Phantom soldiers

Australian tunnellers on the western front, 1916–18

Beneath the western front Australian tunnellers fought a war of technology which contributed significantly to the bloody battles in the trenches. Roy MacLeod uncovers the neglected men of the Australian tunnelling companies.

About midnight on the 6th June we assembled, were given the zero hour, synchronised our watches and departed to our posts... The artillery preparations which, for days, had been intense had died down and the night was comparatively quiet... Suddenly, all hell broke loose around us. The enemy... with the pale light, it appeared as if the whole enemy line had begun to dance, then, one after another, huge tongues of flame shot hundreds of feet into the air, followed by a cacophony of explosions... The French army, using its superior equipment, now had a great advantage over the Germans. It had more powerful and accurate guns, better trained soldiers, and a larger number of experienced officers and men. After a sustained artillery barrage, the French army launched a massive infantry attack, overwhelming the German positions and driving them from their trenches.

Thus, in language which today might suggest a tactical nuclear explosion on the German front, was recorded the greatest exploit ever conceived in military history: the destruction of Hill 60, halting the menace of the Hindenburg Line, and preserving the third battle of Ypres. We had staked', an Australian engineer remembered, 'our every effort and every thought for nearly two years for one glorious moment, and we had won: nothing else mattered, our task was over. It may be that one supreme moment comes in life to every man — ours came to us at 3.10 a.m. on 7 June 1917. In this fiery moment, a fierce, dirty, dangerous chapter of a war that exceeded in its fury all its predecessors in its application of science and technology to the purposes of destruction reached its critical climax. Nineteen mines, concatenated over 4100 metres along the foot of the Messines Ridge south of Ypres, opened a series of craters 15 metres wide, killing outright at least 700 men of Germany's 204th Division. According to Government historian V. Ludendorff, the 'moral effect of the explosions was simply staggering'.

By the ironies that attend extravagant success, this British mining victory virtually ended the mining war.
The crater left by one of the explosions on Hill 60 on 7 June 1917 (AWM E11913).

The first British tunnellers arrived in France in February 1915; by March 1915, five companies had been formed by the simple expedient of rushing men from their British pits and tunnels into the trenches of Flanders, scarcely bothering with the niceties of uniform or military drill. Their newly commissioned pieces were frequently missing graduates of the Royal School of Mines at Camborne, and virtually all ‘civilians in uniform’. Yet so necessary were these subterranean soldiers, and so vital the science of mine engineering, that GHQ requested more, and by the end of 1916 there were twenty-five British tunnelling companies, three from Canada and one from New Zealand; with the three companies from Australia and reinforcements, a total of 25 000 men.

The conception of a separate and identifiable Australian contribution to the mining war has been credited to Lieutenant J. Thomason, a mining engineer of Western Australia. But it is T. W. Edgeworth David, professor of geology at Sydney University, who became popularly associated with the idea, and remained father to the deed. While Australian engineers dug tunnels and set mines on Gallipoli, the lack of equipment precluded extensive operations. In October 1915, Senator George Pearce, Minister for Defence, agreed to form a mining corps of two battalions of picked miners. Then Edgeworth David was commissioned major and placed in charge of the technical headquarters staff. While these plans matured, J. A. Pollock, David’s colleague and professor of physics at Sydney, began work in his university laboratory on a modified telephone for detecting faint sounds underground. This ‘geotelephone’ became one of Australia’s first contributions to the scientific war. It also brought Pollock a commission as a captain in the new mining corps, and appointment to David’s staff. To the ‘fiery zeal of the crusader’, as David later recalled, ‘Pollock brought the heart of a boy rejoicing in the great adventure that now lay before him’. In December, aged fifty, he joined David, aged fifty-eight, in active training at Casula Camp near Liverpool, New South Wales.

The mining corps — in David’s words, ‘the first thoroughly representative unit to be formed in Australia’ — was placed under the command of Lieutenant Colonel A. C. Fawcett, a thirty-one-year-old mechanical engineer from Ipswich, Queensland, then a captain in the Australian engineers, and later to become a distinguished chief engineer of the New South Wales railways. The corps as formed consisted of a technical headquarters, and three companies each of about 400 men. The first was recruited from New South Wales, the second from Victoria and South Australia, and the third from Tasmania and Western Australia, which could supply many ‘thoroughly typical Western Australian miners, skilled at their calling and of sound physique’. Fawcett was joined at Casula by his first officers on 2 February 1916. His headquarters included Captain Stanley Hunter, fifty-three, mining geologist from Mt. Brighton, Victoria, and Deputy of the Geological Survey of Victoria; and Captain James Shand, forty-six, an accountant from Epping. His medical officer was Rupert Haggerston, forty-two, a general practitioner from Marrickville, and his chaplain James Wilson, fifty-two, a Methodist from Melbourne. His first company commanders were Major John MacTaggart, forty-four, a civil engineer from Drummoynie, followed by Captain (later Major) J. D. Henry and Major E. S. Anderson (1st ATC); Captain Victor West, forty-two, a mining engineer from Launceston, followed by Lieutenant (later Major) G. N. Mulholland (2nd ATC). The 3rd ATC was first led by Lieutenant (later Major) Leslie Coulter, and later by Lieutenant (later Major) Alexander Smeeton. The average age of Fawcett’s officers was thirty-five. A third of them were married, about half were from Victoria and a third were from the other States. There were an addition fifty-three officers, a conscripted group of men who, like their British counterparts, had followed their profession all over the world. Few of them, notably excepting Lieutenant (later Major) G. I. Addcock, twenty-one, a mining engineer from Bendigo who had been a staff trainee at Duntroon, had seen previous military service.

