more determined than their enemy. They lost one gun, ten men killed in action, and four wounded in action.

0700. The German tanks again turned to the east but again ran into antitank fire from the 2-3d and the 25-pounders of the RHA. The antitank guns enfiladed them, and the RHA fired from the front. The tanks passed and the smoke and dust cleared to reveal four immobilized tanks in front of the 2-3d. Three antitank guns were also destroyed. The 1st Royal Tanks now engaged the German tanks at one mile and began to close with them. Smoke and dust were everywhere. Farther back, near the perimeter, B Company of the 2-17th was counterattacking against 100 Germans holed up near the ruins called Goschen's house, north of R32. D Company of the 2-15th established a blocking position just to the north to assist in containing the Germans. Attacking with grenades and bayonets, the Australians killed eighteen Germans and captured eighteen. Overhead, Tobruk's RAF Hurricanes were fighting a battle with German and Italian fighters, while antiaircraft guns fired at the weaving and turning aircraft. The Hurricanes brought down four enemy planes and lost one of their own.

Under fire from all sides, the German tanks finally withdrew, turning to the south and heading for the gap. Tank after tank was being knocked out as they ran the gauntlet. The British cruisers and two infantry tanks which had joined them gave chase.

On the perimeter, the German infantry, who had failed to widen the gap and secure the flanks of the penetration, were scattered everywhere. Enemy pockets near the gap were being suppressed by the Australians, but groups who had penetrated deeper to the rear of the perimeter posts continued to cause trouble. There was great confusion as the German tanks and infantry pushed together out through the gap. Captain Balfe, the D Company commander, described the scene:

> The crossing was badly churned up and the tanks raised clouds of dust as they went. In addition, there was the smoke of two tanks blazing just outside the wire. Into this cloud of dust and smoke we fired anti-tank weapons, Brens, rifles, and mortars, and the gunners sent hundreds of shells. We shot up a lot of infantry as they tried to get past, and many, who took refuge in the anti-tank ditch, were later captured. It was all I could do to stop the troops following them outside the wire. The Germans were a rabble, but the crews of three tanks did keep their heads. They stopped at the anti-tank ditch and hitched on behind them the big guns, whose crews had

been killed. They dragged these about one thousand yards, but by then we had directed our artillery on to them. They unhitched the guns and went for their lives.[35]

0730. The Germans were in full retreat. Forty German dive-bombers appeared above the harbor to bomb the town in an attack meant to be coordinated with the lead German tank battalion. Four Stukas were shot down by British antiaircraft gunners and two by Hurricane fighters. Seventy-five Germans were captured at Goschen's house.

Troops in a dust storm, Tobruk

0830. Except for sporadic fighting, the battle was over. By noon, the last of the enemy was rounded up. Rommel gave the order to attack again at 1800, but the order was canceled when sufficient forces could not be mustered. Two days later, on 16 April, Rommel, thinking the 8th Machine Gun Battalion was still within the perimeter, personally directed a new attack from the west against the Ras el Medauuar sector with six medium and twelve light tanks of the Ariete Division, plus the 62d Infantry Regiment of the Trento Division. When counterattacked by the 2-48th Australian Infantry, 26 German officers and 777 men surrendered.

Continuing the attack the next day with ten tanks, the Italians reached their forward posts, but when the infantry failed to follow, they withdrew losing five tanks.[36] During the next

ten days, the Australians gave the Germans and Italians little rest, conducting aggressive patrolling and bringing in approximately 1,700 prisoners. The Germans didn't attack again until their second abortive attempt on 30 April.

Critical Events

The clearly recognizable turning point of the battle was when the 5th Panzer regimental commander, Colonel Olbrich, ordered his forces to withdraw.[37] A mile and one-half inside the Australian perimeter, having reached a slight rise across their front, the panzers suddenly faced a line of British 25-pounders, antitank guns, and tanks on their flanks. The British fire was devastating, and seventeen panzers were destroyed. As soon as the lead panzer battalion turned to avoid the British fire, it ran into the trailing panzer battalion. With this reverse in direction came confusion and an immediate shift of momentum to the defenders. This key event was further magnified by the actions of the German 8th Machine Gun Battalion. Lieutenant Colonel Ponath, the battalion commander, had tried unsuccessfully to prevent Colonel Olbrich from withdrawing.[38] Without tank support, the 8th Machine Gun Battalion's men were lying on the ground, with no cover, under heavy fire, and their ammunition was running short. Colonel Ponath decided to pull the battalion back, and as they made the first rush to withdraw, he was killed, a bullet through his heart. The next senior officer ordered the men to cease fire, and many then surrendered.[39] With this event, the Australian infantry was able to restore the perimeter, except for minor pockets of German resistance. Other key events were B Company of the 2-17th's counterattack to eliminate the German resistance around Goschen's house, thereby relieving the pressure on D Company and Post R33, which was covering the gap; there was also the failure of the German engineers to lead the attacking columns directly to the perimeter opening, causing a delay in the attack time and a loss of the effects of preparatory fires; the numerous probes and the abortive attack on 11 April against the 2-17th's sector also alerted the Australians to the imminence of an attack. Forewarned, General Morshead concentrated his artillery, antitank guns, tanks, and infantry reserves to meet the German assault. All of these major occurrences favored the Australians and certainly helped effect a decisive victory.

III. CONCLUSIONS

Analysis of German and Australian Capabilities

To analyze why the Australians won such a clear tactical victory, it is illuminating to match both opponents against a set of capabilities.

Force Structure

Although the Australians employed 32,000 combat troops in the Tobruk defenses, with about 24,000 being combat troops, there were still insufficient infantry battalions to properly secure the 28-mile perimeter in depth. Each battalion was thinly spread over a five-mile front, with two companies up and one back. The Germans, on the other hand, had sufficient men to operate and maintain vehicles and equipment but lacked enough infantry units to share the load of the 8th Machine Gun Battalion. Hindered by losses it suffered before the final 14 April attack, the 8th Machine Gun Battalion did not have enough infantry to secure the flanks of the penetration as well as to support the panzers in the attack.

Organization and Tactics

The 9th Australian Division's success at Tobruk was predicated on the expert application of all available assets in a combined arms effort. This included aerial, mobile, and foot reconnaissance to determine the enemy's location and movements; aggressive, deep, and continuous combat patrolling to keep the enemy off-balance as well as to deny him ground reconnaissance of friendly positions; air interdiction to prevent him from concentrating his forces outside artillery range; air-to-air interdiction and antiaircraft artillery support to protect the port facilities and naval ships; close air support, artillery, and combat patrolling to keep the enemy from concentrating his forces within range of the main defensive area; a strong system of defense in depth with mutually supporting positions reinforced by mines and obstacles to deny the enemy access to the perimeter; and aggressive, courageous infantrymen supported in depth by well-trained artillerymen, antitank gunners, and an armored counterattack force. These assets combined to defeat the enemy's blitzkrieg tactics. The Germans, on the other hand, were unable to muster sufficient forces at the point of penetration, as they had piecemealed their forces in order to surround the Australian garrison. The units that remained for the attack had 112 light

and medium tanks; some small sapper units; 8 field guns (virtually out of ammunition); a few light and heavy antiaircraft guns; and 1 infantry battalion—the tired and depleted 8th Machine Gun Battalion.

