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Edited by
Fuat Sezgin

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IN ISLAM

Volume 76

Technology of Warfare

Texts and Studies
Collected and reprinted

I

2002

Institute for the History of Arabic-Islamic Science
at the Johann Wolfgang Goethe University
Frankfurt am Main

NATURAL SCIENCES
IN ISLAM

Volume
76

TECHNOLOGY
OF
WARFARE

TEXTS AND STUDIES

I

Collected and reprinted
by
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in collaboration with
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Türkiye Diyanet Vakfı İslâm Araştırmaları Merkezi Kütüphane	
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between Khorasan and Gorgān, having been included by the geographers in either province.

In the 10th century the *rebāt* at Farāva (ascribed by some authorities to the governor of Khorasan 'Abd-Allāh b. Tāher) was manned by a small but bellicose garrison of *morābeṭūn* (fighters for the faith), taking turns at spells of duty. The population was less than a thousand, though there was a mosque with a spring running through its center, which supplied drinking water; no market is mentioned, and the absence of agricultural lands at that time meant that grain had to be imported from Dehestān and Nasā. Later in the 10th century Farāva passed into the political control of the Ma'mūnid *k'arazmshahs* of Gorgānj, and in the early 11th century it became part of the expanding military empire of Maḥmūd of Ghazna (388-421/998-1030). As pressure from the Oğuz Turks increased, Mas'ūd b. Maḥmūd (421-32/1030-41) was forced, in 426/1035, to cede it to their Saljuq leaders Toğrel, Çağrı, and Yabğū. With the gradual Islamization of the Central Asian Turks, Farāva lost its *raison d'être* as a frontier bastion, however. By the 14th century, according to Hamd-Allāh Mostawfī, it was prosperous, with cultivation of cereals and fruit (*Nozhat al-qolūb*, ed. Le Strange, I, p. 151; II, p. 150), but thereafter it faded from historical mention. The site is now marked by Kizyl-Arvat (Red Ribat; 39° N, 56° 23' E), a town that has sprung up in present-day Turkmenistan as a station on the Transcaspien Railway from Krasnovodsk to Marv and beyond.

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(C. EDMUND BOSWORTH)

FĀRES (plurs. *forsān*, *fawāres*), the Arabic term for "rider on a horse, cavalryman", connected with the verb *farasalfarosa* "to be knowledgeable about horses, be a skillful horseman" and the noun *faras* "horse". Since in ancient Arabian society the owner of a horse was a comparatively rich man, often a tribal chief, *sayyed*, and since in the early Islamic *dīvān* (q.v.) system the cavalryman was entitled to a stipend double that of the infantryman, the *forsān* were a privileged class, and acquired some of the fighting qualities and chivalric attributes of the medieval European knight. Hence by later 'Abbasid, Ayyubid and Mamluk time, the term *forūsīya* had evolved for the ensemble of moral qualities and riding and weaponry skills necessary for the cavalryman.

The *fāres* thus came in many ways to be the equivalent of the Persian mailed cavalryman, the Old Pers. *asabāra-*

and the Middle Persian and early New Persian *aswār* (q.v.), later yielding *sowār*, *sovār*, the standard term for a cavalryman in, e.g., the Mughal army in Muslim India.

See also ASB, ASĀWERA.

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(C. EDMUND BOSWORTH)

FĀRESĪ, ABŪ 'ALĪ. See ABŪ 'ALĪ FĀRESĪ.

FĀRESĪ, KAMĀL-AL-DĪN ABU'L-ḤASAN MOḤAMMAD b. Ḥasan (d. 721/1320), the most significant figure in optics after Ebn al-Hayṭam (Alhazen; 354-430/965-1040). The two names have been linked on account of Kamāl-al-Dīn's critical revision of Ebn al-Hayṭam's *Ketāb al-manāẓer*, which represents a watershed in the scientific understanding of light and vision. Kamāl-al-Dīn's work, entitled *Tanqīḥ al-manāẓer le-dawī al-abṣār wa'l-baṣā'ir*, was for long assumed to be a commentary (*ṣarḥ*) on the *Ketāb al-manāẓer*. This impression was partly reinforced by the autobiographical information in the *Tanqīḥ*, which is the main source of what little we know about him.