Among the junior officers were men of diverse backgrounds. Second Lieutenant Alexander Sanderson, a great-grandson of Henry Sanderson, who collaborated with Ghent on their studies of the first railway in England, was educated in Perth and at the School of Mines in Otago, and had worked as a consulting engineer in coal collieries, gold and tin recovery plants, and tin mining in New Zealand, the Philippines and the north-west of Australia before enlistment. He was assigned to the technical staff, with Pollock and Morse, until he arrived in France. Captain Henry Brown (later of the 3rd ATC) was educated at the South Australian School of Mines, and had worked for the Broken Hill Proprietary Company Ltd and four other mining companies by 1914. Lieutenant Joseph Hamilton was an article, a worker on the rabbit-proof fence in Western Australia, and well known in the sports world. Unbeaten in the quarter-mile championship at the Eastern goldfields. Lieutenant Leslie (Jack) Coulter, a graduate of the Ballarat School of Mines, was an assistant surveyor with the Federal Government during the outbreak of war. Captain R. V. Morse, thirty-one, educated at the Sydney Technical College, was a consulting electrical engineer with experience of refrigerating plants. In 1914, Lieutenant (later Captain) Oliver H. Woodward, from Queensland (1st ATC), was on the staff of the Mount Morgan Mining Company in Papua, and Captain Arthur Hillman (1st ATC) was a railway engineer for the Western Australian government.

Life at Casula Camp was memorably uncomfortable for men unused to military formalities. ‘I am positive’, Lieutenant Oliver Woodward, newly commissioned to the 1st Australian Tunnelling Company (1 ATC), muttered to his diary, that ‘the genesis of the idea which ultimately led to the perfection of the mechanical robot was the outcome of the inventor studying the actions of a 2nd Lt. engaged in company drill’. Indeed, the camp experienced at least one outbreak of civil war, when several thousand infantry struck against the camp authorities. However, they unsuccessfully sought the aid of the miners, and indeed, men from the 3rd ATC volunteered for guard duty.

Their secret training included the use of the ‘wombat’ drill, a motor-driven auger, 8 inches (20.3 centimetres) in diameter, invented by Captain Hunter. As Woodward put it, the idea was ‘to bore a hole under every trench, push in a torpedo carrying a charge of high explosive, fire the charge, hurl some hundred-weights of Huns into the air, and repeat the performance’. Their drill also employed the newly invented ‘push-pipe’, sections of rod about 1.2 metres long and 7.6 centimetres in diameter, designed to be driven underground at a depth of about 2 metres by hydraulic jacks. To the initial sections fresh lengths were added, each containing explosives charges. In principle, as Edgeworth David explained, after 60 metres or so of pipe had been pushed across or under no man’s land, the whole line of explosives could be detonated, instantly creating a crevasse, like a railway cutting, between British and enemy trenches. With these techniques, and much practice, the miners were given the means of offensive war.

By the time they had completed training, the mining corps knew they were too late for Gallipoli and that served in Flanders a lay of land. On 20 February 1916, the ‘Miners’ Battalion’ of 1200 men, complete with Belgian boarhound mascot, received its official farewell with a march through Sydney’s Domain. They embarked from Sydney, Woy Woy, and arrived in France on 4 April, formerly the Blue Funnel line passenger ship Ulysses. Their journey to the front was to prove an adventure in itself. First, the transport ran aground off Frencatol, causing some weeks’ delay. The troops employed the time in further training, and Major MacTaggart, who fell ill, returned to Sydney. The troops proudly received a flag given them by the Kalgoorlie mining community. At sea at last on 2 April, Lieutenant Addcock recalled, the officers, splendid in their first-class accommodation, read French prayers and censored letters; while the men endured physical exercises, interspersed with lectures by Edgeworth David on Shackleton’s Antarctic expedition, and no fewer than fifteen courts martial for minor infractions. With the approach of the enemy, the restless troops were unwilling to stay aboard Durban, but in April the tunnellers reached Alexandria. There a party of 120, wearying of life on board ship, rushed their
sentries and made for the centre of the city. Arrested by military police, they had nearly succeeded in tunnelling out of the local prison before their officers secured their release the following day.\(^2\) With this, their first signals had been forged behind them, they left on board Transport 81 (the Ansonia) for Malta, where they marched through the streets of Valletta, before zigzagging across the Mediterranean. No wonder that the muffler's "T" patch on their shoulders was unkindly rendered as "T for tourists.\(^3\) After travelling by train through the pleasant late spring of the Rhône Valley and then through France, they arrived finally at their destination, Hazzebroek, on 8 May.