Weapons and Equipment

The British and Bush artillery completely outgunned the Germans' few fieldpieces and Mark IV tanks mounting the 75-mm gun. The British had forty-eight 25-pounders, twelve 18-pounders, and twelve 4.5-inch howitzers.

The Germans, however, had the edge in available air power with their ability to mass thirty to forty dive-bombers with fighter escorts against the fourteen British Hurricanes and handful of Blenheim bombers.

The German Mark III and IV tanks and 50-mm antitank guns also outranged the British 2-pound tank and antitank gun, but they suffered greatly from the 25-pound guns.

A Bren gun post defending against dive-bombers

Intelligence

The Germans used aerial reconnaissance, ground reconnaissance, and probing attacks in an attempt to determine the strength and location of the Tobruk defenses. But they had no accurate maps and only received two from the Italians just before

the attack on 12 April. The Germans were not sure where the antitank ditch was located, and they fully believed the British forces in the garrison were preparing to evacuate by sea and thus would be completely demoralized and unwilling to fight. The Australians, on the other hand, conducted extensive aerial and ground reconnaissance in maintaining contact with the enemy. Their continuous deep patrolling not only supplied information but denied the Germans close observation of the garrison positions. Lack of cover and concealment forward of the defenses and artillery fire and antiaircraft fire also helped curtail the German reconnaissance efforts. Because of the Germans' lack of information, they conducted numerous probes that revealed to the Australians the intended location of the German attack.

Command and Control

Rommel was noted for leading from well forward in his armored command car. Before the Easter Battle, he had moved rapidly about the battlefield west of Tobruk by air and ground, urging his units on into their final positions around the perimeter. Though he had radio communication, his rapid movement caused him to outdistance the range of his radio, and as a result, he was out of touch with his corps headquarters as well as his subordinate units. Certain subordinate commanders thought this method of command and control also meant Rommel often did not know the true ground situation. General Toppe, in *Desert Warfare: German Experiences in World War II*, felt that higher level commanders should not change locations too frequently but rather remain with their command post at a fixed point, even if the situation was unclear.[40] But Rommel thought differently. His philosophy was to see things for himself, to get a better grasp of the battlefield in order to make the right decisions.[41] At dawn on 14 April, Rommel, having personally gone after the Ariete Division to get them to move up to reinforce the attack, went to within 100 yards of the gap in the antitank ditch, lost his communications, and was out of contact until 0900, when he returned to his headquarters.[42] Like their commander, Rommel's subordinate leaders also moved well forward. General Streich was to move with the 5th Panzer Regiment but got lost en route to their attack position. Colonel Olbrich, commander of the panzer regiment, led the tank attack, and Lieutenant Colonel Ponath, the 8th Machine Gun Battalion commander, led his battalion personally in the reconnaissance probes, in the breaching operation, and the main attack. The serious drawback, however, was that the German chain of command

could not communicate with each other without physically moving to the rear, to the corps headquarters. Rommel also used a trusted representative, Lieutenant Schmidt, who moved along with General Streich to observe the action as it unfolded.

General Morshead also had problems, though communicating from a fixed position was not as difficult as trying to maintain contact in a fluid battlefield situation. For the Australians, radio communication was not yet available for the infantry. A wire telephone network, following the normal lines of command, was laid from the fortress headquarters to the perimeter. Battalion headquarters had strung lines to the companies and from the companies to some of the posts, usually those where the platoon leaders were located. The exposed wire, however, was vulnerable to artillery fire. The most dependable means of communication were the separate artillery cable and wireless network. General Morshead and his commanders throughout the chain also habitually went forward to assess and supervise the preparations for the defense. It is important to note that during the battle, commanders and forward observers moved about whenever necessary to influence the battle as well as to personally lead their men.

Training

While neither opponent had received desert training, the British artillerymen were exceptionally well trained and disciplined in general, as shown by their stand against the German tanks. Though German subordinate units were equally well trained, they certainly had difficulty with night movement and navigation. As for Australian individual training, it was well advanced, the men having experienced some subunit training, but battalions and regiments had not been exercised as units. In particular, German soldiers were well instructed in the use of mortars, dummy positions, and camouflage discipline. The Australians, on their part, were noted for their use of snipers, the bayonet, ground camouflage, target detection, and the use of surprise.

Senior Leadership

The two principal commanders were Rommel and Morshead. Rommel, on his part, was constantly at odds with his higher command, his Italian allies, and his immediate subordinate commander. His conflict with his higher headquarters resulted because he wanted support for an all-out offensive, while his superiors wanted him to conduct strategic defensive operations. (At the time, North Africa had a secondary role in the German grand

strategy, behind the invasion of the USSR.) Rommel was also disconcerted by the Italians and their commander, General Gariboldi, for he felt that they were not equal to carrying out their share of the war, and their failures frequently had a critical effect on German operations. General Streich, the 5th Light Division commander, also posed problems for Rommel, for Streich continually criticized orders and had previously clashed with Rommel in Europe, where Rommel's division had taken credit for successes achieved by Streich's regiment.

Streich was also reluctant to continue the assault on Tobruk and on Easter Sunday had an altercation with Rommel over the feasibility of continuing the attack. But though abrupt and impatient with his senior officers, Rommel was kind and understanding with the younger soldiers; he often shared their hardships, and he had earned their respect.

A British artillery unit, Tobruk

General Morshead, on his part, had executed a well-controlled withdrawal ahead of Rommel, fighting a series of effective rearguard actions. He was respected for his judgment and experience and known for his high standards and extreme attention to detail. While he was a hard taskmaster, his thoroughness gave his men a feeling of security. Morshead, tough and competent,

was supported by a capable group of devoted officers, who possessed all the technical and tactical skills needed to execute successful operations.

Cohesion and Morale

Both the Germans and the Australians were exhausted by 14 April. The Australians, however, were close-knit, aggressive, devil-may-care types with a strong will to fight, yet with a contempt for heroics. Ironically, until the probing attack against the 2-17th's positions on 11 April, the Germans had believed Australian morale was low. Consequently, they were both surprised and shaken by the Australians' stiff defense, including the weight of their artillery and their use of the bayonet. Though still well disciplined and confident, this experience caused the Germans to lose some of their arrogance.

