused a failure to react immediately and correctly to the situation. However the severity of the lung damage indicates a probability that his "asthma", which means that his air passages were over-reactive, converted a lung over-pressure incident with associated CAGE into a situation where lung damage was of unsurvivable severity.

TRAINED BUT INEXPERIENCED. PRE-DIVE AWARENESS THAT UNEQUAL TANK CAPACITIES WOULD RESULT IN A SOLO ASCENT WHILE BUDDIES CONTINUED THE DIVE. SEPARATION/SOLO. BUOYANCY VEST PROBABLY OVERUSED TO COMPENSATE FOR EXCESS WEIGHTS. FAILED TO VENT VEST ON ASCENT. NO CRUTCH STRAP SO VEST PROBABLY DISPLACED REGULATOR. EXCELLENT INCIDENT MANAGEMENT RESPONSE. VALUE OF OXYGEN. SEVERITY PULMONARY DAMAGE PRECLUDED SUCCESSFUL RESPONSE TO RCC. ASTHMA HISTORY. DELAYED DEATH.

Case SC 84/7

This unfortunate young, trained, experienced and apparently healthy diver suffered an unpredictable fatal medical event while making a well conducted dive, death occurring 6 hours later.

The victim was a Cat 2 certificated Cave Diver diving with other trained CDAA divers. They made a morning dive to 36m (120 feet) and carefully followed the pre-calculated dive profile, which included a decompression stop. Shortly after surfacing he walked across to a nearby cave and made a quiet dive through a passage about 12m (40 feet) long, maximum depth 3m (19 feet), returning to his entry point after being seen at the open end by his friends. He mentioned having a minor ear problem on the first dive but it did not trouble him with his subsequent dives. He did not seem unusually fatigued by his dives, though he ate little at the picnic held by the group before going to the sink hole chosen for the afternoon dive.

He was considering purchasing a backpack buoyancy vest and when one of the party who had such a vest decided not to dive he borrowed it to try it out. While putting it on he mentioned that it felt tight across his chest and that he could not seem to make himself completely comfortable, a remark only retrospectively seen to have possible significance. This dive also was very carefully planned, with allowance for residual nitrogen from the first dive. The victim (still troubled by this chest tightness) and his buddy made an uneventful descent to 42m (140 feet), commencing their ascent when 13 minutes had elapsed. They were severely aware that the water temperature was 15°C so swam slowly to conserve energy and increased the 3m (10 feet) decompression stop from 6 to 13 minutes. The buddy did not note anything amiss with the victim and they spent 3 to 4 min-

utes talking at the surface before leaving the water. As they reached the exit ledge the victim coughed out a little blood, which his companions thought strange after an uneventful dive but assumed to come from a nasal source. It was as he started to remove his wet suit that he complained of his chest pain, which quickly worsened, and it was immediately realised that he required urgent medical attention so friends drove him to the nearest hospital. They were agreed that neither the dive profiles nor the symptoms supported a diagnosis of either decompression sickness (DCS) or pulmonary barotrauma, and his previous health had been good, though he admitted to often suffering "indigestion" .

A nurse in the dive group managed to get him oxygen for a trial but this produced no improvement, strengthening his friends' belief that this was not a "diving" problem. Though the victim was breathless and could barely remain still because of the severity of the pain, he tried to make out it was a strained muscle, or even his indigestion. There was no evidence of any "surgical emergency" having occurred so the symptoms were regarded as being due to some undiagnosed but non-serious cause.

He was advised to rest at home but his condition worsened so his friends returned him to the hospital and ensured his being admitted for observation. A chest X-ray taken at this time failed to illustrate the pathology then occurring. This report reassured his friends, though they remained concerned about whatever was the cause of his severe chest pain. He suffered a cardiac arrest that night and resuscitation attempts were unavailing.

The autopsy revealed the presence of a blood in the chest cavity (haemothorax) and a tear in the aorta. The sequence of the fatal events had been a tear in the lining of the aorta with the pressure of the blood separating the layers of the aorta until a time came when the outer layers gave way and the blood escaped. It is possible that some of his "indigestion" was pain due to aortic pathology, but it may have been an unrelated problem. In all other respects he had been healthy.

This case has been reported earlier (SPUMS J 1984, 14(4): 34) and will be subject of a further paper later (James R and Hayman J).