On reaching the front, the Australians were met by the realities of trench warfare. At first the British army had restricted its activities to defensive works against German mines, but in June 1916, just as the Australians arrived, General George Fowke, the redoubtable engineer-in-chief, persuaded the brass-hatted generals to adopt offensive mining as an alternative to expensive frontal infantry attacks. In France the Australians found British mining operations directed by an inspector of mines (Brigadier, later Major General, R. Napier Harvey) at GHQ, and by a controller of mines at each of the three (later four) army headquarters. The Australians and their two supporting companies distributed within the Anzac Corps. But the British argued that mining would never require the wholesale movement of a mining battalion to accompany infantry operations. Consequently, their corps organization was abandoned, and three separate companies were formed. In April 1916, each of the four British armies had between 12 and 13 companies.\(^1\) The first two Australian tunnelling companies were attached to the British Second Army, while the 3rd AOC went to the First Army.

Thirty men from each of the three companies were separated to form a new and unprecedented unit, the Australian Electrical and Mechanical, Mining and Boring Company — after all, and for obvious reasons, known as the 'Alphabetical Company.' Some of the electrical plant the Australians brought with them at first drew laughter from the British mining units, which found the apparatus absurdly impractical for active operations. However, when miners began to strike water and needed pumps, and put in tunnels of such length that extensive lighting was necessary, the Australians were found to have the only adequately equipped unit on the entire British front.

For the three tunnelling companies, the first week was spent receiving lectures from Colonel Stephenson on the organization of mining. For front-line training, sections of each company were sent to experienced British and Canadian units. On 27 May, scarcely a fortnight after their arrival, Australian units were in action. The three companies worked in geologically distinct sectors. In Belgium, to the north, there were sandy beaches from Ypres to the La Bassée Canal, there were layers of quicksand and blue clay; and from the canal to Loos, Vimy Ridge and the Somme, there was chalk. Chalk was easy but noisy to dig; clay proved difficult to dig, but could be dug more quietly.

In 1916, David had persuaded GHQ to seek reports from its mining geologists, before undertaking any new operation or setting artillery concentrations,\(^4\) and by 1918 printed geological maps, with co-ordinates re-placing each trench and mine. The Australians were a leader in the matter of accurate and detailed maps of the mining front, and in the presence of the German mining operations.\(^5\) David, as technical advisor, had a hand in the flying maps sent to the French and Australian governments.\(^6\) He had already worked on the basis that a mine, like a fort or a battery, is a part of the officers in charge, and a part of the skill in the silent, yet efficient, handling of their tools by the men.\(^7\) The mining expert of explosives charge and predicted 'crater size' became increasingly accurate, and mining tactics ever more devastating. Weekly reports by the tunnelling companies to the controllers of mines reached the inspectors of mines, who were given a remarkable view of the 'geological war' all along the front. Harvey monitored closely the 'scientific intelligence' arising from the organisation of German mining systems, and commented on the origins of rock substances used in the construction of enemy pillboxes.\(^8\)

All along the front, shifts were sunk at intervals of thirty to sixty miles, and drives laid underground towards German lines, connected by 'crossets', sometimes twenty to thirty-six miles ahead of the British lines. These were regularly detected and, repeatedly hit by Minenwerfers of forty-five kilograms of high explosive.\(^9\) To detect German countermining, mining engineers used these shifts and the intervals. According to contemporary accounts, the typical gallery was 1.2 metres (four feet) high, 0.76 metres (two feet six inches) wide at the top, and 0.9 metres (three feet) wide at the bottom. The galleries were over 120 metres long, giving over 132 cubic metres (5000 cubic feet) of earth to dispose of — silently! German trench engineers, using British saps, and vice versa, and 'listeners' on both sides were exhausted by the toil and the terror. As Heath recalled, it was often a race as to which side would get in its charge first, and the British were not often the forerunners. German and British engineers were the favourite British technique, to blow in the enemy's galleries.