Battlefield Experience

Many of the German units had fought as part of the 3d Panzer Division during the campaigns in western Europe and had been driving the British forces in front of them for three weeks. Up to the time of the battle, the Australians had been untried, but now they had fought an exhausting, yet successful, delaying action at Tobruk.

Logistical Support

Throughout the siege, the Australians, thanks to their navy, had sufficient food, water, and ammunition. Their rations were good and well balanced. In the forward posts, the meals were similar to C rations, except at night, when hot meals were brought forward. Their most critical shortages were tanks and antitank guns. These two items had a higher priority elsewhere at the time.

The Germans, on the other hand, had serious problems. They were in desperate need of a port close to the front. Benghazi and Tripoli were 300 and 1,000 miles away, respectively. They needed 50,000 tons of supplies a month or 350 tons a day to support one division. Additionally, the Italians required 20,000 tons per month. The Africa Corps was living from hand to mouth. Though capable of handling 50,000 tons monthly, Benghazi was reduced to 15,000 tons a month due to RAF bomber interdiction and a shortage of coastal shipping. The capacity at Tripoli was 45,000 tons per month,[43] but once the offensive began, Rommel did not have the trucks to move materiel to the front. As a result, supplies piled up on the Tripoli docks, while

shortages were felt at the front. Though one of the major reasons Rommel wanted Tobruk was its port facility, in retrospect, it is doubtful its capture would have helped much. Theoretically capable of unloading 1,500 tons a day, in practice it rarely exceeded 600.[44]

Australian troops baking bread, Tobruk

Terrain and Weather

Terrain and weather had an adverse effect on both German and fortress personnel alike. However, by virtue of being on the defense, in prepared positions, and tied to a support base, the elements and topography favored the Australians. The Germans operating in the open south of the 2-17th's positions found it impossible to dig in because of the desert's underlying limestone layer. Consequently, to avoid detection, they had to lie motionless in the scorching sun with black flies swarming over their bodies. Night brought them bitter cold, and often the day blackened with raging sandstorms and hurricane-force winds.

Good Fortune

Everything seemed to go well for the Australians, while nothing seemed to go right for the Germans. The two-day sandstorm before the attack impeded the Germans' preparations but gave the Australians more time to enhance their positions. Get-

ting lost en route to their objective cost the Germans their fire support, and as bad luck would have it, a defective spotlight on one of their lead vehicles blinked on and off revealing their position. Had the Germans received the more accurate Italian maps earlier, they might have picked a more suitable point to breach the Australian perimeter.

Final Assessment

The prime causes for the German failure at Tobruk were piecemealing of forces, a poor assessment of the garrison's defensive strength, and overconfidence. These factors affected the ability of the assault forces to retain the initiative and to hold, reinforce, and expand their penetration.

In reviewing the Tobruk operations from the point of view of the principles of war, the German attack appeared doomed from the start. In their overconfidence and in their underestimation of the Australians' defensive strength, the Germans failed to adhere to the basic principles of war. Rommel's objective was not attainable. He did not possess the tanks, infantry, nor artillery necessary to encircle Tobruk and to penetrate to the city while at the same time maintaining his capability to continue an offensive to the Egyptian frontier. His objective had been clearly defined, and he was most decisive about its execution, but when it came time to go on the offensive at Tobruk, he could not retain the initiative or exploit it. Moreover, Rommel was unable to mass his forces to concentrate their combat power at the point of penetration. In a maneuver to encircle the fortress, he had piecemealed his forces in economy of force efforts, attacking, defending, delaying, and conducting deceptive operations, but failing to allocate enough forces to support the main attack with infantry and a mobile reserve.

Rommel also had serious problems with unity of command, because the 5th Light Division commander strongly objected to his plan. At a critical point, Rommel had taken control from him and then given it back. The Germans also lost the element of surprise, because they could not avoid Australian observation and detection, which interfered with German movements. And finally, the German plan lacked simplicity, because it called for a night attack against a fortified position without sufficient intelligence or reconnaissance.

Morshead, on the other hand, limited his objective to holding Tobruk at all costs. He was successful because he took the initiative away from the Germans, going on the offensive with

a defense based on a program of deep patrolling, air and artillery interdiction, and aerial reconnaissance. Though spread thin in an economy of force effort to cover the 28-mile perimeter, he was able to mass his combat power at the critical time by establishing his defense in depth. This defense included a mobile reserve placed in position to maneuver on short notice to relieve pressure on the defense or, if possible, to take the initiative and exploit a successful defense.

As for unity of command, even though General Lavarack had overall command of the area, General Morshead was responsible for the defense of the garrison. Nonetheless, there was total cooperation between the two, and they shared a common objective.

The Germans never acquired an advantage over the Australians because they were unable to penetrate their security. Again, by aggressive patrolling, air and artillery interdiction, use of snipers, and excellent camouflage, the Australians denied the Germans the opportunity to gain information and kept them continuously off-balance.

Furthermore, the Australians achieved surprise at several critical times during the five days of action. For instance, the Germans were thrown completely off guard by the Australians' aggressive use of snipers, bayonets, artillery, and rapid counterattack. The Germans were also surprised when their tanks were ambushed by the 25-pounders and when the Australian infantry allowed German tanks to pass through the initial defenses before engaging the dismounted troops that followed. The simplicity of the Australian plan influenced its almost flawless execution. In its implementation, fires were well coordinated, positions were mutually supporting, and counterattack forces were properly rehearsed.

The battle for Tobruk is a set piece for light infantry supported by artillery, armor, and antitank weapons in the defense against a heavier armored force. At Tobruk, Rommel had been denied a critical objective, and his blitzkrieg tactics had failed. Psychologically, it was a shocking blow to German morale, cohesion, and momentum. For the British and their allies, it provided a long-needed boost in morale.

A captured panzer officer called Tobruk "a witches cauldron."[45] German prisoners were to refer to it later as "the hell of Tobruk," admitting that nothing like it had ever happened

to them before.[46] Allied forces had made a lasting impression on the German and Italian forces in North Africa.

Lessons Learned

Many lessons were learned from the experiences at Tobruk, both by the Germans and the Allies, concerning tactics, weapons, equipment, logistics, and training. The following are some of these lessons, some arrived at from the German perspective, others from the Australian and British view of things.

- Well-balanced, closely coordinated teams of armored forces—infantry, field artillery, engineers, antiaircraft, and air forces—were the organizations that achieved the best results in desert fighting. However, infantry units, if well balanced, were able to defend themselves against tank attacks from various directions when supported by artillery.