TRAINED. EXPERIENCED CAVE DIVER. APPARENTLY IN GOOD HEALTH. CAREFUL DIVE PATTERN. COLD WATER AND MODERATE EXERTION ADVERSE FACTORS. FATAL DISSECTING ANEURISM OF AORTA. DELAYED RECOGNITION OF THE SEVERITY OF THE ILLNESS. NON-DIVING ILLNESS WHILE DIVING. DELAYED DEATH.

Case SC 84/8

Trained, experienced, with divemaster qualifications.

Case SC 84/9

Trained and experienced.

This was a boat dive taking a group of trained divers to a cave under the cliffs guarding the entrance to a bay. None of the divers had visited the cave previously and in the event there was incorrect identification and a cave adjacent to the intended one was entered. The boat was left anchored a short distance from the cliffs and the nine divers swam on the surface to the entrance of the cave. Two groups had been arranged, the divemaster who was the organiser taking four divers, the two victims leading the others. The dive boat was left in the care of the crewman, a trained diver.

The sea conditions appeared to be suitable and both groups dived, meeting together at 15m before splitting once more into two groups. There were two groups because there were only two torches available, one for each group leader. All descended to the floor of the cave entrance, 21m depth, where a rock column was present which divided the entrance. Here the two groups diverged with the group of four going to the left to explore. While the two experienced divers who led this group were down a passage and the two others waited at its entrance there was a sudden powerful surge of water within the cave, the result of a large wave arriving at the cave's entrance and being funnelled in. Till this time the water movement within the cave had not been severe, though causing some problems to one of the waiting pair even before the major surge separated them and forced them to the surface within the cave. It was rough so they hurriedly both descended again, and both reported the torch was still to be seen in the passage so they believed that the two leaders were still alive at that time, just before the arrival of the second surge. The two divers were again forced to the surface where one hit his head on the rocks as he was pushed round in the cave. Fortunately he came into contact with his buddy, now near to panic after losing her mask. He inflated her vest (a CO_2 sparklet system which fortunately worked) and assisted her from the cave.

Outside the cave they came across two divers from the five diver group supporting an unconscious diver and giving EAR. He was got aboard the dive boat, which had been brought closer inshore to assist, the crewman having seen the sudden waves at the cave mouth and observed the surface events. On the boat a head count revealed that two divers had not returned, but they were experienced and no real concern was felt for their safety, though one diver snorkelled back to the cave entrance in case they surfaced needing help. The divemaster donned scuba and descended to look for them after the near-drowned diver appeared to be recovered, about 20 minutes from the time of surfacing. After about 10 minutes searching he found one of the missing divers lying on his back under the ledge at 12m depth, weight belt and one fin missing, regulator lying loose, vest uninflated and tank on his back. He removed his own weight belt and brought the victim to the surface, making no attempt at EAR in the water but going direct to the boat because he could not palpate a pulse. CPR was immediately commenced on the boat and a MAYDAY call transmitted. The boat quickly returned to land, it being realised that there was no hope of the other diver still being alive. They were met on arrival by an ambulance, resuscitation being continued for a further 25 minutes before death was formally certified.

The five diver group had also experienced the dramatic sea surge. One was pushed upside down and held against a crevice till the current changed direction and he was able to get free. He then met another of the group and together they managed to survive the second surge and make their way out of the cave to signal for the boat to come closer. Another of the group suffered a knock on his head from the rock roof, had the regulator torn from his mouth and had his arm injured, so found himself unable to reach and replace his regulator. By chance he found himself near another diver, who noted his problem and commenced buddy breathing. The second wave surge separated them and dislodged the buddy's mask, despite which the buddy managed to re-establish contact and resumed attempts at buddy-breathing, holding the injured man's weight belt to prevent further separation. This victim remembers no more until he heard himself breathing heavily on the dive boat. A noteworthy rescue.

Police divers made a search for the missing diver the next day but the dangerously turbulent conditions within the cave made it necessary to limit their search. The following day, attached to a securely belayed lifeline, two divers penetrated the full extent of the cave, about 85m, and found the body wedged under a rock, then divers and body were pulled from the cave. Despite their line the police divers were swept 10-15m in either direction as 3-4m waves swept into the cavern's entrance, and they required torches while making their search. Within the cave the most dangerous place was at the surface where anyone was at serious risk of being brought into violent contact with a rock. It was a very dangerous place.