In 1917, the British blew 117 and the Germans 106 mines.\(^10\) In each case, the tactical success attributable to offensive mining was conditioned by the limitations of combined operations between artillery, infantry, and tunnelling. On the Somme, for example, five British and Canadian tunnelling companies were said to have participated 'successfully' in the Fourth Army's disastrous attack of 1 July 1916, but only nine mines were blown before hand, and the enemy positions remained virtually intact. In April 1917, three British tunnelling companies attached to the First Army prepared eight mines, but none of them were detonated; the air bombardment was thought sufficient preparation for the attack.

Australians reinforcements, raised during the summer, began arriving in August 1916.\(^11\) In October, the new 4th, 5th and 6th tunnelling companies were absorbed into the first three. As their experience deepened during the spring of 1917, David's geological
and engineering counsel prevailed, and offensive mining took on the job of slow, methodical digging, in patient parallel to the war of attrition being waged above ground. Keeping the miners supplied was a logistical triumph. In the three months to January to March 1917, the 1st ATC required 135,000 sandbags, 62 new pumps, 3.5 tonnes of nails, 180 metres of suction hose, and 2 tonnes of corrugated iron. The men consumed 33,000 loaves of bread, 39,000 tonnes of preserved meat, 24 tonnes of vegetables, and 6,000 litres of rum. But it was not 'rum courage' that kept them there. More than once, the miners of the 1st ATC could claim that they had held their line against German attack. In July 1917, the 3rd ATC, fighting quite improperly as infantry at Hill 70 near Loos, captured an entire German mining system. Moving between corps, the Australians worked closely with other dominion troops, and many discovered imperial solidarity in their common adversity. When Woodward's section visited the dug-outs of the South African Scotsmen ('Dutchmen in kilts', as he called them), he was moved to ask his diary, 'What is the secret of this great Empire of ours?'. That the fight was 'ours' was never in dispute, although the burden of sharing it, especially with the Americans and other allies, was not always seen to fall equally. Even the British were not above comment. 'If we had all Australians instead of Tommies', Lieutenant Adcock wrote to his parents in Gosford, 'we would be in Berlin in a couple of months'.

While relieved by sections, the Australian tunnelling companies were destined never to leave the front. Thrusting new responsibilities on scarcely trained officers had a predictable effect. As R.V. Morse wrote his wife, 'No one except those who've had it, can realise what it means to work with a limited staff and with such difficulties and casualties'. By February 1917, the 3rd ATC had lost four officers and seventy-one men, with eighteen men dying of illness. Casualties came in ones and twos, except during heavy offensives. The 2nd ATC lost 89 dead, including twenty at a single blow at Hill 70 in November 1916.

Given their task, heroism was commonplace. In July 1916, Major Coulter, commanding the 3rd ATC, Captain Sanderson and five men were wounded during 'push-pipe' operations at Laventie, near Loos. When a 'push-pipe' failed to explode, Coulter went out, under shrapnel and machine gun fire, and blew up the exposed portion of the 'push-pipe'. Later, when leads were cut by hostile shell fire, he went out to light the fuse further down the sap. Wounded, he refused to be removed until the 'push-pipe' had been exploded.

For this he received the Distinguished Service Order. Sanderson, then thirty-five, received the Military Cross for conspicuous gallantry, showing 'great coolness and pluck under heavy shell fire'. All this they bore lightly. 'One does not get much fun here', Sanderson wrote to Coulter in hospital, 'except in the work and risks one has to take. Taking them all round you could not get a finer lot of officers, NCOs, and men'.

In June 1917, Coulter, only twenty-eight, was killed on Hill 70 near Lens, when he joined his men with the 18th Infantry Brigade in heavy fighting at close quarters after gaining a German trench. Sanderson received a bar to his Military Cross that day, and was promoted to major and command of the 3rd ATC.

Possibly the best known story of incidentil heroism was connected with Edgeworth David, who in September 1916 fell down a disused well-shaft he was using to study strata. As anxious soldiers pulled him up, severely injured, he asked them to pull slowly, so his could have more time to observe water levels in the shaft. Meanwhile, all along the British front, the 'Alphabetical Company' led by Major Richard Morse was busy pumping and power stations to drain flooded trench systems. By 1917, Morse's company was also carrying out all the electrical power work associated with 'forward mining' in the British sector. He helped standardize electrical supplies to 440 volts, making possible quick repairs, and developed engine rooms operating nine to twelve metres below the surface. For his services he received the Distinguished Service Order and a mention in dispatches; he lived to enjoy a prominent post-war career in electrical engineering and publishing in Tasmania and New South Wales.