- Infantry battalions, with a proportionate allotment of supporting weapons on the present scale of provision, were not strong enough to provide themselves with all-around defense against an attack in force by tanks. Moreover, there was not enough room inside a battalion sector for a portion of the artillery to be placed to carry out a normal artillery role, which is essential to the defensive plan. Battalion-defended positions must therefore be placed in groups sufficiently close to each other to ensure that the ground between them can be effectively covered by antitank, small-arms, and mortar fire. In addition, each group must be arranged so that the artillery is protected from direct attack from any direction.

- Brigade defensive areas must be established so that from whatever direction attacks may come, each area can be supported by the artillery fire of adjacent areas. If brigades have to be placed in isolated positions, the general plan of defense must provide for their withdrawal in the event an enemy obtains freedom of action in the area in which they are positioned. Otherwise, the enemy will be able to concentrate its attack against such brigades and destroy them in detail.

- Artillery and antitank guns must form the nucleus of all defended positions and sectors. Therefore, organization and establishment of defenses is primarily an artillery and antitank problem and must be treated as such. No defended area can hope to stop a tank attack if the antitank defense is not in depth. The 25-pounder troops should not constitute the depth but only add to it. As far as resources permit, there must be depth in

the disposition of antitank guns in front of the 25-pounder troop positions.[47]

• When the enemy is attacking, he must be brought to a halt by the fire of antitank guns, while the artillery concentrates upon the unarmored portion of his force. A plan must then be made to attack him in the flank or rear, using the largest number of tanks possible, supported by all available weapons. Artillery will be used either to provide concentrations of fire against the enemy's supporting weapons or to blind them by using smoke. All available machine guns and small arms must be used to neutralize enemy antitank guns, to force enemy tanks to remain buttoned up, and to prevent any movement of dismounted troops with the tanks.

• Not only must antitank guns hold their fire until tanks are well within their effective range, but they must wait until tanks are within range of other guns of the defensive sector. If guns open fire individually, they reduce the effect of surprise and run the risk of having the whole of the attacker's fire concentrated on each, in turn. It is, however, dangerous for a gun to remain silent when it has obviously been located by the enemy tanks or supporting weapons.[48] The Bren gun (or similar weapon) with each antitank gun must be used to force the enemy tanks to button up.

• Antitank guns must always be dug in, even if a position is only to be occupied temporarily.

• Usually 2-pounder antitank batteries were directed not to use direct lay against tanks until tanks were within 800 yards of their positions. For 25-pounders, direct fire was held until the enemy vehicles were within 1,000 yards. Opening fire at 600 yards was found to be too short a distance because the enemy machine guns were then within effective range. At 800 yards, the antitank gun was nearly as accurate as at 600 yards, whereas the machine gun had lost considerable accuracy and was unlikely to penetrate gun shields.[49]

• All artillery covering an area of a division or brigade must be under the command of one artillery officer so that the maximum concentration of fire can be brought to bear in support of any one area.

• A 25-pounder battery position should be organized for all-around defense with small-arms weapons used against the possibility of attack by infantry at night, in smoke, or in duststorms.

- The artillery must know the infantry, machine-gun, mortar, and antitank fire plan.

- Every defended position or sector must be prepared to defend against attack from any direction. All-around defense is essential.

- To deny enemy aircraft from penetrating through the harbor unobserved, antiaircraft gun defenses and observation posts at Tobruk were established on the escarpment overlooking the harbor.

- When enemy dive-bombers attacked antiaircraft gun positions, the safest course of action was to engage them, rather than take cover.

- Gun towers were also used by the artillery to gain height for observing fire. These observation post (OP) ladders were used both as dummies to draw fire and for observation. They were mounted on trucks or could be removed quickly and set up. The British observation towers were generally about twenty-five feet high. The Germans had a two-piece telescoping tube mounted on the side of their armored OP, which could be cranked up into observing position. To employ these gun towers effectively, numbers of them—at least one to each four guns—should be used. These, like tanks and the slight rises in the ground, aid in overcoming the flatness of the desert.[50]

- All infantry sections and platoons and all antitank-gun, machine-gun, and mortar subunits must know the areas they are to cover, the ranges at which they are to open fire, and the types of targets they are to engage. They must also know where, for how long, and in what circumstances artillery defensive fire will be brought down and how it is proposed to make use of smoke. Distances to tactical features must be paced off, not guessed. Range marks must be put up. The maximum ranges at which fire is to be opened by each different type of weapon must also be paced off and marked on the ground with rocks, tins, or some other means.[51]

- Troops must be made to dig in at once upon taking up a position, however tired they may be. This applies to machine-gun, mortar, antitank gun, and field artillery units, as well as to infantry platoons.

- Positions must be kept concealed. Trucks must not be allowed to drive around stopping to deliver rations except during mirage hours or in darkness. The enemy will spend hours watching for such clues as to the location of positions.

- The existence of minefields must never be allowed to induce a false sense of security. Commanders must take frequent action to make certain this does not happen. The deeper the minefield, the greater the need for forward patrolling. Minefields can be used to economize in antitank weapons employed, but not in infantry.

- The principle of concentration at the decisive point of attack applies to the allotment of mines and laying of minefields as much as to other aspects of war. Small dispersed minefields are useless.

- There must be enough access lanes to enable troops to move in and out of minefields without undue difficulty. One foot exit on each company front and one vehicle exit on each battalion front was the minimum.[52]

- Dummy minefields can be used to deceive the enemy. Also, dummy lanes are deceptive and excellent for ambushes.

- When the Germans used tanks to cover the breaching of minefields by their engineers, the British used well-directed small-arms fire and machine guns to engage them from the flanks as well as snipers to drive them off.

- In the desert, every gun was dug into a pit, if time permitted, and covered with a net; every tent was set in a pit and camouflaged; and even each tank had a canvas top placed over it to make it look like a truck. All vehicles were painted with nonglare, sand-colored paint, and all glass was smeared with oil or a glycerine solution, and then dirt was thrown on these surfaces. Only a narrow unsmeared slit on the windshield was left to obtain vision. Wheel tracks were everywhere but could not be disguised or obliterated.

A liberal application of dull yellow paint—the color of the sand—was found to be the best method of rendering both artillery pieces and trucks less visible in the desert. The outlines of pieces were broken by the use of scrub and sand mats. The barrel and cradle were sometimes painted a dull sandy color, except for a one-foot diagonal stripe of light brown or green to break up the pattern of the gun. Motor vehicles carried camouflage nets, which were stretched taut from a central position on the roof of the vehicle at an angle of not more than 45 degrees and then pegged to the ground and covered with threaded screen and bleached canvas or with pieces of sandbags, 50 to 70 percent of which were painted a dull yellowish white. The vehicles themselves were painted cream white, broken by irregular patches of

light brown or green. The object was to neutralize dark shadows by an equivalent amount of dull white. The Germans and British adopted this sand color as camouflage. During operations, German tanks were painted black, evidently to aid their antitank gunners in quick daytime identifications while also serving as night camouflage.[53]

- As a security measure and to prevent unauthorized persons gaining information regarding the identification of units and movement of troops, the practice of marking vehicles with unit designations was discontinued by the British. A code system employing colors and combinations of colors with numbers (to indicate various tactical organizations) was adopted.[54]

- All defended localities and areas must be covered by mobile outposts to give warning of approach, to deny close observation of the position to the enemy, and to harass and delay his advance.