Examination of the equipment revealed that both tanks had vented after receiving damage to the attachment of the 1st stage, undoubtedly from contact with rocks, this creating an unsurvivable situation.

It is noteworthy that although five of those involved had completed their training only 2 to 4 months previously they acted in a way that prevented at least two additional deaths, despite so many adverse factors. Also of note is the successful resuscitation after the recovery of one diver and the evidence that life may be still present even after significant time underwater without any air supply. There can be no doubt of the value of training divers to perform resuscitation. It can indeed be lifesaving.

TWO EXPERIENCED DIVERS DIED IN SEA CAVE. INCORRECT CHOICE OF CAVE. DANGER FROM WATER POWER DUE TO WAVES ENTERING CAVE MOUTH. EQUIPMENT DAMAGED BY ROCKS SO TANKS VENTED ALL AIR. ONE DIVER WAS RESCUED AFTER A PROLONGED TIME UNDERWATER WITHOUT AIR. EARLY RESPONSE TO CPR NOT MAINTAINED.

VALIANT RESPONSE BY NEWLY TRAINED DIVERS. RESCUE AND RESUSCITATION OF UNCONSCIOUS INJURED DIVER.

Case SC 84/10

Though classed as a professional diver this man was only an occasional diver. He was employed as a fitter/machinist with a small firm which included among the services it provided that of scrubbing the hulls of ships as they lay at the harbour wharfs. He had received scuba training at the firm's expense and on this day was acting as tender and watching the compressor while the senior diver was underwater using hookah. They were to change roles when one side of the hull had been cleaned. When another employee, a non-diver engineer, came by, the victim persuaded him to watch the compressor while he took the truck to collect their lunch. As he was leaving the dock area he met another employee, who had lost his spectacles into the water while packing up after working on a fishing boat and intended asking the senior diver to look for them whenever it was convenient. He immediately offered to find them and drove back to obtain an air cylinder.

With the scrubber when it was purchased there had been two small (23 cu ft) bailout bottles and these were among the diving equipment taken to the wharf, though not used by the divers. After attaching a regulator to one of these he drove to the dock where the spectacles had been lost. Because of their design these small cylinders cannot be gauged but he checked that air was available by operating the regulator before entering the water, without line or tender, in the restricted area between the fishing boat and the wharf. After a short interval a large bubble was seen to burst at the surface, followed by a stream of small bubbles which very soon ceased. This alarmed the employee who had lost the spectacles and he drove back to inform the senior diver, who accompanied him back to the fishing boat. He made an immediate but unsuccessful breathhold dive, next tried to use the other bail-out bottle but it was empty, then made a successful search using hookah (cylinder supply type) hurriedly brought from the works. About half an hour had elapsed before the victim was brought up and pulled onto a wooden catwalk where his equipment was removed. The limited space restricted EAR attempts so he was hoisted to the wharf and resuscitation efforts were resumed. When the ambulance men arrived they noted that chest compression was being given over the xiphoid, that expired air resuscitation (EAR) had been abandoned, that mucus and froth blocked the victim's mouth and that an OXYVIVA with suction was nearby but unused. However it was now 45 minutes since he entered the water and lost his air so resuscitation efforts were unlikely to be successful however well conducted.

Examination revealed a very heavy build-up of rust in the air cylinder, and the first stage reducing valve had a mixture of dry salt, slime, and verdigris over the parts. Testing showed that the line pressure fell when the air was used and was only 19 psi, less than dive ambient, when the tank was near empty. It is likely he started with a part filled tank, took a few test breaths before entering the water, purged the

regulator on reaching the bottom and then unexpectedly got no air when he took his next breath because of the poor airflow resulting from the depleted tank pressure. He was in a cold, poor visibility restricted space, possibly below the boat, and out of air without warning before he could adjust to his water entry and descent. He probably drowned before resolving the situation. He had no lifeline and no buoyancy vest to assist him. Vests were available but not worn because "they got in the way".