R.V. Morse's letters to his wife in mid-1916, preserved in the Australian War Memorial, recall the mateship of the officers, visits to the trenches by professional friends from civilian life. This was to be the 'place to show and develop manhood, which will be invaluable to the nation and [to] future generations'. When, in July 1916, Oliver Woodward became the first tunnelling officer to receive the Military Cross for blowing up a sniper post, Morse saw his example inspiring his 'holy little family'. Woodward subsequently agreed — conquering, in his own words, 'Cowardice but not fear'.

By November 1916, the miners had established a daily routine. Along the sectors belonging to the 1st and 2nd ATCs, miners saluted under no man's land with bombs and mobile charges of 13.6 kilograms of ammonal, sometimes being gazed by carbon monoxide or mustard gas. Canaries, it was reported, were in great demand. With their geophones, the miners meticulously recorded enemy movements. Switchboards were disconnected when shelling or rats cut their wires, leaving listeners on their own. Casualties were heavy, but nervous stress, which no one measured, had become worse. In the 2nd ATC, two officers were wounded by November, and two others suffered nervous breakdown. The miners kept going on beef-tea and rum — 'of which', one officer confirmed, 'we had a plentiful supply'.

Yet there were interludes. In March 1917 Major Adcock, the one military man in the 2nd ATC, who had earlier described himself in letters home as a 'mining manager', remarked that life was 'fast becoming a business rather than an adventure'. When he and the 2nd ATC moved to Nieuport in mid-1917, beginning offensive mining in what proved to be a short-lived attempt to outflank a German thrust against the Channel ports, Adcock looked forward to 'real' action. Alas, for him, disappointment again: the miners saw the same old routine. 'Shells count no more than tramcar and a fresh raid no more than a business trip'. Whether injured to danger, or bored by the infinite patience expected of him, the war ceased for Adcock to be new. But 'news' carried the miners' war home. A few Australian newspapers eagerly followed their miners underground. 'Wilkie Wombat', writing for the Sydney Morning Herald, told their story from September 1916 onwards, and his articles were syndicated in other capitals. Readers followed the heroism of Sergeant Jack...
Stevenson from Queensland, awarded the Distinguished Service Order (D.S.O.) by Sir John Monash and Sir William Ramsay (South Australia), both awarded the Military Medal for defending their secret minehead against a German raiding party. The Sydney Morning Herald had called the miner with a weapon of the greatest importance in warfare. It was also "Willie Wonkhat" who extolled the initiative shown by Aus-

tralians, who had done many other things first, greater and wider scope of practical knowledge", and who demonstrated repeatedly "their quickness in adapting themselves to things as they find them and proving them"

Nowhere was this adaptability better expressed than during the ten months of deadly secret underground preparations that led to the devastating blow of June 1917. The German tunnellers were new to the area and the British had little experience of mine warfare.

The months of preparation and waiting... the anxious watching of weather conditions, the secrecy of the time, then the trouble commencing as the enemy realises that you are preparing something... and then the changing of plans, the replacement of men and parts lost due to this, and as the time draws nearer, the worse it becomes.

The man-made mound called Hill 60 was formed in the nineteenth century of spoil resulting from a nearby railway cutting. On top was rich loamy clay. Underneath this was a layer of preserved chalk from a period of the earth's history. Above it was a layer of blue clay by two metres of quicksand. The military history of the hill dated from the early days of the war and it had been fought over several times by the Germans. The hill was mined by the British in May 1915, and increased its fortification during the following year. From 1915 onwards, the struggle for control of the hill cost dearly. Only forty-six metres above the clay, it held the key to the entire Messines Ridge, and offered a spectacular view of Flanders. Deep mining operations began in August 1916, by a Belgian tunneling company, from eighteen metres behind the British front line. In January 1916, when GHQ gave mining a high priority underground efforts began in earnest. But owing to an almost chronic shortage of labour among miners, supporting artillery and advancing infantry, the British failed to break the German hold on the hill. In April 1916 the 3rd Canadian Tunnelling Company took over, and began a long effort to undermine the entire area. By July 1916, galleries leading to and under Hill 60 were in places finished, and charged with nearly 2400 kilograms of high explosive. In October, galleries under a neighbouring mound called the 'Caterpillar' were also mined with a further 31 500 kilograms of explosives. At the end of October 1916, the Canadians were released for other work. The Australians remained initially one of maintenance, but after they had inspected the galleries, it was clear that far more would be needed. In November and December they did a sap — optimistically called the 'Berlin sap' — for 174 metres at 12 degrees from the horizontal, bringing them directly under the German forward trench. From

here, a drive of 45 degrees to the left led under the crown of Hill 60, and 45 degrees to the right led to the base of the 'Caterpillar'. But the Canadians, in avoiding the band of quicksand, had had to descend to a water-bearing level, and this had stopped their progress.