Kamāl-al-Dīn relates (*Tanqīḥ*, ed. Hyderabad, I, pp. 4-9) having come to Tabrīz (possibly sometime before 1290) to study under Qoṭb-al-Dīn Šīrāzī (634-710/1236-1311), one of the distinguished team of astronomer-philosophers from the Marāğa observatory in Azerbaijan. Kamāl-al-Dīn's concern with optics was already sufficiently established to question the statements of "leading philosophers" such as Naṣīr-al-Dīn Ṭūsī (Sabra, p. lxxi, n. 112), on the refraction of rays in water and on why stars appeared larger near the horizon than at higher altitudes. In response to Kamāl-al-Dīn's dissatisfaction with his readings, his teacher recollected having seen during his youth "a book on optics in two large volumes attributed to Ebn al-Hayṭam" in a library in Fārs and subsequently obtained a copy for Kamāl-al-Dīn "from a distant land." Fortuitous circumstances thus placed in Kamāl-al-Dīn's hands a unique work which, in an extensive series of mathematical and experimental studies, had brought together for the first time the physics of light (dealing with rectilinear propagation, reflection, and refraction) and ocular anatomy to explain vision. Previous explanations based on visual rays, qualitative impressions, and indivisible forms were replaced by a new theory of an "optical" punctate image formed in the eye by light reflected from the surface of the object—a theory which marks the beginning of physiological optics (Russell, 1996). Qoṭb-al-Dīn Šīrāzī urged Kamāl-al-Dīn to write a commentary on Ebn al-Hayṭam as he himself was preparing one on the *Qānūn* of Avicenna (q.v.).

Sovari (Torb)

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- 2 GÖKHAN FİL, 1315 (1899-1900) tarihli süvari talimnamesine göre Son Dönem Osmanlı ordusunda süvari eğitimi, Cumhuriyet Üniversitesi, Yüksek Lisans, 2013

16 JUOAI 1993

S. M. Gillmor

CAVALRY, EUROPEAN

CAVALRY, ISLAMIC

On tournaments, see Malcolm Vale, *War and Chivalry* (1981), for the argument that the late medieval tournament was a practice ground for war. Also, Richard W. Barber, *The Knight and Chivalry* (1970), 153-208; N. Denholm-Young, "The Tournament in the Thirteenth Century," in *Studies in Medieval History Presented to Frederick Maurice Powicke* (1948), 240-268; and K. G. Webster, "The Twelfth Century Tournay," in *Anniversary Papers by Colleagues and Pupils of George Lyman Kittredge* (1913).

Decline of heavy cavalry, 1300-1500. On the chivalric view of war, see Maurice H. Keen, *The Laws of War in the Late Middle Ages* (1965); and "Chivalry, Nobility, and the Man-at-Arms," in C. T. Allmand, ed., *War, Literature, and Politics in the Late Middle Ages* (1976), 32-45. On missile weapons, see A. T. Hatto, "Archery and Chivalry: A Noble Prejudice," in *Modern Language Review*, 35 (1940); and M. G. A. Vale, "New Techniques and Old Ideals: The Impact of Artillery on War and Chivalry at the End of the Hundred Years War," in *War, Literature, and Politics*, *op. cit.*, 57-72.