TRAINED. INEXPERIENCED. LEFT HIS RESPONSIBLE POSITION TENDING DIVER TO CARE OF UNTRAINED PERSON. SOLO UNPLANNED DIVE. USED SMALL BOTTLE WITH UNKNOWN REMAINING AIR. NO LIFELINE. NO TENDER. NO BUOYANCY VEST. RESTRICTED SPACE. NIL VISIBILITY BETWEEN WHARF AND VESSEL. POORLY MAINTAINED EQUIPMENT. RUSTY CYLINDER. FAILED TO DROP WEIGHT BELT. POOR APPLICATION OF RESUSCITATION REPORTED. OXYVIVA AVAILABLE BUT UNUSED.

SC 84/11

This incident is possibly unique and concerns the fatal embrace of a cuttlefish and the diver who speared it. It happened during a dive organised by a dive school as either the conclusion of the course or a post-course social before the presentation of certificates (opinions differ on this point). Two boats were used to reach the dive area, one owned by the instructor and the other by his assistant. Neither belonged to a national diving instructor organisation, nor accepted usual scuba safety protocols. There were 16 divers in all. There was no provision for anyone to remain as surface observer and boat minder, though two divers aborted their dives so one boat was manned.

All entered the water as buddy pairs. The victim, a former breath-hold spearfisherman, carried a handspear. It is not known how many others also intended spearfishing. About 12 minutes after entering the water the victim's buddy realised that he was low on air (J valve, no gauge), signalled this to the victim, who pulled the reserve for him but indicated that he would remain below so the buddy surfaced alone. He would have acted similarly. When he returned to the boat and found a diver there with a full air tank he exchanged his empty one for it and dived again. He was certain that such was correct behaviour and he made no attempt to rejoin his buddy or any other divers. He continued to dive until he had completely used this tank also, an air management plan that seems to have been expected of all those present.

At some stage two of the divers saw the victim apparently with a fish on his spear and a cuttlefish on the spear tip. At an earlier time the buddy had prodded a cuttlefish trying to shelter beneath a ledge. As divers used up their air they returned to the boats and ultimately only the victim remained absent. The surface was watched in the hope he had surfaced and been washed away and there was a flurry of hope when something surfaced, disappointment when it was seen to be the headless body of a cuttlefish. Neither of the instructors attempted an underwater breathhold search, nor was there any questioning of the incorrect assumption that nobody had any air remaining.

It was 25 minutes after the last diver had returned to the boat with empty tanks that open concern was first expressed. It was decided that one boat should return to shore to notify the police and obtain three full tanks. It was not possible to radio for assistance because neither boat's radio was working. The body was found on the sea bed, with all equipment in place except for one fin, which lay nearby. It had an old nick out of the heel piece and in consequence would have been loose fitting.

At the autopsy some neck marks and a bitten ear were noted to be consistent with an attack by a 30cm cuttlefish. It is said that cuttlefish may hold onto divers but they do not attack. This one may have disliked being speared and attacked when shaken from the end of the spear. Both middle ears contained blood, a sign of recent barotrauma. His tank was empty. It was suggested that when the injured cuttlefish attached itself to his head he grabbed hold of it and tried to tear it off (ultimately he tore it apart, some indication of his desperate strength) while vigorously finning to reach the surface, by which time he was possibly out of air. When his fin came off he sank down, weighted by his equipment, suffering distracting pain in his ears in addition to his previous troubles and drowned, having no buoyancy vest and not having ditched his weights. The J valve was in the OFF position when the body was found so it is probable that he had been diving with it OPEN and pulled it to the OFF position when intending to utilise the reserve air.

Several students spoke highly of the course they had just completed and the instructor defended his belief that there is no need to leave anyone in a dive boat as surface cover, to be strict with buddy diving discipline, to use contents gauges, wear buoyancy vests, or take an extra tank of air for emergency use. The Coroner was told that it would have put the divers at risk of decompression sickness if air had been available and they dived again, a remarkable argument as they had been diving at only 18-25m and if this was a real risk for participants in a search-and-rescue dive then in-water decompression stops could have been arranged. Here a diver's life was at stake as contrasted with a slight risk of the rescuer suffering the treatable condition of DCS. The false wisdom of placing reliance on a J-valve reserve is highlighted here, as when a diver enters the water with the valve OPEN, as may occur by some chance knock, he finds himself completely and unexpectedly without air when he moves the reserve's lever in anticipation of more air.