In July 1916, little was known of the actual geology of the area until the British compiled data on the sedimentary strata and calculated the depths — between twenty-four and thirty-six metres — at which offensive galleries could be sunk without fear of striking water. With this information, the 1st ATC dug a vertical shaft twenty-seven metres deep, from which were run at angles three galleries (the 'Sydney', the 'Brisbane' and the 'Perth') and one 152 metres under the hill, a second 244 metres to the left under another German stronghold called the 'Snout', and a third 152 metres under the right, under the 'Caterpillar'. In the event, neither of the latter two were used as tactical calculations pointed to the critical significance of Hill 60.

In this sector, during the twelve months following July 1916, thirty-four British mines were fired and the Germans replied in kind along the chord of an arc reaching from Hill 60 to just east of Ploegsteert Wood.

The Germans knew British mining was under way, and sought by artillery and camouflage (small underground charges) to find the Australian galleries leading to Hill 60. On May 15 they even succeeded in two cases to entrap two Australian 'listeners' for forty-eight hours. Miraculously, the tunnellers survived, and heard the cracking windshakes above the German shafts that gave away the enemy's mining operations. Under the hill, two small dynamite charges of eight kilometres of galleries had been dug, three or four metres each day and night, pumping engines never ceasing, using water from the chalky tunnel roofs and ground.

Yet, for seven months, the enemy failed to find the Australian tunnels.

From the beginning of May 1917, nine divisions of the Second Army, including Monash's newly arrived 3rd Australian Division, supported by more than two hundred heavy guns, began to concentrate on the southern sector of the line. The Australian 'Armies' of 1916 were: three corps (9th, 10th, and 2nd ANZAC), with three divisions each, or 80 000 men, which included the two divisions holding the hill. The infantry rehearsed their second and third attacks many times while their officers consulted a vast wooden model of the ridge, set in a field behind the lines. On 3 June, a series of mines running along the ridge, then south from Wytschaete to Messines, was exploded by eleven firing teams. The single largest charge was 43 000 kilograms of ammonal, laid again at St Eloi, which had already suffered more than thirty British and German 'blows'. At last, opposite Hill 60, a firing party was assembled under Captain Woodward, with two officers, a sergeant and forty sappers. After repeated checks by Royal Engineers of the electric telephone lines, and the charges, the Australians did their own tests, using galvanometers to test the circuits and Wheatstone bridges to test that the fuses and detonators were working. The Hill 60 and 'Caterpillar' systems, consisting of twenty-one mines, were linked through a single circuit, with a conventional bomber available as an emergency alter-

native. In a series of sketches, Will Dyson, the war artist, commemorated these Australian efforts above and below ground.

Given this chilling prospect, the week ending 7 June was one of intense anxiety for Woodward's men. The week opened with a massive gas shelling along the Hill 60 sector. At last the day came. With prophetic irony, Plumer's chief of staff, Major General Sir Charles, Harrington, reputedly told a press conference on 6 June that: I don't know whether we are going to make history tomorrow, but at any rate we'll change geography!

The New Zealanders remember the evening of 6 June as cool and sweet, after a sharp thunderstorm that afternoon. The last Australians were not finally withdrawn from the pits until 2 a.m. on the morning of the 7th. As the men returned from their ghostly ritual, their pale faces gave no sign of the enormous shock they had prepared. Then, at 3.10 a.m., before (as Edgeworth David, quoting from the Rubaiyat of Omar Khayyam, recalled) the 'phantom of false morning died', just nineteen of the twenty-one mines laid, representing nearly a thousand tons of explosive, went off at split-second intervals. In David's words, 'Nineteen gigantic red roses sprang suddenly from the ground and as their crimson petals fell apart flames of all colours of the rainbow ending in brilliant white towered upwards'.

Brigadier Harvey, inspector of mines, wrote of the "gorgeous sheet of flame", and of a scene which "baffles[ed] description". Philip Gibbs, the official war correspondent, spoke of witnessing 'the most diabolical splendour I have ever seen'. Others spoke of doors thrown open, as from a set of colossal blast furnaces. The countryside was illuminated by a red light, and sounds of the explosion were reported as far away as London. Where some of our stoic watchers were watching the flash and spellbound by this burning horror, the ground trembled and surged ... Truly the earth quaked.

Paintings by Franco Flameng and Paul Nash vividly captured the event. It was the greatest series of simultaneous explostions in history. People marvelled at the technical neatness of it all. "The tongues of flame shot upwards," he recalled, 'then seemed as if they would roll towards our lines and consume their creators'. Pillars of cloud succeeded the pillars of fire, and before these died away, 'the most tremendous, and possibly the most perfect barrage of the war was that of the mines'. Gunners and howitzers— one gun to every seven metres of front— opened fire. Nearly six million shells were fired that day.