- All motorcycles, including half-track motorcycles, proved unsatisfactory for the Germans and were replaced eventually by Volkswagens.

- Movement of units or replacements to the desert in the summer resulted in more metabolic disorders than during the rest of the year.

- A period of acclimatization is not absolutely essential before engagement of troops, as efficiency is not greatly affected upon arrival.

- After one year in the hot desert climate, troops should be rotated to a different theater, as their efficiency and health declines rapidly. Units carried more supplies than was contemplated by peacetime training; seven days' supply was advocated by many units, and the Germans were said to carry fourteen. Each unit sent into the desert needed to be as self-sustaining as possible.[55]

- The British relied on supply dumps to a greater extent than the Germans, who used supply trains. The artillery played an important role in the defense of both dumps and columns.

- German maintenance and recovery units went into battle with their tanks. The British did not have this capability and suffered accordingly.

- The Germans gave much attention to the effect of the tropical sun on their munitions and weapons. All ammunition other than small-arms ammunition was especially packed for

the tropics. All munition cases were so marked. Normal charges for tropical use were calculated at an average temperature of 77° Fahrenheit.[56]

• Flashless powder was highly desirable, especially for medium and heavy artillery, which were the favorite targets of dive-bombers, strafing fire, and enemy batteries. Weapons were difficult to detect at a distance when this type of propellant was used. The use of separate-loading ammunition placed any weapon at a disadvantage during action against armored vehicles.[57]

• Extensive use on both sides was made of captured machine guns, antiaircraft weapons, artillery, tanks, and motor vehicles.

• In regard to tank and antitank technology, the Germans felt that all tank and antitank systems should have the longest possible range since the enemy could be seen at great distances, and it was critical to engage him before he engaged you. Because there was little cover and only a few reverse slope positions in the desert, they said it was desirable to have only vehicles and weapon systems with a low silouette. They determined it was especially important to have tanks that were fast, maneuverable, and equipped with long-range guns.[58]

• Shortage of tank crews was a greater problem than the shortage of tanks.

• German units that were transferred to Africa during the course of the campaign there received no specialized training owing to the fact that the orders for their transfer came so unexpectedly that there was no time for this purpose. However, in a suggestion submitted to the army High Command by the army in Africa, the following training subjects were considered important:

— Exercises of all types in marching and combat in open, sandy terrain.

— Cover and camouflage in open terrain.

— Aiming and firing of all weapons in open terrain and at extremely long ranges.

— Recognition and designation of targets without instruments. Aiming and firing exercises were to be carried out by daylight, at night, in the glaring sun, during twilight, facing the sun, with the back to the sun, with the sun shining from one side, by moonlight, and with artificial lighting.

— Exercises during extreme heat.

— Exercises of long duration with no billeting accommodations.

— The construction of shelters in sandy terrain.

— Practice in night driving and in driving over sandy terrain.

— Marching at night in level terrain.

— Orientation by compass or by the stars.

— Driving by compass.

— Recovery of tanks and other vehicles in sandy terrain.

— Laying and removing mines in sandy terrain.

— Exercises in mobile warfare.[59]

APPENDIX A*

Tobruk Fortress
Order of Battle, 14 April 1941

HQ 9th Aust Div & Tobruk Fortress
- 9th Aust Div Intelligence Sec

HQ 3d Armored Bde (60 × tanks working; another 26 tanks in repair)
- 3d Hussars/5 the Royal Tanks (Det 4 × light tanks and 18 × cruisers)
- 1st Royal Tank Regt (Det 15 × light tanks and 19 × cruisers)
- 1st Kings Dragoon Guards (30 × armored cars)
- 4th Royal Tank Regt (Troop of 4 × infantry tanks)

18th Cavalry Regt (Indian)

HQ Royal Horse Artillery

1st RHA Regt	(16 × 25-pounders)
3d RHA (minus one btry)	(16 × 2-pounder antitank guns)
104th RHA Regt	(16 × 25-pounders)
107th RHA Regt	(16 × 25-pounders)
51st Field Regt	(12 × 18-pounders and 12 × 4.5 inch how)
2-3d Aust Antitank Regt (minus one btry)	(Unk no., type, Bofors 37-mm; Breda 47/32-mm; 2-pounders)

HQ Royal Australian Engineers
- 2-3d Aust Field Company
- 2-7th Aust Field Company
- 2-13th Aust Field Company
- 2-4th Aust Field Company
- 2-4th Aust Field Park Company
- 2-1st Aust Pioneer Battalion

Signals 9th Aust Div

*Source: AIF (Middle East). Military History and Information Section. *Active Service: With Australia in the Middle East* (Canberra: The Book of Management of the Australian War Memorial, 1941).

HQ 18th Aust Inf Bde
Sig Sec
16th Aust Antitank Company
2-9th Aust Inf Bn
2-10th Aust Inf Bn
2-12th Aust Inf Bn

HQ 20th Aust Inf Bde
Sig Sec
20th Aust Antitank Company
2-13th Aust Inf Bn
2-15th Aust Inf Bn
2-17th Aust Inf Bn

HQ 24th Aust Inf Bde (-) (2-25th Inf Bn still in Australia)
Sig Sec
24th Aust Antitank Co
2-28th Aust Inf Bn
2-43d Aust Inf Bn

HQ 26th Aust Inf Bde
Sig Sec
26th Aust Antitank Co
2-23d Aust Inf Bn
2-24th Aust Inf Bn
2-48th Aust Inf Bn

1 Royal Northumberland Fusiliers (Machine Gun Bn)

HQ Aust Army Service Corps (AASC)
9th Aust Div Supply Column
9th Aust Div Ammunition Co
9th Aust Div Petroleum Co
Composite Co AASC
7th Aust Div Supply Column
2-3d Aust Field Ambulance Co
2-8th Aust Field Ambulance Co
2-11th Aust Field Ambulance Co
2-5th Aust Field Ambulance Co
2-4th Field Hygiene Co

9th Aust Div Provost Co
9th Aust Div Protection Platoon
9th Aust Div Empl Platoon
9th Aust Div Postal Unit
9th Aust Salvage Unit

Fortress Troops

Royal Artillery

HQ 4th Antiaircraft (AA) Bde
13th Light AA Regt
14th Light AA Regt
51st Heavy AA Regt
3d Aust Light AA Regt