Nowadays there is a growing acceptance that those who have a professional status must accept a requirement that they provide an appropriately greater responsibility for their actions than is required of others. A diving instructor, or any-

one who runs diving trips commercially, must shoulder a burden of care for everyone on the dive which would not be expected from a diver taking out some friends. This would include careful listing of all dive pairs as they entered and left the water, ensuring that some capable person remained in the boat to provide surface cover and ensure the boat did not drift away, and have a "disaster plan". This should include a first aid box, oxygen, a spare air cylinder, and a working radio. If dives were to be made where decompression stops were required, or made prophylactically, a shot line with tank should be provided.

JUST TRAINED. INEXPERIENCED. THIRD OPEN WATER DIVE. SCUBA SPEARFISHING. SPEARED CUTTLEFISH. "CUTTLEFISH ATTACK". NO CONTENTS GAUGE, DIVED WITH J VALVE OPEN. NO BUOYANCY VEST. NO SURFACE COVER THOUGHT NECESSARY. FAULTY BOAT RADIOS. BUDDY SOLO DIVED OFTEN SOLO SURFACING AND BORROWING FULL TANK. MOST OF THE DIVERS ONLY SURFACED WHEN OUT OF AIR. DELAYED SEARCH. SEPARATION/SOLO. FAILED TO DROP WEIGHT BELT. LOW OR OUT OF AIR. BITTEN ON EAR. LOST FIN. MIDDLE EAR BAROTRAUMA.

Case SC 84/12

Three friends anchored their boat over a wreck which lay in 48m deep water and descended together to its deck. After they had checked that their anchor was secure they swam above the deck to the stern. One noticed the victim swimming as if he had orally slightly inflated his vest to compensate for being overweighted. At this time one of the divers left the others and swam forwards to examine the bridge section, and a little later the other buddy turned round after looking in at a porthole and found that he was alone. Such separation was not unexpected when wreck diving and did not alarm him when it occurred. He arrived at the anchor after 12 minutes underwater in accordance with the dive plan and joined the first diver. They assumed that the victim had started back to the surface earlier but made a short (4 minutes) search swim over the wreck before starting their ascent. They expected to find the missing diver at either the 6m (20 feet) or 3m (10 feet) decompression stop or even waiting for them in the boat. There were no bubbles to be seen coming to the surface so they became worried, fearing that he had washed away after surfacing before them. They made a surface search about one mile in each direction over the next one and a half hours, only giving up and returning to land when their fuel began to run low. They made a personal appearance at the nearest police station to report the loss of their friend, lest a phone call be mistrusted, refuelled the boat, and returned to the wreck area to await the police boat.

There were no police divers immediately available so they brought out a local diving instructor who knew the wreck and they asked the helicopter rescue service to supply one of their divers to buddy him. However the diver was not considered to be equipped for a deep dive and the search was postponed until the arrival of the police divers. They did not locate the body that day or next morning, but one of the victim's buddies, with a friend, succeeded a short time later. It was found lying free on the sea bed near the stern of the wreck, all the equipment was in place.

The victim had dived on this wreck previously, was healthy, and showed no signs of panic when last seen. He was wearing a twin cylinder scuba unit and it was over 3/4 full. Examination of his buoyancy vest revealed why it could not be inflated to assist body recovery. The CO_2 sparklet was empty and the inflator button for the tank-feed inflation of the vest was missing. Both faults had been present for some time and the wearer must have known of their presence. Although the vest fault was a significant adverse factor it is believed that nitrogen narcosis was the most likely critical factor in this fatality. The dive boat was well equipped for diving and carried oxygen. It did not carry a radio.

TRAINED. EXPERIENCED. DEEP DIVE (48M). HAD PREVIOUSLY DIVED ON THIS WRECK. SEPARATION BEFORE INCIDENT. FAILED TO DROP WEIGHT BELT. TWIN TANKS. PLENTY AIR. KNOWINGLY WORE FAULTY BUOYANCY VEST ON DIVE. POSSIBLY OVERWEIGHTED. NITROGEN NARCOSIS PROBABLE.

Case H 84/1

In the heyday of the pearl fisheries entire lugger fleets were sometimes lost in storms but it was divers who suffered the highest mortality rate, with air embolism, drowning, and decompression sickness managed by in-water treatment claiming most, though some pearl-shell beds had the added danger of sharks. In recent years there have been few such fatalities, though this has reflected the downturn in the pearling industry rather than any improvement in diver training or diving methods.