As David later recalled, 'nineteen German strongholds had been demolished in the twinkling of an eye'. By first light, hundreds of German soldiers were staggering blindly, or crawling on their hands and knees, giving the impression that the German system had disappeared. By the end of the day, ten thousand Germans were reported missing. The British took 7354 prisoners, many dazed. Along the 9.5 kilometres of Messines Ridge to the north, the 60th and 70th Brigades moved forward. The New Zealand division captured Messines, and the 16th and 17th Irish divisions captured Wytschaete. For a time, the Ypres salient ceased to exist as the line straightened south and east of Hill 60, from near Zillebeke to Flersheim.

The weather was warm. So von Ludendorff later recollected, "no sound of underground work on the part of the enemy could be heard at our listening posts". Evidence suggested that faulty judgment by the command of the 2nd German Army, and the German 19th Army Corps and Crown Prince Rupprecht. It was later reported that twelve German aircraft dropped bombs on Messines on the morning of 7 June and denounced for assuring the high command that the German positions could not be cratered. According to the story relayed by David to Harvey, those German geologists under forty years of age were sent to front-line units as punishment, and those over forty back to Berlin. German military and political leaders, including William von Blomberg, the German Minister of War and the German Army High Command, believed that the tunnels were the work of the British. The tunnels were built by the Germans, and the British had failed to find the tunnels. But the Germans were surprised to find that the British had found the tunnels.

The next day, on 8 June, the British infantry began their 'Pillow Ridge' attack. The German front held until 12.30 p.m. and then began to collapse. The next day the British captured Hill 60 and Wytschaete and the entire ridge of Messines was in British hands. The British forces then began to advance in the direction of the German coast, and the German forces were forced to retreat. The Battle of Messines was a great victory for the British, and it marked the beginning of the end for the German forces on the Western Front.
other armies, moving forward rapidly after the German retreat. Most of the troops and mines were ahead of the allied advance.89 Members of both the 1st and 2nd ATCs were in the line at the armistice.

In September 1918, the units, now twice reinforced, crossed the Vysse and the minefields. By September 1st the 1st ATC had lost 67 killed (5 officers and 62 men), 166 wounded and 37 invalided, of their total assigned strength of 1,220. Of the 130 ATC officers and men, 74 men had been killed, 290 wounded, and 205 were lost through sickness. In all, casualties represented 24 or 44 per cent of men embarked. This was less than the 66 per cent average of casualties for the AIF as a whole, but all three ATCs had been continuously in the fighting for over two years, forming closely cohesive groups, and they felt their losses deeply. Morse's 'Alphabetical' Group was the original band, although final casualty lists do not survive. Death and accidental injury continued until the very end, as defensive trenching proceeded through October 1918. But for many, at least the men of the 1st ATC, their finest moment had come long before, on that early morning in June 1917.

Today, two of the largest craters in the St Eloi district are privately owned fish ponds and swimming pools. The Hill 60 and Caterpillar, captured by the Germans in 1915, are still preserved as they were in 1918, looking like disused quarries amid rich Euro-farmers' fields. Near them, bisected by the principal rail line between Ypres and Comines, lies the 7th Battalion Memorial. Was the effort of Hill 60 worth the cost? The Sydney Morning Herald greeted the news of Hill 60 as 'A Proud Day for Australia', no less than one of the 'great days in our history'.90 Their 'typical Australian' qualities of endurance and fortitude that the miners' praises were sung. Few knew or appreciated the significance of the part played by Australian leadership and intelligence in geology, and in electrical and mining engineering along the thirteen kilometre front. The tunnellers' victory was short-lived. Tactically, Hill 60 demonstrated the benefits of mining, and the wisdom of scientific deep mining of a type Australians could do well. But for an attack to succeed, co-ordination between the forces not to lose the allies had not yet mastered was needed. By August, any illusion of a breakthrough in Flanders had disappeared when the main British assault of twelve divisions became mired in the mud of Passchendaele, and allied casualties exceeded 300,000 men. Strategically, mining could never be more than one option, an expedient that, depending too much for its success entirely on reasonably static conditions and known terrain. In retrospect, the Australians at Hill 60 witnessed not so much the beginning of a new age of high explosives, as the high price of the art of siege craft. A decade later, the inspector of mines, lecturing at Chatham, argued that no future war would see the same kind of mining that had been so impressive. The air was now far more deadly, the artillery and other 'bolts from above', the 'bolt from below [was] far too slow and, of course, could not be readily adapted to the conditions of a rapidly moving front.91 As with other aspects of offensive and defensive methods, the men at Hill 60 were repatriated. David returned to Sydney on 25 April, to an enthusiastic response from local journalists.92 His Distinguished Service Order in 1918 was followed by a Knight of the British Empire in 1920. The rest of the men sighted Rottnest Island on 6 May, and Victorians and Tasmanians disembarked at Port Phillip nine days later. On 18 May, after a separation of three years and eleven months, the New South Wales contingent met their families at Woolloomooloo. For the officers, at least, return to civilian life meant an end to 'amateur soldiering'. The task of reporting their exploits fell unevenly. The 1st ATC had an unofficial historian in O.H. Woodward, but the 2nd ATC had none. The 3rd ATC rested content with an epigrammatic reminder: 'We said farewell to the world. We had only an appreciation'. After several years had elapsed, many surviving officers and men joined the ranks of the Tunnellers' Old Comrades Association, which met annually in Britain, with branches in the dominions, from 1927 to the outbreak of war in 1939. Edgeworth David — the 'Grand Old Man' — and J A. Pollock returned to their class-rooms at Sydney; others returned to careers in mining and engineering. For the Australian public, the 'phantom war' underground would become a sleep and a forgetting. But for those who saw the vision, the tongues of flame at Hill 60 burned brightly in their memories of the Great War. As symbols, their awesome craters remain, no less today cradles of remembrance before the prospect of a nuclear-free Earth.