Notts Yeomanry (coast defense)

Royal Engineers (under chief royal engineer, 9th Aust Div)
295th Field Co Royal Engineers
551st Tps Co Royal Engineers
4th Field Sqd Royal Engineers
143d Field Park Troops

Signals (under Cdr Signals, 9th Aust Div)
K Base Section
27th Line Maintenance Section

Royal Army Service Corps (RASC)
309th Reserve Motor Co
345th Reserve Motor Co
550th Co
RASC 4th Lt AA Bde
RASC Sec 13th Lt AA Regt
No. 1 Water Tank Co

Medical
16th MAC

Ordnance (Royal Army Ordnance Corps [RAOC])
2d Armored Div Workshops RAOC
Y Army Tank Receiving Section, RAOC
2d Spt Gp Ord Field Park Sec, RAOC

A Sec Ord Field Park AAOC
2-1st AFW AAOC
Det 2-2d AFW AAOC

Tobruk Subarea

HQ Tobruk Subarea
1st Libyan Refugee Bn
2d Libyan Refugee Bn
4th Libyan Refugee Bn
HQ 45th Group

1205th Indian Pioneer Co
1206th Indian Pioneer Co
1207th Indian Pioneer Co

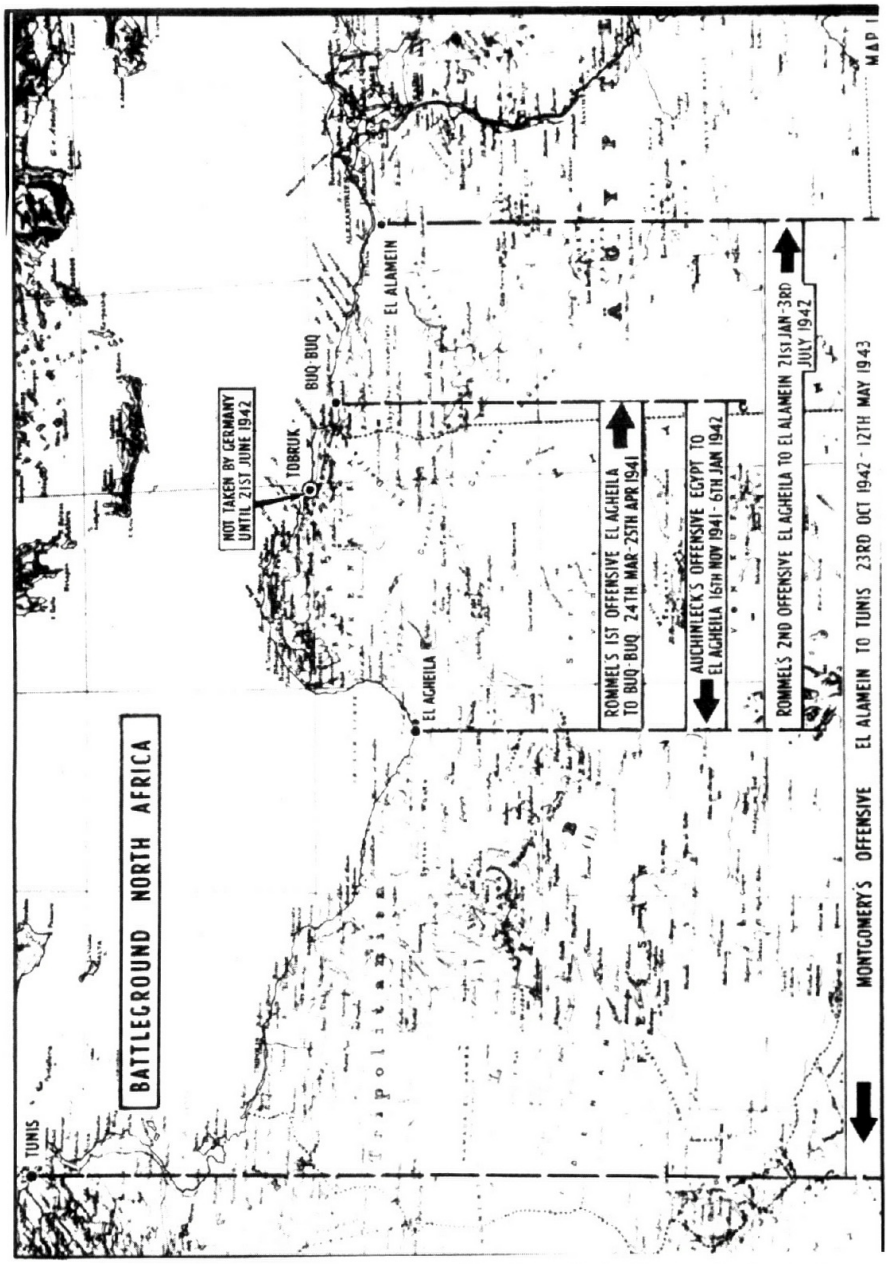
Libyan Work Bn
Army Post Office

H Adv Stationary Depot
Transit Camp

Misc Detachments:
Greek Civilians
POW Cage

APPENDIX B*

The North African Campaigns



*Source: George Forty, *Afrika Korps at War* (New York: Charles Scribner's Sons, 1978), 9.

APPENDIX C*

German Offensive Tactics

. . . A German tank battalion in tactical formation moves in short rushes, taking advantage of the terrain. Frequently the whole regiment advanced in mass formation with lines of tanks at regular intervals of about 50 yards, advancing in waves. The relatively close formation is more readily controlled than a widely dispersed one. Field artillery and antitank weapons are kept up close, although their location is not apparent until they go into action, usually on the flanks of the tank column. The Germans have in the past been able to bring effective artillery and antitank fire to bear on the British before the British could effectively fire upon them. In addition, RAF planes, because of the pilots' inability to distinguish between their own and German tanks, have not attacked German tank formations in the forward areas.

d. *Offensive Tactics*

In the desert frontal attacks have not often been used, an effort being made more often to attack from one or both flanks. German tanks usually open fire at 1,500 to 2,000 yards, which is beyond the effective range of the hostile weapons that they have thus far encountered. When contact is made, the speed of advance is slowed down unless the movement is a quick thrust to force the withdrawal of weaker hostile forces. The 75-mm and 50-mm guns are used to keep hostile tanks out of range.

(1) *Usual German objectives.*—The object of the Germans is to knock out quickly as many of the antitank guns and foremost field guns as may be visible. When the German tank commander has decided to attack a position, his first objective has often been the British 25-pounders. By reconnaissance in tanks he first locates the British battery positions and makes his plans. This plan in principle always appears to be the same. He decides which battery to attack and he arranges to attack it from enfilade. His attack is made with 105-mm guns, the 88-mm dual-purpose guns, and both Mark III and IV tanks. The

*Source: U.S. War Department, Military Intelligence Service, *Artillery in the Desert* (Washington, DC: U.S. Government Printing Office, 25 November 1942), 54—59.