The victim was one of the seven man crew of a pearling lugger, all of them licenced divers. A licence is granted to an applicant when he can document his claim to have served as a diver's tender on a lugger. There is no requirement on the applicant to attend a formal course of instruction, and despite requests no such courses have been available, although this recruitment route provides some learning opportunities and an exposure to the diving community's folklore. The Japanese, who monopolised the diving pre-war, used to give their recruit divers a basic training. Difficulties arise in ensuring that recruits not previously exposed to such concepts gain an understanding of the physiology and pathology of diving. However all divers must pass a basic medical fitness check each season.

He was an experienced diver making this first dive of this day, one of three sent down following a favourable report made by a diver sent down to check the presence of shell. Sea depth was 16m (9 fathoms, ie. 54 fsw) and although

they descended at about the same time they naturally were not watching each other. One thought the victim was near him as he started collecting shell but it is also reported that he aborted his descent, for no discovered reason, and ascended rapidly by climbing up his lifeline after descending only 40 feet. There was no interruption of the air supply, which was from a compressor supplying all three, and his fellow divers were very surprised to be hauled unceremonially back to the surface.

The victim was seen to surface, regulator hanging loose and mask on. He expelled some air and held onto his line for a little while, then let go and swam around aimlessly, the weight belt and air hose still attached. Two of the crew immediately jumped into the water-and swam to assist. They thought he was already dead before they reached him and they saw some blood from his mouth but there was a determined attempt to resuscitate him after getting him back onto the lugger.

At the autopsy there was some evidence of both past and more recent pleurisy, but there were no reports that he had shown signs of any ill health. The equipment was checked and found to be in a poorly maintained condition but to function adequately. Although the hose connections were described as unsafe there is nothing to suggest they failed, and a crack in the demand valve's case which may have let in water is of uncertain significance, the victim and other pearl divers being accustomed to substandard conditions. It can never be known what prompted his tragic rush to the surface (a sudden pleuritic pain or receiving a sudden spray of water rather than the air he expected?) but the result was pulmonary barotrauma. Mediastinal emphysema was found and there was a clinical picture typical of CAGE. For safety each diver had a short rope connecting his demand valve to his weightbelt to ensure that he could easily regain it should it be pulled from his mouth, so regulator loss is unlikely to have caused panic in such an experienced diver.

UNTRAINED. EXPERIENCED. INCIDENT OCCURRED AS DESCENDING FOR FIRST WORKING DIVE OF THE DAY. UNEXPLAINED SUDDEN ASCENT FROM 16m OR 54 FSW. CLIMBED UP HIS LINE STILL WEARING WEIGHT BELT AND AIR HOSE. REGULATOR OUT OF MOUTH WHEN HE SURFACED. TYPICAL AIR EMBOLISM (CAGE). RAPID RESPONSE BY CREW. EQUIPMENT IN POOR CONDITION. EVIDENCE OLD AND RECENT PLEURISY.

DISCUSSION

Reports such as this require the involvement of the reader if they are to achieve their objective, the continuing improvement of diving safety. It is suggested that readers will obtain the greatest benefit if they imagine themselves as a member of each of the dive groups described and assess how they would have acted having regard to their usual diving practices. Naturally some of these incidents occur in circumstances foreign to the diving most recreational divers will meet, but the principles of safe diving have a common strand whatever the type of diving. By considering each case the reader can discover the features of diving training and diving equipment which, if neglected, decrease the likelihood of successful resolution of some misadventure.

The fatalities reported above have prompted the "examination paper" below. There are no prizes offered, except an inner glow of satisfaction and an increased awareness of diving safety, to those who complete the paper. However the pages of the SPUMS Journal are open to anyone who wishes to send in any of their answers (typed in double spacing with wide margins on one side of the paper only).

Questions

1. Identify the event which started the incident and identify in order of importance the factors which ultimately led to the fatal conclusion in each case.

2. What responsibilities rest on the person who organises a dive, and is more expected of an Instructor or a Divemaster?

3. What equipment should a dive charter boat carry so as to be prepared to adequately manage an "incident"?

4. Can dive boats be safely left unattended while divers are underwater?

5. Discuss the value of a contents gauge, a J-valve reserve, of wearing a buoyancy vest, of ascending before all air has been used, of strict buddy-diving, of allowing one of a dive group to ascend solo, and the value of buddy-breathing skills. Select evidence from the cases presented.