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Endnotes

2. Ibid., p. 23.
5. The principal British accounts of tunnelling are the sequence of articles by Sir Edward Newman, Tunnellers: The Story of the Tunnelling Companies, Royal Engineers during the World War, London, 1936, written on behalf of the Tunnellers' Old Comrades Association, and the official volume of the Royal Engineers in the European War, 1914-1919: Military-Mining, Chatham, 1922, published by the Institution of Royal Engineers. A more partisan account, with illustrations, is Alexander Barrie's War Underground, London, 1962. None of these, however, were intended to serve as detailed accounts of military efforts. There are a few individual British unit accounts, of which one of the most thoroughly researched is the Life of a Tunnelling Company, being an Intimate Story of the Life of the 185th Tunnelling Company, RE, during the Great War, 1914-1917. TOCA bulletin, no. 27, p. 1. An interesting parallel may be drawn between German initiatives and British. There responses in the 'geological' war in late 1914, and the 'chemical' war from the spring of 1915.
9. 'Historical Record of the 3rd Australian Tunnelling Company', AWM MSS 78, p. 5.
13. Sydney Morning Herald, 1 January 1917; Revellie, 1 November 1950, pp. 34-5.
16. Ibid., p. 224. (See Unwin's 'Tunnellers Notes… on a visit to 3 ATC…'.)
18. 'Historical Record of the 3rd Australian Tunnelling Company', AWM MSS 78, p. 1.
19. Woodward, War Story, p. 10. For a description of the 'woombat' drill, see the Sydney Morning Herald, 2 May 1919.
20. David, 'Prof. Pollock's War Service', p. 82.
21. Sydney Morning Herald, 21 February 1916, p. 110. The history of the 204th (Wurtemberg) Division suggests that the professional German engineer in charge of surveying in the sector, Lieutenant Colonel Finselm, lacked the mining experience of the Australians, and had instead to make do with improvised infantry arrangements. He was caught off-guard, and was perhaps overconfident of his success in monitoring British movements. But this was the consequence of the loss of Messines Ridge and adjoining sectors in June 1917.
24. David, ‘In Flanders Fields’, pp. 11-12. In this account of the Flanders battle, the poem is used as a metaphor for the sacrifice of the Australian soldiers in World War I.
26. Reed, ‘In Flanders Fields’, pp. 11-12. The poem is used as a metaphor for the sacrifice of the Australian soldiers in World War I.
27. Letts, Morse to his wife, 11 and 25 June 1916, ADM 12/18/819.
30. Letts, Morse to his parents, 4 March and 26 July 1917, ibid.
31. Sydney Morning Herald, 16 September, 15 and 30 November 1916, 18 April and 6 June 1917.
32. Letts, Morse to his wife, 20 September 1917.
33. Letts, Morse to his wife, 20 September 1917.
34. The desperate speed and appalling conditions under which the men worked are vividly recounted by Leon Wolf, In Flanders’ Fields: The 1917 Campaign, London, 1961, pp. 107-13. Wolf seems unaware that the exploits he describes were largely those of the Australians.
37. ‘In Flanders Fields’, ADM 2012/19.
38. ‘In Flanders Fields’, ADM 2012/19.
42. ‘In Flanders Fields’, ADM 2012/19.
43. Letts, Morse to his wife, 5 May 1914, ADM 2012/19.
44. Woodward, War Story, p. 121.
45. Sydney Morning Herald, 25 April and 2 May 1919.