105-mm guns fire from covered positions; their observation posts are in tanks. The 88-mm dual-purpose guns are towed. These guns use direct fire from their trailers after attaining defiladed positions at ranges varying from 2,000 to 2,500 yards. The Mark IV tanks assume positions in defilade and fire over open sights at ranges varying from 2,000 to 2,500 yards. The high velocity 75-mm gun in the Mark IV tank and the 88-mm dual-purpose gun have far higher muzzle velocities than any artillery that the British have had in the desert.

(2) *German Mark III tanks.*—The Mark III tank is used as the main striking force in attack. It has the dominant role in tank-versus-tank combat. Its heavy armor and powerful 50-mm gun give it a decided advantage over all types of tanks which it has thus far encountered in the desert. The 75-mm gun in the Mark IV tank is not an antitank gun but a close-support weapon. Its maximum range is 7,000 yards. Frequently these tanks use direct laying from a defiladed position in which, owing to the location of the gun in the turret, they offer a very small target. At other times the fire is massed, with indirect laying, and is adjusted by forward or flank observers in tanks. Tanks rarely fire while moving, although in at least one instance they were used to fire a rolling barrage at from 3,000 to 4,000 yards while advancing slowly. This forced the opposing tanks to close up doors and turrets.

The first wave of Mark III tanks overrun the gun positions. The second wave of Mark III tanks is closely followed by the motorized infantry, which detrucks only when forced to and cleans up the position with small-arms fire, assisted by tanks which accompany it. After the artillery has neutralized the tanks, the support infantry is attacked. Such attacks have nearly always neutralized the artillery, either by destroying it when the attack was driven home, or by forcing it to withdraw before the tank attack was launched. A successful defense against such attacks has been made only when a tank force was available to launch a counterattack from concealed positions against the flank of the German tank attack.

(3) *The German Mark IV tanks used as artillery.*—In the attack the Germans maneuver to some position where their Mark IV tanks can take up a position in defilade. The Germans meanwhile make a reconnaissance, probing the enemy from all directions to test his strength, and to induce the defenders to disclose their positions by opening fire. During this period, observation posts keep close watch, and any guns which disclose

their positions are marked down for destruction when the main attack begins. Then, from their defiladed positions, the Mark IV's attack by fire all antitank guns or light artillery which are visible and within range. Light artillery, antitank guns, and machine guns with the same mission are pushed forward among and to the flanks of the tanks. Observers and occasionally infantry are pushed further forward.

Each German tank battalion has one company of 10 Mark IV tanks, which are employed in 2 principal roles: as highly mobile artillery, and as a component of a fast-moving column. Often field artillery cannot be immediately available in armored engagements; the Mark IV tank with its 75-mm gun together with the artillery of the armored division provides German armored formations with the necessary heavy firepower for a breakthrough.

The maximum range of the 75-mm gun is reported to be 9,000 yards. This relatively long range dictates to troops equipped with light antitank guns the time and place of a battle. In addition, the speed of the Mark IV tank is sufficient to enable it to take part in a rapid advance with the Mark III tanks. The Germans have used these tanks as sniper guns, as artillery against forward British columns, and as heavy concealed weapons in the ambushes into which German armored cars have tried to draw the British cars. In a defensive situation the Mark IV is able to engage British troops from outside the range of the antitank guns, avoiding at the same time, by their mobility, the British artillery fire.

(4) *Field artillery support.*—The 105-mm mobile batteries and the 75-mm guns of the Mark IV tank furnish the principal artillery support for the German Mark III tank, which is the main attacking tank. Sometimes the 88-mm dual-purpose gun is used in conjunction with the Mark III tank.

Some reports indicate that the direction of this supporting fire is carried out by a system of air bursts, since air bursts have been immediately followed by HE concentrations. The fire of 75-mm and 105-mm guns using HE shells has not been reported to be extremely effective. Casualties caused to personnel and tanks by these weapons have been reported to be the result of a new flare—a 75-mm shell which envelopes the tank in flames regardless of what portion of the tank is hit. One whole tank regiment was reported destroyed by this type of projectile. Although the casualties caused from these weapons may be

slight, all reports agree that they have a high nuisance value to tanks because of the blinding effect of the smoke and dust. The 88-mm is effective; tanks hit squarely by this gun are destroyed . . . .

e. *German Methods of Forcing Gaps through Mine fields*

A heavy artillery concentration is placed on the point to be forced and upon the defending troops in the vicinity. After the defenders' resistance is lowered by the concentration, a comparatively small number of foot troops advance to the gap under cover of smoke or of dust raised by the concentration; they locate the mines by prodding the ground with bayonets or with mine detectors; the mines are then removed. Casualties are replaced from a reserve unit that is held immediately in the rear. This method was used in forcing a gap through the mine field that was part of the defenses of Tobruk; the preliminary concentration lasted for two hours. After a gap is forced and marked, infantry followed by tanks or tanks followed by infantry attack through the gap. Infantry preceded the tanks in the battle of Tobruk.

APPENDIX D*

British Antitank Operations

a. *Organization*

Since the number of guns in use in Cyrenaica has been inadequate, all available are used or emplaced before the close of each operation. The antitank weapons, which are considered artillery by the British, are under the command of the division artillery commander in the British forces, and he is responsible for so placing his artillery and antitank guns that they will be mutually supporting. For any action the artillery commander issues the necessary orders alloting the antitank weapons to both artillery and infantry units.

Antitank artillery regiments of 2-pounders consist of 3 battalions of 2 batteries of 8 guns each, totaling 48 guns. They are organized exactly in the same manner as the artillery units except for the number of personnel assigned. A few 6-pounder and 18-pounder batteries are being used. The 6-pounder guns are mounted portee, and the 18-pounders are truck-drawn. These units are also organized in the same fashion as the artillery batteries. The trucks used for the 2-pounders and 6-pounders portee are in general of the 1 1/2-ton type.

The minimum amount of antitank guns required with units necessarily depends on the type of country; the more open the country, the larger the number of guns needed. In the desert where there are no natural tank obstacles an attack may come from any direction. Headquarters and rear echelons must be protected. The large frontages covered and the wide dispersion necessary to minimize the efforts of air attack make this problem of protecting rear elements a difficult one.

In the western desert there have been in use no antitank warning systems, but the British make use of armored car patrols to prevent any surprises, and, as a rule, when one weapon fires, all prepare for action. OP's [observation posts] to the front and flank warn by visual signals of the approach of the enemy armor.