6. Discuss the adverse effects which may follow diving while wearing equipment having defects.

7. Discuss the possible relevance of an "asthma" history.

8. Are sea conditions given enough importance by divers?

9. Discuss the evidence for supposing that a good knowledge of resuscitation methods is valuable and illustrate from cases presented.

10. What problems may rise if buddies have air tanks of greatly differing capacities, or have equal initial air but differ significantly in rate of air use?

ACKNOWLEDGMENTS

This report would not be possible without the generous and continued support of many organisations and individuals, in particular the assistance of the Attorney General/Justice/Law Department in every State and of continued active help

of the Australian Underwater Federation. This diving safety project can achieve nothing without the interest and active involvement of many people.

PROJECT STICKYBEAK

The object of this investigation is to collect, store and, as appropriate, publish and make available for discussion, accurate information relating to all types and severities of problems encountered by divers.

CONFIDENTIALITY IS ALWAYS MAINTAINED CONCERNING THE IDENTITY OF THOSE INVOLVED IN EVENTS PUBLISHED.

The investigation is totally independent of any single diving or government organisation. Comments and reports to:

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THE INCIDENCE OF ACUTE OXYGEN TOXICITY IN A CLINICAL SETTING

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INTRODUCTION

The occurrence of oxygen toxicity is frequently described as one of the hazards of the use of hyperbaric oxygen in a clinical setting. Despite this, very few articles have been written on the incidence of acute oxygen toxicity in this setting.

A retrospective study of the occurrence of acute oxygen toxicity symptoms at the Maryland Institute for Emergency Services Systems, Hyperbaric Medicine Department (MIEMSS) from January 1978 to December 1983 was thus performed. During this period, 891 patients were treated with a total of 14,966 patient dives. All dives were performed in a multiplace chamber with the patients breathing 100% O_2 by face mask or hood and at various depths: 165 fsw, 66 fsw, 60 fsw, 48 fsw, 45 fsw and 33 fsw, depending on the condition treated.

METHODS

The patients and symptoms were identified by reviewing the chamber operators' dive logs for the time period involved and then reviewing the chamber nursing notes for the patients so identified. One problem with this method was that only patients with severe symptoms were identified, those with minor symptoms from oxygen toxicity are thus not included in this study.

A total of 137 incidents of acute oxygen toxicity symptoms in 90 patients and 11 categories of symptoms: nausea and vomiting, seizures, muscular twitching, anxiety, respiratory changes, vertigo (or dizziness), behaviour changes, visual changes, sweating, auditory changes, and altered consciousness were identified with this method.

RESULTS

The overall incidence of acute oxygen toxicity symptoms at MIEMSS during the 6 years studied is shown in Figure 1 and in Table 1.

TABLE 1
INCIDENCE OF ACUTE OXYGEN TOXICITY SYMPTOMS 1978-1983

Nausea & Vomiting	0.37%
Seizures	0.21%
Muscular Twitching	0.13%
Anxiety	0.09%
Respiratory Changes	0.05%
Vertigo	0.06%
Behaviour Changes	0.03%
Visual Changes	0.02%
Sweating	0.03%
Auditory Changes	0.02%
Altered Consciousness	0.05%

The incidence of acute oxygen toxicity symptoms was broken down further by calculating the incidence of symptoms in the treatment of the 10 categories of conditions shown in Table 2. The results are shown in Figures 1-7.

TABLE 2
CONDITIONS TREATED

Decompression Sickness
Gas Gangrene/Aerobic and Anaerobic infections
Air Embolism
Wound Healing Enhancement
Radiation Necrosis
Carbon Monoxide Poisoning/Smoke Inhalation
Osteomyelitis
Spinal Cord Injury
Head Injury
Multiple Sclerosis

We also attempted to determine whether or not there was a relationship between the duration of oxygen breathing before symptoms occurred and the number of dives (treatments) the patients have received, but there did not appear to be any significant trend other than that 73% of all incidents occurred between the first and tenth dives, with the incidence of symptoms decreasing as the number of dives increased (Table 3).