On the Swiss, see B. Meyer, "Die Schlacht bei Morgarten," in *Revue suisse d'histoire*, 16 (1966). On the Burgundian army, see C. Brusten, *L'armée bourguignonne de 1465 à 1468* (1953). Also, his "La fin des compagnies d'ordonnance de Charles le Téméraire," in *Cinq-centième anniversaire de la bataille de Nancy (1477): Actes du Colloque organisé par l'Institut de recherche régionale en sciences sociales, humaines et économiques de l'Université de Nancy* (1979), and "Les compagnies d'ordonnance dans l'armée bourguignonne," in *Grandson 1476, Essai d'approche pluridisciplinaire d'une action militaire du XVe siècle*, D. Reichel, ed. (1976); also his "Les campagnes liégeoises de Charles le Téméraire," in *Liège et Bourgogne, Actes du Colloque tenu à Liège les 28, 29 et 30 octobre 1968* (1972). See also G. Grosjean, "Die Murtenschlacht. Analyse eines Ereignisses," in *Actes du Ve Centenaire de la bataille de Morat* (1976).

On the use of the longbow in England before the Hundred Years War, see John E. Morris, *The Welsh Wars of Edward I* (1901). On cavalry service under Edward I, see Michael Prestwich, *War, Politics, and Finance Under Edward I* (1972), ch. 3; and Michael Powicke, "The General Obligation to Cavalry Service Under Edward I," in *Speculum*, 28 (1953).

On the Hundred Years War, the most important recent work is Philippe Contamine, *Guerre, état, et société au temps de la guerre de Cent Ans* (1971). On the role of cavalry in the set battles of this conflict, see Contamine, "Crécy (1346) et Agincourt (1415): Une comparaison," in *Divers aspects du Moyen Âge en Occident, Actes du Congrès tenu à Calais en septembre 1974* (1977), 29-44. See also Alfred H. Burne, *The Crecy War* (1955); and Herbert J. Hewitt, *The Black Prince's Expedition of 1355-1357* (1958); and his *The Organization of War Under Edward III, 1338-1362* (1966), ch. 5, on the *chevauchée* and an ap-

pendix on the transport of horses. John Keegan, *The Face of Battle* (1977), compares three battles fought in the same general area (Agincourt, Waterloo, and the Somme), emphasizing the mechanics of battle and the viewpoint of the individual fighting man.

For the development of plate armor and changes in cavalry equipment, see Vale, *War and Chivalry*, ch. 4. Also, F. Buttin, "La lance et l'arrêt de cuirasse," in *Archaeologia*, 99 (1965); and Eugene Heer, "Armes et armures au temps des guerres de Bourgogne," in *Grandson 1476, op. cit.*

On equine veterinary medicine, see Johannes Zahltzen, "Die 'Hippiatria' des Jordanus Ruffus," in *Archiv für Kulturgeschichte*, 53 (1971). On the trading of war-horses, see V. Chomel, "Chevaux de bataille et roncins en Dauphiné au XIVe siècle," in *Cahiers d'histoire*, 7 (1962). Treatises on the training of war-horses are still in manuscript form or in limited printed editions; they are listed in Frederick H. Huth, *Works on Horses and Equitation* (1887).

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[See also Arms and Armor; Avars; Cataphracts; France: to 987; Games and Pastimes; Hundred Years War; Normans and Normandy; Warfare.]

CAVALRY, ISLAMIC. In legend, the Arabs were horsemen whose *khayl*, or cavalry, had conquered half the world. In fact, it seems that only an aristocratic minority was able to afford horse and armor in imitation of the Persians and Byzantines, and that the outcome of the first great battles depended essentially on infantry. Wealth from the newly conquered empire, as well as the recruitment of mounted Persian warriors, enabled this cavalry to multiply, without displacing the infantry from its central role. Horsemen engaged in preliminary skirmishing, attacked from the wings, or remained in reserve for a final charge.

At the end of the seventh century, the adoption of the stirrup gave the rider a firmer seat, to the advantage of the man in armor fighting with lance and sword, although its first use may have been as an aid to archery, in hunting as well as in war. At the same time it contributed to a rapidly growing distinction between the well-armed knights of the nobility, with their mounted escorts of clients and freedmen, and the lightly equipped horsemen who appeared on the frontiers of Islam to make their living in raids upon the infidels. With these may be classed the tribesmen, Arabs for example, or Berbers in North Africa, who acquired horses and acted either as auxiliaries or as