*Source: U.S. War Department, Military Intelligence Service, *Artillery in the Desert* (Washington, DC: U.S. Government Printing Office, 25 November 1942), 73—86.

b. *Positions*

In some cases one battery of twelve 2-pounder antitank guns is detailed to protect each infantry regiment. Each attached supporting battery of artillery is often given one troop of four antitank 2-pounder guns. Organic artillery has the support of one antitank troop per artillery battery. These 2-pounder antitank units are not usually grouped or held in reserve at any point but are actually placed in positions from 100 to 300 yards from the unit protected.

British artillery regiments are armed with 25-pounders which, although not so designed, have formed the basis of the antitank defense. This has been necessary, because the 2-pounder antitank gun has not proved effective. The 25-pounders are sited to give protection in depth, and, where the terrain permits, to give all-around protection to the position.

Antitank guns are placed to cover the 25-pounders in front, in intervals, and on the flanks. A proportion of them may be kept on wheels to counter a threat from an unexpected direction. The fewer the total number of antitank guns, the larger will be the proportion kept in mobile reserve. But positions which guns may have to occupy will in most cases be reconnoitered and prepared beforehand.

Despite the fact that the British have usually operated with one and sometimes two 48-gun antitank regiments to the division, they have still found the number to be too small, and consequently have had their choice of positions affected by the necessity of choosing terrain which could allow them the maximum use of their inadequate number of antitank guns. Unless otherwise dictated by the terrain, it is considered better to place the few antitank guns in comparatively small localities for all-around defense rather than to attempt a complete defense in depth over a wide area. The batteries of 25-pounders are used to provide depth to the defense. Antitank weapons are often placed from 100 to 300 yards on the flank of a battalion in action. For all-around defense of an organization, they are placed from 500 to 1,000 yards in front or on the flank of a battalion with instructions to move close to the battalion position when tanks approach within 1,000 yards of their positions. . . .

. . . Harassing and bombardment tasks are carried out by the 25-pounder guns that are situated in covered positions.

The efforts to avoid observation are directed toward concealment and protection. Scrub ground, or other rough ground, is

chosen wherever possible, and digging is done with great care. Movement of all personnel is rigidly controlled.

Guns are placed so as to give effect to the principle of concentration of fire. This is necessary, as the German tanks usually attack in a mass, which cannot be engaged effectively by single guns.

NOTES

1. Ernst Bolbrinker. *"5th Panzer Regiment (13—14 Apr 1941)."* Foreign Military Studies No. MS D-088 (Historical Section, U.S. Army Europe, 1947), translation from the German by Colonel Gunter Siebert, U.S. Army War College Class, 1984, 2.

2. AIF (Middle East), the Military History and Information Section, *Active Service: With Australia in the Middle East,* (Canberra: The Book of Management of the Australian War Memorial, 1941), 35.

3. Ian Stanley Ord Playfair, *The Mediterranean and Middle East,* Vol. 2, *The Germans Come to the Help of Their Ally (1941)* (London: Her Majesty's Stationery Office, 1956), 38.

4. Barton Maughan, *Tobruk and El Alamein: Australia in the War of 1939—1945* (Adelaide: The Griffin Press, 1966), 225.

5. Peter Firkins, *The Australians in Nine Wars: Waikato to Longtan* (New York: McGraw-Hill, 1972), 232.

6. Maughan, *Tobruk,* 267.

7. Ibid., 210.

8. John Strawson, *The Battle for North Africa* (New York: Charles Scribner's Sons, 1969), 57.

9. Maughan, *Tobruk,* 125.

10. Generalmajor Alfred Toppe, et al, "Desert Warfare: German Experiences in World War II." Extracted from Foreign Military Studies No. MS P-129 (Mimeographed. Historical Division, U.S. Army Europe, 1952), 66.

11. Ibid., 66.

12. Maughan, *Tobruk,* 131.

13. John Robertson, *Australia at War, 1939—1945* (Victoria: Brown Prior Anderson Pty Ltd., 1981), 16.

14. Maughan, *Tobruk,* 159.

15. Ibid., 159.

16. Ibid., 169.

17. Anthony Heckstall-Smith, *Tobruk: The Story of a Siege* (New York: W. W. Norton, 1960), 121.

18. Maughan, *Tobruk,* 410.

19. Ibid., 120.

20. John Cumpston, *The Rats Remain: Tobruk Siege 1941* (Melbourne: Grayflower Productions, 1966), 208.

21. Ibid., 76.

22. George Forty, *Afrika Korps at War* (New York: Charles Scribner's Sons, 1978), 48.

23. Playfair, *Mediterranean*, 35.
24. Ibid., 13.
25. Ibid., 13, 342.
26. G. B. Jarrett, *West of Alamein* (Northridge, CA: Sentry Books, 1971), 64.
27. Playfair, *Mediterranean*, 341.
28. Ibid., 299.
29. Maughan, *Tobruk*, 19.
30. Chester [R.W.W.] Wilmot, *Tobruk, 1941: Capture, Siege, Relief* (Sydney: Angus and Robertson, 1944), quoted in Maughan, *Tobruk*, 133.
31. Ibid.
32. Bolbrinker, "5th Panzer Regiment," 2.
33. Maughan, *Tobruk*, 145.
34. Bolbrinker, "5th Panzer Regiment."
35. Chester [R.W.W] Wilmot, *Tobruk, 1941*, quoted in Maughan, *Tobruk*, 133.
36. Playfair, *Mediterranean*, 38.
37. Wolf Heckmann, *Rommel's War in Africa* (New York: Doubleday, 1981), 82.
38. Ibid.
39. Ibid., 83.
40. Toppe, et al, "Desert Warfare," 83.
41. Erwin Rommel, *The Rommel Papers* (New York: Harcourt, Brace, 1953), 122.
42. Ibid., 125.
43. Martin Van Creveld, *Supplying War: Logistics from Wallenstein to Patton* (Cambridge: Cambridge University Press, 1977), 184.
44. Ibid., 187.
45. Heckstall-Smith, *Tobruk*, 63.
46. Ibid.
47. U.S. Army Command and General Staff College, Department of Tactics, RB 100-6, *Battalion and Brigade Operations: Main Lessons of Recent Operations in the Western Desert* (Fort Leavenworth, KS, 1976), 2—37.
48. Ibid., 2—35.
49. U.S. War Department, Military Intelligence Service, *Artillery in the Desert* (Washington, DC: U.S. Government Printing Office, 25 November 1942), 78.
50. Ibid., 42.
51. CGSC, DTAC, Main Lessons, 2—38.

52. Ibid., 2—41.
53. U.S. War Department, *Artillery in the Desert*, 45.
54. Ibid., 47.
55. Ibid., 1.
56. Ibid., 37.
57. Ibid.
58. Toppe, 66.
59. Ibid., 10.

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